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Counteridenticals and dream reports: A unified analysis[1]

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Abstract. Counteridenticals are counterfactual conditional sentences whose antecedent clauses contain an identity statement, e.g. *If I were you, I'd buy the blue dress.* Here, we argue that counteridenticals are best analyzed along the lines of dream reports. After showing that counteridenticals and dream reports exhibit striking grammatical and perceptual parallels, we suggest an analysis of counteridenticals with Percus and Sauerland's (2003) analysis of dream reports. Following their proposal, we propose to make use of concept generators, realized as centered worlds. To this end, we argue that the presence of *if* licenses the presence of an *imagine*-operator, which constitutes the attitude the antecedent clause '*x* be-PAST *y*' is taken under; The speaker predicates, in the imagine mode, the consequent property to his/her imagined self. To capture the different degrees of identification between the subject and the predicate of the identity statement of counteridenticals' antecedents observed in the literature, we incorporate Percus and Sharvit's (2014) notion of asymmetric *be* into the analysis. This proposal has several advantages over existing analyses (Lakoff, 1996; Kocurek, 2016) of counteridentical meaning, as it both explains the different degrees of identification observed for counteridenticals and correctly predicts the parallels between counteridenticals and dream reports.

Keywords: Counteridenticals, counterfactuals, dream reports, pronoun movement

1. Introduction

Counteridenticals are conditionals with the following two properties: First and foremost, they are *counterfactual* conditionals, meaning that the propositions embedded in their antecedent clauses do not hold in the actual world. Nevertheless, counteridenticals do not just constitute any kind of counterfactuals but rather a specific subtype: Their antecedent clauses always embed an identity statement which *identifies two inherently incompatible entities* with each other. Examples of counteridenticals are given in (1) and (2): We know that, in the real world, the meaning of the expression 'Paula' is unlike the meaning of 'Angela Merkel', and likewise for 'I' and 'you'. Yet, these expressions are felicitously identified with each other in the antecedent of counteridenticals:

(1) If <u>I</u> were <u>you</u>, I'd buy the blue dress.

(2) If <u>Paula</u> were <u>Angela Merkel</u>, she'd be the chancellor of Germany.

From the above examples we derive the following intuitive meaning of counteridenticals, and it is the aim of this paper to capture it in formal terms: A speaker is imagining a counterfactual world. In this contrary-to-fact world, the subject and the predicate entities of the antecedent clause have been identified with each other, leading to the creation of a counterpart of the

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subject entity in the counterfactual world. According to Lewis (1973), the counterpart of an entity is a non-actual individual who is not the same individual as the actual entity itself but similar enough to it such that the reference across worlds is rigid. For counteridenticals, we gather that the counterpart belongs to the subject entity since sentences like (3) are marginal for native speakers of English and, thus, will not be considered in this paper.

(3) ?/* If I were Angela Merkel, her name would be Carina.

The counterpart entity that lives in a counteridentical world is a composed individual—it contains properties of both the antecedent clause's subject and predicate entity, i.e. the referents of the clause's subject and predicate. This becomes evident when considering scenarios like the following: Imagine that we are dress shopping. I like the blue dress best, but I do not have the money to buy it. You, on the other hand, have the money to buy it, but you like the red dress better. In this scenario, neither you nor I would buy the blue dress in the actual world. Nevertheless, if you asked me which dress you should buy in the given scenario, I could felicitously utter "If I were you, I'd buy the blue dress", to express that a non-actual counterpart of mine—having my taste in clothing but your financial situation—would buy the blue dress. Hence, the consequent propositions of counteridenticals are evaluated with respect to a composed counterpart individual that possesses a set of contextually relevant properties derived from the subject and predicate entities.

In this paper, we argue contrary to existing proposals of counteridentical meaning (Lakoff, 1996; Kocurek, 2016) that counteridenticals are best analyzed along the lines of dream reports, which already receive a similar intuitive interpretation as counteridenticals: Also when dreaming, we may identify two inherently distinct entities with each other. And also when dreaming does such an identification of two entities lead to the creation of a composed subject counterpart in the counterfactual world with respect to which the consequent propositions are evaluated (cf. (4)). In order for the dream report in (4) to be uttered felicitously, for example, the subject entity of the second coordinated clause (i.e. *she*) has to possess properties of both Paula and Angela Merkel, as otherwise Mary could not even have known whom she has identified with each other in her dream.

(4) Mary dreamed that Paula was Angela Merkel and that she had dinner with the Macrons on top of the Eiffel tower.

In order to argue for a novel analysis of counteridenticals along the lines of dream reports and, thereby, strengthen the intuitive parallel that was just established, this paper is structured as follows. In Section 2, we show that counteridenticals and dream reports exhibit striking grammatical as well as perceptual parallels. In Section 3, we then suggest an analysis of counteridenticals along the lines of Percus and Sauerland's (2003) (henceforward P&S) analysis of dream reports. The proposal incorporates Percus and Sharvit's (2014) asymmetric *be*-operator in order to capture the contribution of the identity statement embedded in the counteridentical's antecedent clause. Section 4 concludes the paper by discussing predictions the proposal makes as well as questions it raises.

2. Parallels Between Counteridenticals and Dream Reports

Counteridenticals and dream reports exhibit at least four parallels with regard to their grammatical and perceptual make-up. Some of these correlations have already been noted by Arregui (2007), but this paper provides two novel arguments in favor of an analysis which treats the two constructions on par.

2.1. Parallel 1—Validity of Identity Statements

Both counteridenticals and dream reports enable us to comprehend clauses which, under canonical circumstances (i.e. excluding role playing situations, etc.), seem irremediably false in extensional contexts. An example of such a clause is given in (5a).

(5) a. *I was you.
 b. <u>If I was/were you</u>, I would be happier.
 c. I dreamed <u>I was you</u>. (cf. Arregui, 2007: 31)

When evaluated against the facts of the actual world, the identification of two inherently different individuals, here, the referents of *I* and *you*, seems clearly infelicitous. Nevertheless, in the case of dream reports (5b) and counteridenticals (5c), we can easily make sense of such a relation, since we derive from their structures that instead of consulting our knowledge of the actual world we are to imagine worlds which differ from ours with regard to some contextually relevant presuppositions, here: the identity of the speaker and the addressee.

2.2. Parallel 2—Principle B Effects

Both counteridenticals and dream reports allow for sequences to occur that cannot be independent matrix clauses.

(6) a. *I kiss(ed) me.
 b. I dreamed I was Brigitte Bardot and <u>I kissed me</u>.
 c. If we were you, <u>I'd kiss me</u>. (Arregui, 2007: 31)

In extensional contexts (e.g. (6a)) the sequence *I kiss(ed) me* constitutes a violation of the binding principle B, which requires that a pronoun must be unbound within its binding domain (cf. Chomsky, 1982). In dream reports and counteridenticals, however, pronouns with the same features may have multiple referents, as can be made explicit by adding indices to the examples in (6), yielding (7). Whereas the subscripts i and j are used for pronouns referring to entities inhabiting the actual world in addition to the counterfactual one, the subscript $i \oplus j$ designates pronouns referring to the non-actual entity that possesses a combination of the antecedent clause's subject and predicate entity's properties, i.e. the subject's dream/counterfactual self. The availability of multiple referents enables the circumvention of the binding principle's application in (6b)/(6c).

(7) a. *I$_i$ kiss(ed) me$_i$.
b. I$_i$ dreamed (I$_i$ was Brigitte Bardot$_j$) and I$_{i\oplus j}$ kissed me$_i$.
c. If I$_i$ were you$_j$, I$_{i\oplus j}$'d kiss me$_i$.

Strikingly, however, both counteridenticals and dream reports only allow principle B violations for first person pronouns. Similar structures are not permitted for third person pronouns, second person pronouns, or a mix thereof (cf. Arregui, 2007: 32):

(8) a. (i) *If Peter$_i$ were Bill$_j$, he$_{i\oplus j}$'d kiss him$_i$. (3rd)
(ii) *Sue$_i$ dreamed [she$_i$ was Brigitte Bardot$_j$ and] she$_{i\oplus j}$ kissed her$_i$.
b. (i) */?If you$_i$ were me$_j$, you$_{i\oplus j}$'d kiss you$_i$. (2nd)
(ii) *You$_i$ dreamed [you$_i$ were Brigitte Bardot$_j$], and you$_{i\oplus j}$ kissed you$_i$.
c. (i) *If Peter$_i$ were you$_j$, he$_{i\oplus j}$'d kiss him$_i$/you$_j$. (3rd/2nd)
(ii) *Peter dreamed [he was you] and he$_{i\oplus j}$ kissed him$_i$/you$_j$.

This is especially striking since second/third person pronouns may actually have multiple referents, as can be seen from the following example, in which a possessive structure has been chosen to avoid the intervention of the binding principle B (as possessives in English never trigger Principle A/B effects).

(9) If Susan$_i$ were Sue$_j$, she$_{i\oplus j}$ would be in love with her$_i$ brother.

2.3. Parallel 3—Identity Inferences

In both counteridenticals and dream reports, the counterfactual identification of the subject entity with the predicate entity prompt the assignment of the entire set of (contextually relevant) properties defining the predicate entity to the subject on the part of the listener. If, in such a situation, the speaker wants to change any of the predicate entity's properties which undergo the re-ascription process, s/he has to make the change explicit. Otherwise the listener is expected to object. Consider, for instance, the following examples:

(10) [CONTEXT. Assuming Angela Merkel does not like traveling.]
a. If I were Angela Merkel, I'd be traveling all around the world, <u>but (unlike her,)</u> I'd be enjoying it.
b. A: If I were Angela Merkel, I'd be traveling all around the world and I'd be enjoying it.
B: <u>Wait a minute</u>, I thought Angela Merkel hates traveling.

(11) [CONTEXT. Assuming you don't live in a great apartment in New York.]
a. I dreamed I was you. <u>But</u> you lived in New York and had a great apartment.
b. A: I dreamed I was you. I lived in New York and I had a great apartment…
B: <u>I don't think</u> it was me that you dreamed you were. My apartment is pretty crappy.
(cf. Arregui, 2007: 36)

2.4. Parallel 4—Oneiric Reference Constraint

The pronouns of both constructions obey the Oneiric Reference Constraint (ORC), a syntactic constraint on pronoun movement that rules out any LF for dream reports in which some pronoun referring to the dream-self is asymmetrically c-commanded by a pronoun referring to the actual entity (cf. Percus and Sauerland, 2003: 5). The ORC explains why dream reports involving two pronouns with the same agreement features (e.g. (12)) are ambiguous between only three readings, even though there are four possible combinations of the consequent pronouns' referents (i.e. the actual-John and his dream-self): It disallows that reading in which the first pronoun refers to the actual self of the dreamer, while the second one refers to that person's dream-self (26d) (cf. ibid.: 4).

(12) John$_i$ dreamed that (he$_i$ was Peter$_j$ and that) <u>he</u> was marrying <u>his</u> grand-daughter.
   a. In John's dream, he$_{i\oplus j}$ marries his$_{i\oplus j}$ grand-daughter.
   b. In John's dream, he$_{i\oplus j}$ marries his$_i$ grand-daughter.
   c. In John's dream, he$_i$ marries his$_i$ grand-daughter.
   d. *In John's dream, he$_i$ marries the his$_{i\oplus j}$ grand-daughter.

In counteridenticals, we find a similar pattern (cf. (13)): Those pronouns which can be interpreted ambiguously between referring to the speaker's actual self and the person s/he counterfactually identifies with obey the ORC. (Note that the first consequent pronoun, I$_{i\oplus j}$, is excluded from the constraint in this example since it can never refer back to the actual speaker). In (13), the ORC renders that reading infeasible, or at least marginal, in which the actual speaker's son shall play with the imagined daughter, i.e. that reading in which the pronoun referring to the counterfactual entity is within the local domain of the pronoun referring to the actual entity.

(13) If we were you, I'd encourage <u>my</u> son to play with <u>my</u> daughter.
   a. If I$_i$ were you$_j$, I$_{i\oplus j}$'d encourage my$_{i\oplus j}$ son to play with my$_{i\oplus j}$ daughter.
   b. If I$_i$ were you$_j$, I$_{i\oplus j}$'d encourage my$_{i\oplus j}$ son to play with my$_i$ daughter.
   c. If I$_i$ were you$_j$, I$_{i\oplus j}$'d encourage my$_i$ son to play with my$_i$ daughter.
   d. *If I$_i$ were you$_j$, I$_{i\oplus j}$'d encourage my$_i$ son to play with my$_{i\oplus j}$ daughter.

In sum, we have provided at least four striking structural and conceptual parallels between counteridenticals and dream reports. These call for an analysis of counteridenticals on par with that of dream reports, which will be developed in the following section.

3. Analyzing Counteridenticals in Terms of Dream Reports

As with the analysis of any conditional, the overarching question to be answered in this section is what the worlds look like that the antecedent clause of a counteridentical takes us to. The first step to finding an answer to this question is figuring out how the composed counterpart individuals, i.e. those individuals that received an $i \oplus j$-index in the above examples, are generated. This query is directly related to the interpretation of the copular clause 'x be-PAST y'. Once the counterpart individuals are felicitously generated, the analysis then needs to be able to explain the parallels observed between counteridenticals and dream reports.

3.1. The Meaning of ‘If *X* Were *Y*’

When analyzing the identity clause embedded in the antecedent of a counteridentical, two empirical observations have to be accounted for. First, the antecedent clause *If I were you* does not mean the same as *If you were me*. For this and further reasons, an analysis that interprets both of these clauses by means of the relation $I = you$ is ruled out, which is why this proposal refrains from interpreting the counteridentical antecedent as an equative copular clause (for a more detailed discussion see Kauf (2016)). Secondly, since the copular clause is responsible for generating the composed individual, it needs to be flexible with respect to the (re-)assignment of properties of the predicate entity onto the subject entity’s counterpart. This constraint becomes evident when reconsidering examples (1) and (2), repeated here for convenience as (14) and (15). Whereas the former sentence triggers an ascription of only a partial set of the predicate entity’s properties onto the counterpart (i.e. his/her financial situation in the scenario created above), the latter utterance is true either if the contextually relevant properties connected to being the chancellor of Germany are reassembled or if most/nearly all of Angela Merkel’s properties are transferred onto the counterpart. This dichotomy boils down to the following distinction: Whereas the utterance in (14) is not necessarily true if the composed counterpart is assumed to have all of the contextually relevant properties of the predicate entity—in fact, in such ‘advice’ scenarios, it is usually assumed that the counterpart must have some of the subject entity’s relevant properties (cf. Pelletier, 2004) –, the same configuration always makes utterance like (15) true; the subject entity’s properties are not needed for the true outcome of the consequent proposition.

(14) If I were you, I’d buy the blue dress.

(15) If Paula were Angela Merkel, she’d be the chancellor of Germany.

To give an explanation to both of these observations, the proposal presented in this paper endorses the notion of asymmetric *be* as proposed by Percus and Sharvit (2014) in its redefinition by Zhang (2016) (indicated below by $\overset{\text{Zhang}}{=}$).

Percus and Sharvit receive motivation for the introduction of such an asymmetric *be*-operator from mistaken identity contexts like the following:

(16) [CONTEXT. Peter is throwing a party in honor of his cousin Dan who has just been awarded his PhD. All the guests know that it is a PhD party, but they don’t all know Dan (and some of them, like Kevin, don’t even know the new PhD’s name). When Becky arrives, Kevin, who is already completely toasted, walks up to her with a big smile. ‘You must be proud to be a doctor now,’ he says. Seeing this, Jim says to Peter:]
a. Kevin thinks that Becky is Dan, (but he doesn’t think that Dan is Becky).

In a nutshell, what the asymmetric copula in (16a) does is take an individual concept as its input and identify it with an individual x (Percus and Sharvit, 2014). If such an individual concept is overtly available, as in *Dan is the new PhD student*, the concept (here: being the new PhD student) is simply predicated as a property of the subject referent (here: Dan) by means of (17).

(17) $[\![\text{PRED}]\!]^w \overset{\text{Zhang}}{=} [\![\text{be}_{\text{asymmetric}}]\!]^w_{<<s,et>,et>} = \lambda P_{<s,et>}.\ \lambda x_e.\ P(w)(x)$

For cases as in (16a), in which the copula is used to (mistakenly) identify a person with another individual instead of with an overt individual concept, Percus and Sharvit (2014) suggest a refinement of the semantics of asymmetric *be*. The predicate entity of the copular clause (here: Dan) is then first coerced into a contextually salient set of properties (here: being the new PhD student) before $[\![\text{PRED}]\!]^w$ can be applied to predicate this set of properties of the subject entity (here: Becky) (cf. (18)).

(18) $[\![\text{PRED}\ y]\!]^w \overset{\text{Zhang}}{=} [\![\text{be}_{\text{asymmetric}}]\!]^w_{<e,et>} = \lambda y_e.\ \lambda x_e.\ P_{(w,y)}(w)(x)$,
where $P_{(w,y)}$ of type $< s, et >$ represents the coersion of the individual y into some contextually salient set of properties in a world w

Thus, the sentence (16a) comes out to be true if and only if in all of Kevin's epistemically accessible worlds, Becky's counterpart possesses Dan's contextually salient properties; she is the new PhD student.

Turning back to the analysis of counteridenticals, the asymmetric *be*-operator proves to easily be able to explain the empirical observations stated above. Since the predicate entity is coerced into a set of properties that is subsequently predicated of the subject entity, the asymmetry in meaning between (19a) and (19b) is obtained for free: Whereas in the former clause, it is the addressee that is reduced to a set of properties and a counterpart individual of the speaker living in the counterfactual world is reassigned these properties, in the latter it is reversed. Thus, when uttered in the same situation, the make-up of the counterpart individual in (19a) and (19b) can differ vastly, since the respective contextually salient properties are obtained from different individuals.

(19) a. If I were you $\rightarrow P_{(w,you)}(w)(I)$
b. If you were me $\rightarrow P_{(w,I)}(w)(you)$

At the same time, the same asymmetry also immediately accounts for the marginality of counteridenticals such as (3), repeated for convenience as (20), in which it is the predicate entity that the counterpart individual is referenced to and not the subject entity.

(20) ?/* If I were Angela Merkel, her name would be Carina.

The marginality originates from the clash that is obtained by the asymmetric *be*-operator's wanting to coerce Angela Merkel into a set of contextually relevant properties, here: name properties, and wanting to predicate it of the subject entity, i.e. the speaker, and the proposition expressed by the consequent proposition's centering around the coerced individual.

What is more, the asymmetric *be*-operator is also able to explain the second empirical observation, i.e. the different degrees of identification between the antecedent clause's subject and predicate. It is able to do so as it does not impose any restrictions on the set of properties which the predicate is coerced into. In (21), the speaker assumes the addressee's external properties while keeping his/her internal properties intact, a strategy which enables him/her to give advice. Note again that in this case, the consequent property must neither be true of the subject nor the predicate in the actual world (for an example scenario, please refer back to sec. 1, par. 3). By contrast, the truth of the consequent clause in (22) is achieved if Peter is either completely identified with Angela Merkel in the counterfactual worlds or if he is merely identified with her in terms of her contextually relevant properties, i.e. her profession. In this case, the consequent property is always true of the predicate in the actual world. This can be made explicit by adding follow-up phrases to the examples that explicitly negate the truth of the consequent proposition if evaluated with respect to the predicate entity in the real world. Whereas such an extension does not affect the truth value of sentence (21), it turns the counteridentical in (22) false.

(21) If I were you, I'd be buying the blue dress, which you are not buying.

(22) *If Peter were Angela Merkel, he'd be the chancellor of Germany, which she isn't.

In addition to being able to explain these empirical observation, the asymmetric *be*-operator is conceptually appealing. Consider for example the sentence in (23):

(23) If Peter weren't Peter, the situation would have escalated.

When interpreting such sentences, we do not imagine worlds in which Peter is not Peter. Rather, what we infer is that if we were taken to a world in which Peter does not have the contextually relevant set of properties, i.e. being forgiving/calm/funny/etc—but might be just like Peter otherwise –, then the consequent proposition would hold of his counterpart.

All things considered, Percus and Sharvit's (2014) asymmetric *be*-operator successfully captures the relation set up between the subject and predicate entity of a counteridentical antecedent clause.

3.2. Explaining the Parallels to Dream Reports

Once the proposal is able to describe the identity relation set up by the counteridentical's antecedent, it then needs to explain the parallels observed between counteridenticals and dream reports. In this context, it is especially the similarity with respect to the ORC which calls for an analysis of counteridenticals along the lines of Percus and Sauerland (2003).

In their analysis of dream reports, P&S propose to make use of concept generators in their realization as centered worlds; In his/her dream, the dreamer, x, identifies him-/herself with another individual, y, with respect to whom the consequent proposition is evaluated. In other words, P&S assign the predicate *dream* attitude verb-like semantics:

(24) $[\![\text{dream}]\!]^g = \lambda P.\ \lambda x.\ \lambda w.$ For all $< y, w' >$ in $\text{DREAM}_{x,w}$, $P(y)(w') = 1$.
($\text{DREAM}_{x,w}$ stands for the set of pairs $< y, w' >$ such that w' is a world compatible with x's dream in w, and y is the individual in w' who x, in w, identifies as himself.)
(ibid: 8)

Multiple pronoun reference in Percus and Sauerland (2003) is accounted for in the following way: Reference to the actual person is realized by means of an unstarred pronoun (underlined in the following example), which is analyzed *in situ* like a usual variable. It combines with a world parameter which, due to lambda-abstraction, receives its denotation from the worlds compatible with the agent's dream worlds, i.e. w'. Reference to the dream-self, on the other hand, is realized via a starred pronoun, which behaves similar to a relative pronoun: it does not receive an interpretation *in situ* but moves to the left periphery of the complement clause, which triggers a predicate abstraction over the trace it leaves behind (cf. Percus and Sauerland, 2003: 7f). Since P&S assume the denotation of 'dream' to be similar to that of attitude verbs, i.e. they assume that 'dream' quantifies over centered worlds and takes a property (the meaning of the complement clause) as an input (cf. (24)), such a movement leads to an identification of the moved pronoun with the center of worlds that are compatible with agent's dream worlds, i.e. the dream-self y. A possible logical form of a dream report under this proposal looks like the following:

(25) [CONTEXT. *In his dream, John is Fred*]
(John) dreamed that he$_{\text{dream-self}}$ was marrying his$_{\text{actual-self}}$ grand-daughter.
a. dream [he* λ_3 [λw_1 [$_{VP}$ w_1 t_3 was marrying [$\underline{\text{his}_2}$ w_1] grand-daughter]]]
b. $\lambda x.\ \lambda w.\ \forall < y, w' > \in$ DREAM$_{x,w}$, y marries the grand-daughter of g(2)(w') in w'.
c. *This "property" will hold, e.g., of John, if he has a dream in which his dream-self, Fred, marries his own, i.e. John's, grand-daughter.*

(ibid.: 10)

The ORC now excludes all those structures by means of a concept which P&S call 'superiority' in which a starred pronoun *pro** would have to move across an unstarred pronoun which a) asymmetrically c-commands it and which b) shares the same features *pro** has (cf. Percus and Sauerland, 2003: 13ff) (compare with (12)):

(26) John dreamed that <u>he</u> was marrying <u>his</u> grand-daughter.
a. In John's dream, he* λ_3 his* λ_4 [t_3 marries t_4 grand-daughter.]
b. In John's dream, he* λ_3 [t_3 marries his grand-daughter.]
c. In John's dream, [he marries his grand-daughter.]
d. *In John's dream, his* λ_3 [he marries t_3 grand-daughter.]
X

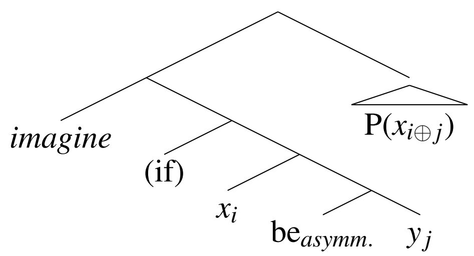
In order to transfer P&S's analysis to counteridenticals and keep the implications it makes with respect to the ORC intact, some adaptations have to be made. First of all, the starred pronoun responsible for dream-self reference in P&S is dependent on the left periphery of the embedded CP as the landing site for its lambda abstractor, since it needs to be identified with the center of the speaker's doxastic worlds (cf. (25)). Nevertheless, with counteridenticals no such landing site seems to be available; They do not constitute attitude reports, or otherwise embedded sentences (where the complementizer is part of the embedded CP). One way to remedy this problem is to assume that, even though not visible, there actually is an underlying attitude report-like semantics in the meaning contribution of counteridenticals. Such an assumption receives independent motivation from proposals like Moltmann (2003), who suggests to interpret *all* propositions as attitudinal objects. For her, it is only in the presence of an illocutionary force operator that independent sentences receive a 'complete meaning' (cf. 97). Under Moltmann's (2003) proposal, a simple declarative sentence such as (27) is thus interpreted as specifying a property of the speaker (cf. 97).

(27) Mary is happy.
   a. $\lambda x[\mathrm{R}_{(\mathrm{ass},3)}(x,<\mathrm{Happy}, \mathrm{T}_1>,<\mathrm{Mary}, \mathrm{T}_2>)]$
   b. An agent predicates, in the assertive mode, the property of being happy$_{T_1}$ of Mary$_{T_2}$

(cf. Moltmann, 2003: 98)

In this example, R is an assertion-relation which connects the speaker of the sentence to the proposition that the property of being happy holds of Mary. Hereby, each of the propositional constituents in turn is perceived under a specific mode of presentation, T_i (following the standard literature on propositional attitudes). Whenever the attitudinal component and/or the agent are not specific, Moltmann (2003) suggests to make use of the most basic propositional attitude, that of entertaining, by means of which a way of relating the propositional argument to an agent is always ensured.

Without having to fall back on Moltmann's default relation of entertaining, we argue that for counteridenticals a relation which contributes an *imagine*-like meaning constitutes a suitable candidate for the attitudinal relation: *If* licenses an environment in which the proposition *x is y* is taken under a relation which has a similar meaning contribution as an *imagine*-operator (for a further proposal which establishes a relation between *if* and the presence of *imagine* cf. Anand (2006), p.c.). The speaker predicates, in an *imagine*-like-mode, the counteridentical's consequent property of his/her counterfactual-self (cf. (29)). Without committing ourselves to the existence of an *imagine*-operator or an exact location to which it applies in the semantics, we suggest the following interpretation of counteridenticals:



As a result of this structure, a (covert) landing site for the starred pronoun needed for an analysis of counteridenticals on par with P&S's dream reports analysis is created below the operator.

That the presence of *if* licenses the presence of (a covert) *imagine*-like-operator can be independently supported, for example by considering conditional sentences like the following. In (28), an *imagine*-operator occurs overtly, arguably without triggering a change in meaning. Furthermore, the example shows that the antecedent clause of a counteridentical functions as the restrictor of the *imagine*-worlds, since the consequent clause is not obligatory, but can be pragmatically inferred from knowing which worlds to consider based on the antecedent proposition.

(28) (Imagine) If Julius had been Peter!

Under the made assumptions, counteridentical antecedent clauses thus receive the following, preliminary interpretation:

(29) *Preliminary*
$[\![\text{If } x \text{ were } y]\!]^g = [\![\text{imagine [} x \text{ be } y \text{]}]\!]^g = \lambda Q.\ \lambda x.\ \lambda w.\ \forall < y, w' > \text{ in } \textsc{imagine}_{x,w}$: $Q(y)(w') = 1$. (based on Percus and Sauerland, 2003: 8)

The denotation of $\textsc{imagine}_{x,w}$ (cf. (29)) is based on that of P&S's $\textsc{dream}_{x,w}$. Nevertheless, given the insights derived from the interpretation of the antecedent clause in the preceding section, the worlds imagined by the speaker are restricted to those which incorporate the additional ingredient of Percus and Sharvit's (2014) asymmetric *be*-copula. Hence, the worlds a counteridentical antecedent clause takes us to can, preliminarily, be described as follows:

(30) $\textsc{imagine}_{x,w} = \{< y, w' > \mid w'$ is a world compatible with the worlds x imagines in w, and y is the individual in w' from whom x, in w, takes over a contextually relevant set of properties (meaning that $P_{(w,y)}(w')(x) = 1$, where $P_{(w,y)}$ of type $<s, et>$ represents the coersion of the individual y into a contextually salient set of properties in w)$\}$.
(based on P&S 2003; Percus&Sharvit 2014)

With these semantics in place, multiple pronoun reference in the counteridentical's consequent clause can be accounted for as in Percus and Sauerland (2003) (cf. (25)), leading to the following analysis of (31).

(31) (If I were you,) $\text{I}_{\text{imagine-self}}$'d love $\text{me}_{\text{actual-self}}$.
a. (I) imagine [I* λ_3 [λw_1 [$_{VP}$ w_1 t_3 love [me_2 w_1]]]]
b. $\lambda x.\ \lambda w.\ \forall < y, w' >$ in $\textsc{imagine}_{x,w}$: y loves g(2)(w') in w'.
c. *This property will hold, e.g., of the speaker, if for all of his/her imagined world, at which s/he takes over contextually relevant properties from the addressee, his/her imagined self loves his/her actual self.* (cf. ibid: 8)

Reference to the actual speaker is achieved through *in situ*-interpretation of the first person pronouns (cf. me_2 in (31)). By contrast, reference to the dream-self, i.e. the addressee, is realized via a starred pronoun (cf. I* in (31)) which moves to the left periphery of the complement clause, thereby triggering a predicate abstraction over the trace it leaves behind. Since $\textsc{imagine}_{x,w}$ is assumed to quantify over centered worlds and takes the meaning of the complement clause as an input, the starred pronoun gets associated with the counterpart individual, y (cf. (29)). The ORC effects then follow parallel to those in dream reports.

Even though the proposal as it stands provides answers to several crucial questions in the analysis of counteridenticals, it has (at least) two shortcomings. First, unlike in P&S's analysis of dream reports, in the current analysis of counteridenticals, the antecedent's predicate entity, y, should not be the same as the consequent y (as we're proposing that the predicate entity is only an individual that the subject entity takes over properties from, but not one s/he completely identifies with). This challenge also becomes evident when considering that the asymmetric *be*-operator actually wants to quantify over 'subject entity-centered' worlds and not 'predicate entity'-centered worlds, as it currently does (cf. *If I were you* $\rightarrow P_{(w,you)}(w)(I)$, where I is the individual that constitutes the counterpart individual at the counterfactual world, albeit with properties of the addressee, whereas the addressee is the individual that is merely coerced into a set of properties). Secondly, the proposed analysis so far can only account for counteridenticals in which the person setting up the counterfactual scenario is the same as the subject entity of the counteridentical's antecedent clause, as in (31). Nevertheless, a theory of counteridentical meaning should be able to also account for sentences like *If Peter were Susan, he would VP* and *If you were me, you would VP*, where a speaker is imagining worlds in which another person is counterfactually identified with a third person/the speaker.

In order to solve the first challenge, we tentatively propose that the antecedent and consequent y's in (29) are in fact not the same. Instead, a new variable, z, is introduced which references the counterpart individual—the individual of whom the consequent proposition holds. In the new analysis, z and not y constitutes the center of the IMAGINE-worlds x sets up. The counterpart individual z is able to receive the relevant combination of properties from the antecedent clause's subject and predicate entities in the following way: On the one hand, it provides the second argument of the asymmetric *be*-function, which is thus assigned the set of properties the predicate entity y is coerced into. On the other hand, it is associated with, and thereby receives the missing properties from, the subject entity x by postulating that the presupposition $z \simeq_{w'} x$ is part of the meaning contribution of *imagine*.

Independent evidence for the introduction of another entity variable, z, for the counterpart individual can be obtained by considering counteridenticals like (32), in which reference to all three individuals, the antecedent's subject and predicate entity, and their shared counterpart individual is made.

(32) If I_i were you_j, $\mathrm{I}_{i \oplus j}$'d be sitting where you_j are and $\mathrm{I}_{i \oplus j}$'d be looking at me_i.

Under this proposal, we receive the following analysis of the sentence *If I were you, I'd kiss me*:

(33) If I were you, $\mathrm{I}_{\text{imagined-self}}$'d kiss $\mathrm{me}_{\text{actual-self}}$.
  a. [[(I) imagine [I be you]] [I* λ_3 [λw_1 [$_{VP}$ w_1 t_3 kiss [me$_2$ w_1]]]]]
  b. [$\lambda y.\ \lambda x.\ \lambda w.\ \forall <z, w'>$ in $\{$ $\text{IMAGINE}_{x,w} \wedge P_{(w,y)}(w')(z) : z \simeq_{w'} x$ $\} \rightarrow z$ kisses g(2)(w') in w'](you)(I)
  c. True iff for all of the speaker's imagined worlds at which his/her imagined self takes over a set of contextually relevant properties from the addressee, his/her imagined self kisses his/her actual self.

To account for the second challenge, i.e. counteridenticals in which the speaker is imagining worlds in which not s/he but another person is identified with a third person, we tentatively suggest to detach the center of the imagined worlds from the imaginer him-/herself. Via a counteridentical's antecedent, a speaker attitudinally relates him-/herself to a counteridentical proposition centering around a person a, i.e. s/he imagines an entity a to have a property, based on which s/he draws a consequence in the consequent clause about the 'altered a'. Whereas the speaker is the default imaginer of a counteridentical, *a* may or may not be the speaker him-/herself or a different person (cf. (34)). Since the embedded clause of this 'attitude report' (here: the counteridentical) only attaches below this matrix clause, the lambda abstractor responsible for the interpretation of the starred pronoun, yielding the counterfactual counterpart of *a* according to the dream-report proposals, can receive its information from *a* and is not dependent on the speaker. Phrased differently and everything put together, we thus propose counteridentical antecedents to have semantics along the following lines:

(34) *Final Version*

a. $[\![\text{If } a \text{ were } y]\!]^g = [\![\text{imagine}_{\text{sp(c)}} \text{ [} a \text{ be } y \text{]}]\!]^g = \lambda Q.\ \lambda a.\ \lambda y.\ \lambda w.$ $\forall < z, w' >$ in $\{$ IMAGINE$_{(\text{sp(c)},w),\text{a}} \wedge P_{(w,y)}(w')(z) : z \simeq_{w'} a \} \rightarrow Q(z)(w') = 1$, whereby sp(c) = speaker, and

b. IMAGINE$_{(\text{sp(c)},w),\text{a}} = \{< z, w' > | w'$ is a world compatible with the worlds sp(c) imagines in w, and z is the individual in w' which sp(c), in w, identifies with a and $P_{(w,y)}(w')(z)$, meaning that z possesses y's contextually salient properties$\}$.[2]

The fact that the presupposition relation $\simeq_{w'}$ always relates the counterpart individual to the subject entity and not the speaker can be independently supported via applying well-known presupposition projection tests, like the subsequent, in which the relevant presupposition $a \simeq_{w'} z$ projects across the board:

With the semantics in (34), a sentence like (35) then receives the following interpretation:

(35) SCENARIO. *Susan, in real life, has a brother, but Sue does not have one.*

If Susan were Sue, she$_{\text{imagined-self}}$'d be in love with her$_{\text{actual-self}}$ brother.

a. imagine$_{\text{sp(c)}}$ of Susan [she* λ_3 [λw_1 [$_{VP}$ w_1 t_3 be in love with [[her$_2$ w_1] brother]]]]

b. [$\lambda w.\ \forall < z, w' >$ in $\{$ IMAGINE$_{(\text{sp(c)},w),\text{Susan}} \wedge P_{(w,y)}(w')(z)$: $z \simeq_{w'} a \} \rightarrow z$ kisses g(2)(w') in w']

c. True iff for all of the speaker's imagined worlds at which Susan's counterpart self takes over a set of contextually relevant properties from Sue, this counterpart self of Susan is in love with Susan's actual brother.

One further tentative argument in favor of an analysis which incorporates two differently centered worlds—i.e. a world centered around the speaker and one centered around the subject entity's counterpart—is that it predicts the duality of deixis observed in counteridenticals: Whereas some indexicals seem to always be anchored to the speaker (cf. (36)), others seem to be relative to either the subject entity or the counterfactual counterpart (cf. (37)). Note that in the examples, the relevant deictic center has been made explicit by means of subscripts. Interestingly, the observed deictic relations persist regardless of the entities identified with each other by means of the antecedent clause.

[2] Note that when a speaker is reporting a counteridentical another person is attitudinally related to (e.g. *Susan thinks that if Peter were John, he VP*), the value of the imaginer in the semantics change accordingly. The report's speaker then is attitudinally related to predicating a counteridentical attitude to the attitude holder, here Susan, likely via an assertion or entertaining relation (cf. Moltmann, 2003).

(36) a. If I were Mary, I wouldn't be dating $\underline{\text{that horrid guy}}_{[\text{attitude of speaker}]}$.
b. If Paula were Mary, she would be $\underline{\text{here}}_{[\text{speaker}]}$ right $\underline{\text{now}}_{[\text{speaker}]}$.

(37) SCENARIO. *Assuming Mary is at the beach in Spain.*
a. If I were Mary, I would taste all of the $\underline{\text{local}}_{[\text{Mary/speaker}]}$ goodies.
b. If Paula were Mary, she'd jump into the sea $\underline{\text{in front of her}}_{[\text{Paula/Mary}]}$.

3.3. Interim Conclusion

Under the proposed analysis, the striking parallels between counteridenticals and dream reports laid out in Section 2 receive a proper explanation. The fact that identity statements like *I was you* can be felicitously used in counteridenticals and dream reports (Section 2.1) can be explained via the proposal's implementation of Percus and Sharvit's (2014) asymmetric *be*-operator which induces the creation of a counterpart of the subject entity at the counterfactual worlds without assuming proper identification. The parallel in identity inferences (Section 2.2), follows directly from the similar assumptions of composed individuals and how the composition comes about (also cf. Section 1 for a discussion). The Oneiric Reference Constraint (Section 2.3) follows directly by suggesting counteridentical LFs to be along the lines of P&S's dream report analysis. Finally, the similarities with respect to the Principle B effects follow from assuming a difference between the real individuals and their shared counterpart.

4. Implications and Open Questions

After having laid out how the analysis works in detail, this section sets out to discuss further predictions the proposal makes and questions it raises.

Let us first reconsider the asymmetric *be*-operator discussed in section 3.1. One of the reasons we adopted the operator for our analysis was its flexibility with respect to the amount of properties it coerces the predicate entity into before predicating them of the subject entity to create a suitable counterpart individual at the counterfactual worlds. Given this flexibility, the proposal predicts counteridentical antecedent clauses to have a variety of meanings, ranging from limited, partial contextually relevant property reassignment to complete (contextually relevant) identification. Counteridenticals in which the composed counterpart only takes over a *partial* set of contextually relevant properties from the predicate entity will henceforth be referred to as 'advice' counteridenticals. Counteridenticals which demand complete, at least contextually relevant, identification are dubbed 'imagine' counteridenticals.[3] In this context, it is crucial that

[3] Note that by means of adding focus one can easily shift between the two types of counteridenticals. To prove this point, consider the following scenario. In the first clause the speaker makes use of an 'advice' counteridentical whereas the second clause consists of an 'imagine' counteridentical:

(i) SCENARIO. *You are afraid of heights whereas I love the thrill. You were invited to go sky-diving and are asking me what to do and I say ...*
a. If $\overset{F}{\overline{\text{I}}}$ were you, I'd totally go, it sounds like so much fun ... but, then again, if I were $\overset{F}{\overline{\text{you}}}$, I probably wouldn't go, I don't think you'd be able to enjoy it.

Even though the antecedent clause remains the same in both conditionals and the consequent clauses oppose each other, we understand the utterance. Given the different foci, the clauses do not pose a contradiction to each other.

the term 'advice' counteridenticals is solely dependent on the partial reascription of properties from one individual to another and not on usual pragmatic assumptions about advice giving, i.e. it is usually uttered in a speaker-addressee context and given about the future. As a result, both of the following sentences count as 'advice' counteridenticals for the purposes of this paper:

(38) *'Advice' counteridenticals*
  a. If I were you, I'd buy the blue dress. (I like it much better than the green one.)
  b. If I were Stephen Hawking, I would've insisted on a speaking device with a British accent. (It surprises me that he didn't.)

For the same reason, counteridentical antecedents within the usual setting of advice giving (as described above) can receive an 'imagine' interpretation:

(39) *'Imagine' counteridenticals*
  a. If Paula were Angela Merkel, she'd be the chancellor of Germany.
  b. (I'm so jealous of you right now.) If I were you, I would already be done with all of my papers and could enjoy the weather. (Instead, I am stuck at my desk.)

A naïve empirical test which strengthens the intuition that there is a difference in meaning between 'imagine' and an 'advice' counteridenticals is to replace the antecedent clauses by 'in {predicate entity}'s shoes'—forcing an advice-reading—and checking the acceptability of the resulting clause for the intended meaning. From the sample comparison in (40) we see that the test results in a degraded judgment for the 'imagine' counteridentical whereas the 'advice' counteridentical's meaning remains unchanged.

(40) a. In your shoes, I'd buy the blue dress.
  b. *In your shoes, I would already be done with all of my papers.

Across languages, both the 'advice' and the 'imagine' readings can be found, as predicted. Also across languages, we usually find constructions like *In s.o.'s shoes*, which can felicitously replace the copular antecedent clause in 'advice' counteridenticals but not 'imagine' counteridenticals. Interestingly, however, in many languages, the availability of such constructions does not block the copular clause-antecedent for 'advice' counteridenticals, rendering the 'advice' and the 'imagine' readings vastly unspecified (e.g. in English, German, French, Dutch).

Nevertheless, other languages do disambiguate between these readings. One strategy hereby consists of having different, designated antecedent clauses for the two kinds of counteridenticals which stand in complementary distribution to each other, thus enabling a blocking of the other reading. This is for example the case for Polish, Greek or LIBRAS (for an in-depth discussion, see Kauf, 2016). In Polish, the construction usually used to express counteridenticals, i.e. past tense-marking of the copula in combination with the subjunctive mood (*Gdybym był toba* [= literally: I be-PAST you]), is restricted to the 'imagine' reading of counteridenticals, even though the copula is not generally restricted to equative contexts. In the case of 'advice' counteridentical, by contrast, speakers of Polish must make use of a paraphrase structure (*Na Twoim miejscu* [= literally: On your spot]) (p.c. Z. Fuchs; Kauf (2016)).

In other languages it is the grammatical tense of the consequent clause which helps to distinguish between the two readings: According to Han (1996), counterfactuality in Korean arises via a conversational implicature that is drawn when a conditional sentence uses past-tense morphology in its antecedent and future-tense morphology in its consequent (cf. ibid.: 5). Extending Han's morphological discussion, the following four grammatical structures have been approved for Korean present counterfactuals by Ahn and judged with respect to their validity for the two uses of counteridentical antecedents (p.c.):

1. [...V-Past...if] [...V-Fut]	['Advice' ✓/'Imagine' ✓]
2. [...V-Past...if] [...V-Past-Fut]	['Advice' ✓/'Imagine' ✓]
3. [...V-Past...if] [...V-Past]	['Advice' ✓/'Imagine' ✓]
4. [...V-Past...if] [...V-Pres]	['Advice' ✓/'Imagine' *]

(Han 1996, extended by Ahn (p.c.)[4])

What is notable about this data for the purpose of this paper is that the use of the PRES-IND in the consequent forces an 'advice' reading, while all other structures can be used ambiguously between the two suggested interpretations. To illustrate this distinction more clearly, consider the following set of example sentences, provided by Ahn (p.c.), where '**A**dvice'-readings presuppose a context in which the speaker proclaims what he would do if he were in Mary's situation—he would go into the sea, even though she might not –, and the '**I**magine'-counteridentical version could, for example, be uttered in a scenario in which the speaker has just received a message with a picture showing Mary going into the sea at this moment and is now fantasizing about being her.

(41) If I were Mary, I would go into the sea right now.

a. Nay-ka Mary-i-ess-tamyen, cikum-ccum pata-ey teleka-l.kess-ita. [A/I]
I-NOM Mary-be-PAST-if around.now ocean-DAT enter-FUT-IND
'If I were Mary, I would go in the sea right now.'

b. Nay-ka Mary-i-ess-tamyen, cikum-ccum pata-ey teleka-ss-ul.kess.ita. [A/I]
I-NOM Mary-be-PAST-if around.now ocean-DAT enter-PAST-FUT-IND
'If I were Mary, I would go in the sea right now.'

c. Nay-ka Mary-i-ess-tamyen, cikum-ccum pata-ey teleka-ss-ta. [A/I]
I-NOM Mary-be-PAST-if around.now ocean-DAT enter-PAST-IND
'If I were Mary, I would go in the sea right now.'

d. Nay-ka Mary-i-ess-tamyen, cikum-ccum pata-ey teleka-n-ta. [A/*I]
I-NOM Mary-be-PAST-if around.now ocean-DAT enter-PRES-IND
'If I were Mary, I would go in the sea right now.'

The proposal thus correctly predicts the antecedent clause of counteridenticals to have different meanings in addition to being able to explain the parallels between counteridenticals and dream reports. In these respects it fares better than existing analyses of counteridentical meaning like Kocurek (2016) and Lakoff (1996) (for a detailed discussion, see Kauf (2016)). At the same time, however, it raises several questions.

[4] For reasons of clarity and comprehensibility, this analysis has been limited to Korean present counterfactuals. For an in-depth analysis of Korean past counterfactuals, the reader is encouraged to consult Han (1996).

A first question which should be answered as part of future research is why the principle B violations persist in the case that $a \neq y$ (Section 2.1), i.e. whenever we are talking about 2nd/3rd person pronouns. One potential answer consists in assuming a speaker special hypothesis to be at work. Following this line of argumentation, Arregui (2007), suggests that first person pronouns allow for special binding, namely *de se* binding (cf. 38). A tentative answer in line with the analysis proposed in this paper is that only for first person pronouns it is the case that the center of the dream worlds is associated with the speaker, i.e. the default imaginer. For all other values of a, the imaginer and the center of the imagine worlds are distinct. Finding answers to this question might also help to shed further light on the integration of the analyses of counteridenticals and dream reports, since reports like *I dreamed that Peter was John and that he married his brother* seem parallel to counteridenticals with second and third person subjects, but have not been included in Percus and Sauerland's (2003) theory.

Another, more pressing, question concerns the proposal's compatibility with existing analyses of counterfactual meaning. In the beginning of this paper it was stated that counteridenticals are first and foremost counterfactuals; hence, standard analyses of counterfactuals (e.g. Iatridou (2000) and Ippolito (2013)) should be applicable to counteridenticals as well. Interestingly, however, these analyses are not trivially able to capture the correct meaning of counteridenticals (for a more detailed discussion see Kauf (2016)). Under past-as-past analyses like Ippolito (2013) it is in particular the assumption of a historical accessibility relation that is not philosophically trivial. In stipulating such a relation, we would have to assume—everything else remaining the same—that there is a point in time in the past such that some kind of ghost develops into one person in one set of continuations of those worlds while developing into another person in another set of continuations. It seems doubtful, however, that such a point in time should exist. An alternative was recently presented by Krifka (2018), who also interprets the past morphology in the counterfactuals as a real past, but proposes it to quantify over commitment spaces rather than worlds; hence, the philosophical concerns do not necessarily arise. Under past-as-fake proposals like Iatridou (2000), the main difficulty concerning the analysis of counteridenticals arises from the definition of the closest worlds. Whereas it is true for 'imagine' counteridenticals that in all those closest worlds in which the antecedent clause holds, i.e. in which the subject entity is identified with the predicate entity, the counterpart entity does whatever the predicate entity does, the same conditionality relation is inherently rejected for 'advice' counteridenticals; these contrary-to-fact worlds are twice removed from the actual world: The subject entity is not the same as the predicate entity, and his/her counterpart does not necessarily do what the predicate entity would do in the consequent situation (cf. sec.1 par 3 for an example situation). Hence, some other factors must be at play.

A question which immediately arises for the current proposal in this context is whether the $\forall$-quantifier in the denotation of *imagine* requires a similarity relation. Of course, we can imagine all kinds of worlds; nevertheless, underlying the semantic representation of counteridenticals is the constraint to stay as close to the real world as possible when imagining worlds at which the antecedent proposition holds. A further prediction this proposal thus makes is that every (counterfactual) conditional licenses a covert, center-inducing *imagine*-like operator. The investigation of these and further questions, like the proposal's interaction with focus or aspect, is left to future research.

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A formal pragmatic account of Double Access[1]

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Abstract. This paper argues that Double Access sentences in English (Smith, 1978) are a kind of loose talk. When the meaning of a Double Access sentence is computed literally, the result is infelicity. Double Access sentences can be used meaningfully only when rescued by pragmatics which intervenes to interpret the embedded clause loosely. A formal model for loose interpretation, building on Klecha (2018), is provided.

Keywords: tense, embedding, Double Access, imprecision, defaults, embedded implicature.

This paper argues that Double Access sentences in English are a kind of loose talk. Double Access sentences (Smith, 1978) are typified in English by featuring a Present-Tensed clause embedded under a Past-Tensed attitude verb (henceforth I refer to this morphosyntactic configuration as *Present-under-Past*).

(1) Dorothy said that Tricia is sick.

Double Access sentences are often characterized as giving rise to two inferences; a simultaneous inference and a speech time inference. The supposed simultaneous time and speech time inferences of (1) are given in (2) and (3) respectively.

(2) *The Simultaneous Inference of (1)*
(1) CONVEYS: *According to D's speech event S, T is sick at τ(S).*

(3) *The Speech Time Inference of (1) (Classical Analysis)*
(1) CONVEYS: *T is sick at τ(1)*

This second inference, however, is not a consistent consequence of (2). Characterizing the speech time time inference of Double Access sentences remains difficult.

I present a characterization of the second inference, and then present a formalized analysis of Double Access as a case of non-literal meaning, one which also critically requires that non-literal meaning to be calculated at a local level. Specifically, I argue that Double Access sentences are, in a sense, grammatically ill-formed, and require pragmatic intervention to be rescued. It is as a consequence of this pragmatic rescue that the second inference arises.

The paper proceeds as follows. In Section 1, I present the essential facts surrounding Double Access, and provide some theoretical context for their significance. In Section 2, I present and motivate the temporal semantic framework I adopt. In Section 3, I present and motivate the pragmatic framework I adopt. In Section 4, I briefly lay out my assumptions regarding

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embedded implicature. In Section 5, I bring these elements together to present the analysis, before concluding.

1. Double Access

Here I present what I take to be the critical facts surrounding Double Access.

1.1. Fact #0: Present-under-Past Morphology

First of all, Double Access sentences have a curious morphological pattern: Present-under-Past morphology. While this is not a semantic fact, it is worth noting. This is because the analysis of embedded tense (at least in English) is tied up with the morphosyntax of tense. Many analyses of English embedded tense posit a syntactic *Sequence of Tense* (SOT) rule (e.g., Ladusaw, 1977; Kratzer, 1998; Schlenker, 2004; Stowell, 2007; Klecha, 2016) which says that certain other sentences of English are not what they appear on the surface.

In particular, an SOT rule is usually invoked to explain the two putative readings of (4).

(4) Dorothy said that Tricia was sick.

(5) *Simultaneous Reading of (4)*[2]
   a. (4) CONVEYS: *According to D's speech event S, T is sick at $\tau(S)$.*
   b. (4) ~~CONVEYS:~~ *According to D's speech event S, T is sick prior to $\tau(S)$.*

(6) *Backshifted Reading of (4)*
   a. (4) ~~CONVEYS:~~ *According to D's speech event S, T is sick at $\tau(S)$.*
   b. (4) CONVEYS: *According to D's speech event S, T is sick prior to $\tau(S)$.*

According to the SOT rule analysis, the Backshifted Reading is the result of embedding a real Past Tense under another one. Tenses are (or can be) interpreted relatively, meaning that the evaluation time of the embedded Past Tense is the reference time of the matrix one; thus Dorothy's speech event is in the past relative to (4), but Tricia's alleged sickness is further in the past with respect to Dorothy's speech event.

The Simultaneous Reading, however, is the result of embedding a fake Past Tense under a real one. Details vary, but what these analyses generally have in common is that "fake Past Tense" is not a lexical item, but a derived one. For example, Ladusaw (1977) posits that an underlying Present Tense undergoes agreement, so that it becomes morphologically past; Klecha (2016) presents further arguments for this. Kratzer (1998), on the other hand, posits an underlying Null Tense which undergoes agreement. Stowell (2007) argues against a transformational account, instead arguing that Fake Past results from a different combination of lexical items than Real Past.

[2] Altshuler and Schwarzschild (2013) argue that the simultaneous reading entails the backshifted reading.

What these analyses all have in common, however, is that Present-under-Past morphology can never be realized on the surface under normal circumstances. The Present-Tense-Agreement approach of Ladusaw and Klecha predicts that Present Tense will always be morphologically realized as Past Tense when it is embedded under Past Tense. The Null-Tense-Agreement approach of Kratzer stipulates that Present Tense (and tenses generally) cannot be embedded under an attitude verb for type reasons, while Stowell's account makes Present Tense singularly unembeddable under Past Tense by way of a syntactic polarity mechanism.

Naturally, the mere existence of Present-under-Past morphology is, on its face, problematic for all these accounts. Stowell's account is specifically designed with Double Access in mind, and posits covert movement which rescues Present-under-Past morphology from the polarity violation, but results in the unusual interpretation.

An alternative, of course, is to pursue approaches that simply don't make use of a syntactic SOT mechanism. Some, like Abusch's (1997) semantic feature transmission approach, or Ogihara's (1995) highly influential tense deletion approach, are essentially semantic analogs of the syntactic SOT approach, and operate on the same logic–allowing the embedded past in Past-under-Past cases to be interpreted as something other than a simple anterior operator. Because these are not syntactic in nature, they don't problematize Present-under-Past morphology. Others, like Gennari (2003); Altshuler and Schwarzschild (2013), simply reject the ambiguity of Past-under-Past cases altogether, treating them instead as cases of generality, and requiring no SOT mechanism whatsoever.

However, these analyses have difficulty providing a non-stipulative answer to the highly marked semantics of Double Access, whereas syntactic SOT approaches can motivate the marked semantics by way of the marked syntax. Next, I explore said marked semantics.

1.2. Fact #1: The Simultaneous Inference

As discussed before, Double Access sentences give rise two inferences, one of which has proven difficult to characterize. The easy one, however, is the simultaneous inference, repeated below.

(1) Dorothy said that Tricia is sick.

(7) *The Simultaneous Inference of (1)*
(1) CONVEYS: *According to D's speech event S, T is sick at $\tau(S)$.*

While easy to characterize, this inference is not always easy to account for. As discussed above, there is an ongoing debate in the embedded tense literature about what kind of SOT rule, if any, is necessary for a proper analysis of the English facts. This debate is also tied up in another controversy, over whether tenses are indexical or relative.

What is uncontroversial is that in unembedded contexts, tenses behave as if they are indexical.

Thus the tense in each of (8a-b) relates event time (ET; the time of the event described by the verb) to speech time (ST; time of the speech event).

(8) a. Tricia is sick. ET = ST
b. Tricia was sick. ET < ST

What is also uncontroversial is that in certain embedded contexts, (certain) tenses behave as if they are relative; i.e., their evaluation time is not ST, but rather another time determined by their syntactic environment. In (9), the Past Tense on *turned* conveys that the turning-in event is in the past with respect to the giving-an-A event, which is in turn in the future with respect to ST. So the turning-in time need not be in the past with respect to ST.

(9) Alan will give an A to every student who turned in their homework.

The question is which of these behaviors is exceptional. The relative approach says that (9) is the norm, and (8) is due to a default rule for evaluation time determination; whereas the indexical view says that (8) is the norm, and (9) is due to indexical shifting.

This debate is most consequential for the analysis of embedded cases, especially Past-under-Past and Present-under-Past. On the relative view, the backshifted reading of Past-under-Past is readily accounted for, while the simultaneous reading is not–which is what necessitates appeal to SOT rules. The indexical view, on the other hand, predicts no ambiguity, but rather generality between simultaneous and backshifted cases, so one potential advantage to the indexical view is that it could avoid having to posit SOT rules. (The problem for the indexical view is that this generality should extend to a forward-shifted case, which does not usually exist. More on this below.)

As for Present-under-Past, the relative view predicts that it should simply have a simultaneous reading and nothing else (to the extent that Present-under-Past morphology can be squared with SOT). So the simultaneous inference is a strong point for the relative view. The indexical view, on other hand, has no means to predict a simultaneous inference, which makes this inference highly problematic for such views, unless they are considered cases of indexical shifting–but if indexical shifting is available here, it ought to be available in Past-under-Past cases as well, in which case the indexical theory starts to be indistinguishable from the relative one.

What is problematic for the relative theory, however, is that the simultaneous inference isn't the only inference that Double Access sentences give rise to.

1.3. Fact #2: The Speech Time Inference

When Double Access sentences were first discussed by Smith (1978), she characterized the second inference they give rise to as being (10).

(1) Dorothy said that Tricia is sick.

(10) *The Speech Time Inference of (1) (Classical Analysis)*
(1) CONVEYS: *T is sick at* $\tau(1)$

However, Ogihara (1995) showed that this is not the correct characterization; (9) can be uttered, felicitously and truthfully, in cases like (11).

(11) a. *Tricia's nose is running and her face is puffy.*
b. *Jamie knows she has allergies, but Dorothy doesn't.*
c. *D/E:* Tricia is sick.
d. *A bit later, Jamie runs into Emily.*
e. *J/E:* Tricia has allergies.
f. *E/J:* Oh, Dorothy said that she's sick.
g. *E/J:* Guess she's wrong.

Furthermore, Double Access sentences do not convey that the embedded event hold at ST *in the worlds of the attitude* (i.e., (11f) does not convey that Tricia being sick at ST is an entailment of what Dorothy said), nor do they convey that the embedded event hold at ST in the ST-belief worlds of the attitude holder (i.e., (11f) does not convey that Dorothy currently believes Tricia to be sick at ST); see Ogihara (1995) for detailed arguments.

My characterization of the Speech Time inference is as follows: It is the inference that anyone who believes the content of the attitude believes that the prejacent holds at ST. Thus it is odd for the speaker of a Double Access sentence who endorses the content of described attitude to deny that the prejacent holds at ST.

(12) a. Dorothy concluded that Tricia is sick.
b. And Dorothy is always right about this kind of thing.
c. So Tricia certainly was sick...
d. #...but she probably isn't anymore.

This can be shown even more clearly with a factive attitude, which requires the speaker to endorse the content of the attitude.

(13) a. Dorothy realized that Tricia is sick.
b. #...but she isn't anymore.

This pattern does not depend on the subject being the endorser.

(14) a. Dorothy said Tricia is sick.
b. And she stands by what she said.
c. #But she thinks Tricia isn't sick anymore.

Moreover, as discussed by Schlenker (2004), there is a limit on the span between reference time and UT; but also it depends on the embedded predicate. See also Bary et al. (this volume) for more discussion.

(15) a. {Yesterday/$^{?}$Last month/#2 years ago}, John said that Mary is pregnant.
b. {A minute ago/#Yesterday}, Mary said that John is in the kitchen.
c. The ancient Romans thought that the sun revolves around the earth.

This fact follows from my characterization of the speech time inference.

It is this inference which is troublesome for any analysis of embedded tense. On their face, indexical analyses seem best suited to handle this problem, since a naïve indexical analysis predicts that Present-under-Past should give rise to a speech time inference. However, such an analysis does not predict the inference exactly as I characterized it; it instead predicts the second inference possibility that Ogihara showed to be wrong (i.e., that the prejacent holds at ST in the worlds of the attitude).

What's more, most if not all *non*-naïve indexical analyses posit the existence of an Upper Limit Constraint (ULC). Originating with Abusch (1997), the ULC is a stipulated filter on permissible LFs that bans any LF which lets an embedded reference time be later than the time of embedding attitude verb. In other words, it simply rules out the forward-shifted cases discussed in the previous section that the indexical analysis would otherwise predict. It is the Upper Limit Constraint, on indexical analyses, which rules out (16), whereas on relative analysis, it is ruled out by the semantics of Past Tense.

(16) #Three days ago Dororthy said that Tricia was sick yesterday.

The ULC further problematizes any attempt to account for Double Access, because it ought to violate it. So there is no obvious mechanism which would derive these facts. I argue that this fact does follow from general mechanisms, but they are pragmatic mechanisms–imprecision and default inferences–which I discuss in Section 3.

1.4. Fact #3: Interaction with Aktionsart

Finally, in many (but not all) contexts, stative attitude verbs are incompatible with Double Access (Altshuler et al., 2015). This is another fact in need of explanation.

(17) I saw John yesterday.
a. He said that Mary is pregnant.
b. #He thought that Mary is pregnant.

1.5. Interim Summary

Although I have presented a characterization of the Speech Time inference, I have not explained how it arises, why it arises together with the Simultaneous inference, nor why this configuration favors eventive predicates. In brief, my analysis is that (18) can be felicitously uttered at *t* if the difference between *t* and the time of Dorothy's saying is, for the purposes of discussing Tricia's (alleged) sickness, irrelevant; we can thus conflate the two and treat Dorothy's saying time as identical to t, allowing use of Present Tense but giving rise to a Simultaneous Inference. But without this conflation there is a violation of the Upper Limit Constraint, so (17) can **only** be felicitously used when conflating the two times, thus the Speech Time Inference.

2. The Temporal Semantics

2.1. Attitude Verbs

I mostly adopt the temporal semantics framework of Klecha (2016). Klecha observes that the Upper Limit Constraint, discussed above, is lexically variable. Thus, some attitude verbs, like *hope*, do allow for forward-shifted readings; (18a) requires that Tricia's sickness be prior to Dorothy's thinking, but (18b) does not.

(18) a. Dorothy thought Tricia got sick.
b. Dorothy hoped Tricia got sick.

An important upshot of this observation is that the Upper Limit Constraint *does* exist, and needs to be reconciled with Double Access.

I adopt Klecha's analysis of attitude verbs, which accounts for these facts. On Klecha's analysis, attitude verbs (and modals generally) quantify not over worlds but over *histories*, which can be modeled as world-interval pairs.

(19) *Histories*
if $h = \langle w,t \rangle$, $\omega(h) = w$ and $\tau(h) = t$

Maximal histories are those who interval component is the maximal temporal interval, representing the whole timeline of a given world. But modals can also quantify over partial histories, and thus restrict the range of possible temporal reference in their prejacents. Particularly, attitude verbs like *say* and *think* (and most other finite-embedding ones) quantify over *actual histories*, whose time component is an interval $(-\infty,t]$ for some t; i.e., the interval representing the past and present of t, but not its future. This is what prevents forward-shifting in the case of these attitudes.

(20) *Actual Histories*
$\mathscr{A}_t := \{h \mid \tau(h) = (-\infty,t]\}$

So the denotation for *think* is (21a), where $\textsc{dox}_{x,t,h}$ is the set of histories consistent with x's beliefs in h at t, and the denotation for *say* is in (21b), where $\textsc{dc}_{x,t,h}$ is the set of histories consistent with the discourse commitments induced by x's utterance in h at t.[3]

[3]This ignores the eventive component of *say*, since there is no representation of an actual saying event, only the stative/modal component. A better denotation would include this, but I exclude it because modeling this component is not relevant for the present investigation.

(21) a. $[\![\text{think}]\!]^c_s = \lambda p_{st} \lambda x \lambda t \lambda h [\forall i \in \mathscr{A}_t \cap \text{DOX}_{x,t,h}[p(i)]]$
b. $[\![\text{say}]\!]^c_s = \lambda p_{st} \lambda x \lambda t \lambda h [\forall i \in \mathscr{A}_t \cap \text{DC}_{x,t,h}[p(i)]]$

(21) says that *think* combines with a prejacent proposition (a property of histories; denoted by the embedded clause), individual (the subject), a time, and a history, and is true iff, in every actual history consistent with the beliefs of the subject at the evaluation time in the evaluation history, p is true.

2.2. Indexical Tenses

Klecha also argues for an SOT rule and a relative semantics for tenses. But his analysis of the ULC alone does not demand a relative semantics for tense, and in fact makes an indexical analysis possible, at least without considering other data. I will not weigh in on this question, except to point out that indexical readings of embedded tenses must at least be *possible*. This is shown by the behavior of the Past Perfect under Past.

First, consider that the Past Perfect requires the existence of a salient past time.

(22) *Andy walks into Chuck's party and sees Bella.*
a. *A/B:* Why so serious?
b. *B/A:* Chuck (#had) kissed my ex.

(22b), which is discourse initial, is bad when put into a Past Perfect configuration, but good in the simple Past. Presumably the requirement is a uniform property of the Past Tense; it always requires its reference time to be salient. But in cases of the Simple Past, the time of the event is identified with reference time, and so it can be accommodated to act as the salient past time. In the case of the Past Perfect, however, the event time must be in the past with respect to Past's reference time, so this is what requires a genuinely salient past time from prior discourse apart from the event time.

However, when embedded under a Past Tense attitude, this requirement seems to go away.

(23) *Andy walks into Chuck's party and sees Bella.*
a. *A/B:* Why do you look grim?
b. *B/A:* Chuck told me a few weeks ago that he (had) kissed my ex the day before.

This can only be because the salient past time needed by the Past Tense is the time of the matrix attitude verb, *tell*. But this would require that the reference time of the embedded Past Tense is simultaneous with, not prior to, the time of the attitude. The only way for purely relative past theories to account for this is to posit SOT. But this cannot be a case of SOT either–that would mean that (23b) is a case of the Present Perfect which has undergone SOT; but the Present Perfect is incompatible with frame adverbs like *the day before* (see e.g., Portner, 2011).

So either tenses are indexical, or, if they are relative, there is a mechanism which allows the possibility of indexical readings, while perhaps also allowing relative readings. This mechanism could be Stowell's movement operation, which would make the seemingly embedded relative tense unembedded, and thus behave as if indexical. But for the sake of simplicity and space, I will simply adopt an indexical analysis of tense for the purposes of this discussion. So the denotation I assume for the tenses are as follows, where 0 is the distinguished variable that all assignments map to ST; thus $g_c(0)$ below represents ST.

(24) a. $[\![\textsc{pst}_j]\!]^c_s = \lambda p \lambda h[p(g_c(j))(h) \ \& \ g_c(j) < g_c(0)]$
b. $[\![\textsc{prs}_0]\!]^c_s = g_c(0)$

2.3. The Upper Limit

A typical verb phrase is modeled as in (26), where $h|t$ is defined in (25).

(25) a. $h|t$ is defined iff $\tau(h) \cap t$ is a non-empty interval
b. if defined, $h|t := \langle \omega(h), \tau(h) \cap t \rangle$

(26) $[\![\text{Tricia be sick}]\!]^c_s = \lambda t \lambda h[\exists s[\text{sick}(s)(\omega(h)) \ \& \ \tau(s) = \tau(h|t)]]$

Combining such a verb phrase with tense, and then an attitude, gives (27) and ultimately (28).

(27) $[\![\text{Tricia } \textsc{pst}_j \text{ was sick}]\!]^c_s = \lambda h[\exists s[\text{sick}(s)(\omega(h)) \ \& \ \tau(s) = \tau(h|g_c(j))] \ \& \ g_c(j) < g_c(0)]$

(28) $[\![\textsc{pst}_k \text{ Dorothy say Tricia } \textsc{pst}_j \text{ was sick}]\!]^c_s = \lambda h[g_c(k) < g_c(0) \ \&$
$\forall i \in \mathscr{A}_{g_c(k)} \cap \textsc{dc}_{d,g_c(k),h}[\exists s[\text{sick}(s)(\omega(i)) \ \& \ \tau(s) = \tau(i|g_c(j))] \ \& \ g_c(j) < g_c(0)]]$

(28) models the meaning of (29).

(29) Dorothy said Tricia was sick.

Notice that if $g_c(j)$, the salient time picked out by Past Tense, is later than $g_c(k)$, the evaluation time of *think*, and thus outside the interval component of (all values of) i, the result will be a crash, because the term $i|g_c(j)$ will be undefined. This is what enforces the Upper Limit Constraint. Thus (28) correctly predicts that (29) is consistent with backshifted or simultaneous cases, but not forwardshifted ones.

Accordingly, replacing Past Tense in the embedded clause with Present Tense guarantees infelicity, according to the present model, since $g_c(0)$ is now necessarily later than $g_c(k)$.

(30) $[\![\textsc{pst}_k \text{ Dorothy say Tricia } \textsc{prs}_0 \text{ is sick}]\!]^g_s = \lambda h[g_c(k) < g_c(0) \ \&$
$\forall i \in \mathscr{A}_{g_c(k)} \cap \textsc{dc}_{d,g_c(k),h}[\exists s[\text{sick}(s)(\omega(i)) \ \& \ \tau(s) = \tau(i|g_c(0))]]]$

This is a feature of the analysis, not a bug: I argue that the literal meaning of Double Access sentences is ill-formed. I argue that Double Access sentences are only uttered meaningfully because they are rescued by pragmatics. I now present the tools necessary to formalize this.

3. Pragmatics

Two features of pragmatic interpretation will play important roles here. First, *imprecision* is what allows humans to utter sentences whose literal meaning is false, but whose *pragmatic meaning* may be true. In other words, imprecision is a phenomenon by which sentences are mapped to meanings which are weaker than their literal semantics.

(31) a. Julian arrived at 3.
 b. (31a) CONVEYS: J arrived at around 3.

Second, *default reasoning* is one of several pragmatic features which allow humans to utter sentences whose literal meaning is true, but whose pragmatic meaning is false; i.e., it is a feature which allows sentences to be strengthened relative to their literal meaning, in this case with information that is considered an ordinary, but not necessary, consequence of the literal meaning of the expression.

(32) a. I opened the door.
 b. (32a) CONVEYS: I opened the door using the doorknob.

Below I present a formal framework for pragmatic interpretation, before explaining how imprecision and defaults are captured within it.

3.1. The Framework

Following many authors on formal pragmatics (e.g., Franke, 2009; Jäger, 2012), I assume that literal meaning is relevant to interpretation only in as far as it serves as a baseline from which to determine what is actually communicated, analogous to the underlying representations of phonology. So for every sentence, there is a literal meaning determined by semantic meaning conventions (and perhaps also the semantic context σ_c), and then a pragmatic meaning, which is a function of that and of the pragmatic context ρ_c. The pragmatic meaning of a sentence could be enriched by scalar implicature, for instance.

(33) SEMANTIC MEANING: $[\![S]\!]^c_s$ PRAGMATIC MEANING: $[\![S]\!]^c_p$

The pragmatic context specifies things like alternative utterances which compete with the target utterance (crucial in the case of scalar implicatures for example), but also a set of *domain goals* and *prevailing assumptions*.

3.2. Imprecision

Per Klecha (2018), imprecision is determined by the domain goals. The domain goals for a given discourse are the issues, choices, or questions, which are considered by the interlocutors to be worthy of their attention. The domain goals can be modeled as a partition K on the logical space. Each cell in the partition contains worlds which are *indistinguishable* for the purposes of the domain goals. So, if it is in my domain goals that I catch my train at 3, then perhaps a cell in the partition which models it will contain both a world where I leave at 2:59 and a world where I leave at 3:00, because the question of leaving at 2:59 versus 3:00 is doesn't matter for the purposes of catching my train; either way, I'll make it in time. But if leaving at 3:05 would result in my missing the train, worlds where I do so will end up in a different cell.

One effect of pragmatic interpretation is that meanings are *coarsened*. In other words, they are pixelated according to the resolution imposed on the logical space by the domain goals. Consider a proposition p against the backdrop of the logical space W.

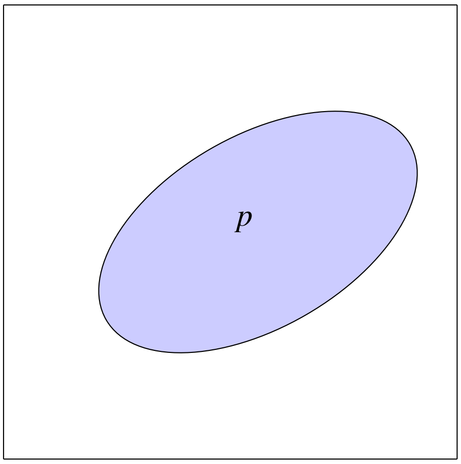

Figure 1: W (maximum resolution)

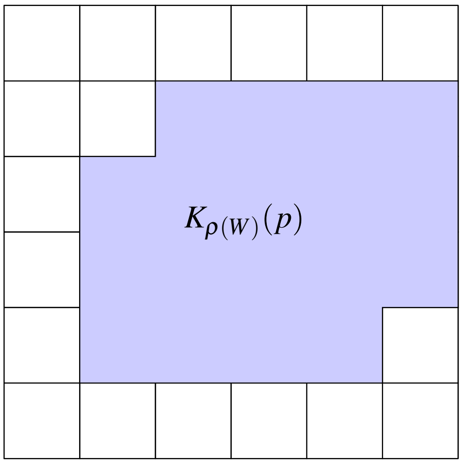

Figure 2: W_ρ

So in a context *where imprecision is the only pragmatic effect on meaning*, the pragmatic meaning of a sentence S will be as in (34).

(34) $[\![\text{S}]\!]^c_p = K_{\rho_c(W)}([\![\text{S}]\!]^c_s)$

3.3. Defaults

Default inference is a related phenomenon (e.g., Jäger, 2012; Franke, 2014; Klecha, 2018). Here I assume that the pragmatic context has another parameter, prevailing assumptions, which are responsible for default inferences. Prevailing assumptions are simply propositions which both interlocutors either assume to be true, or act as if are true because they believe the other interlocutor to be assuming them. Prevailing assumptions narrow the logical space, making assertions more informative than they might otherwise be. I'll use P_{ρ_c} to stand for the prevailing assumptions in a given context c.

For any sentence uttered in a context *where default inferences and imprecision are the only pragmatic effect on meaning*, the pragmatic meaning of a sentence S will be as in (35).

(35) $[\![\mathrm{S}]\!]^c_p = K_{\rho_c(P_{\rho_c})}([\![\mathrm{S}]\!]^c_s)$

3.4. Accommodation

The domain goals and prevailing assumptions are both discourse parameters. They can, at least in some cases, be modified by a process similar to accommodation, a la Lewis (1979). As discussed by Klecha (2018), for example, utterance of a non-round number in a context that otherwise makes such a number equivalent to a round number causes the standard of precision to rise; i.e., it causes the domain goals to become richer, and thus the logical space becomes more finely partitioned. As Klecha argues, since non-round numbers are more costly to utter, one should have no reason to utter them when imprecision makes nearby round numbers indistinguishable. Once they are uttered, the hearer has no choice but to recognize that the speaker must be assuming a higher standard of precision. Accommodation of prevailing assumptions is crucial to the present analysis, as discussed below.

4. Embedded Implicature

Lasersohn's (1999) analysis of imprecision says that each lexical item in a derivation is assigned an imprecise interpretation, and then those are composed alongside the literal meanings, thus determining a pragmatic interpretation for the sentence as a whole. Klecha (2014, 2018) argues against this; since different expressions within a sentence might be interpreted with different levels of precision.

(36) For the dinner tonight we need 50 place settings and 200 bottles of beer.

According to Lasersohn (1999), individual terms like *50* and *200* would need to be assigned standards of precision before composing with other elements in the sentence. But since (36) provides a sentence where, conceivably, *50* could be interpreted with maximum precision, and *200* with less than maximum precision, it can't be that precision is determined at the lexical item level, with no input from the rest of the sentential context. So Klecha argues for an entirely post-semantic pragmatic interpretation mechanism.

The present analysis of Double Access says that the literal interpretation of a Double Access sentence is ill-formed, and needs to be rescued by pragmatics. But this pragmatic rescue cannot happen entirely after semantic composition. If it did, the input to pragmatic interpretation would be an infelicitous sentence with no meaning.[4] Instead, the embedded clause must be assigned a pragmatic interpretation before composing with the attitude verb, to avoid violation of the Upper Limit Constraint.

[4]Thanks to Julian Grove (p.c.) for making this point especially clear to me.

The notion that pragmatics may occur below the sentence level is not a new one. Besides Lasersohn (1999), it has been recently argued that certain implicatures can be calculated in the midst of composition. For example, Potts et al. (2015) argues that embedded implicatures are derived in a manner not so dissimilar from Lasersohn, with pragmatic alternatives being assigned to every lexical item, composing pointwise, resulting in a set of alternative interpretations for the whole sentence. The optimal alternative is then selected and becomes the pragmatic interpretation for the sentence.

However, to avoid the problem with imprecision raised by Klecha (2014, 2018), I propose that alternatives be assigned to every clause (i.e., proposition denoting projection) rather than every lexical item. This allows for an analysis of (36) whereby the difference between 50 place settings and 51 matters, but the difference between 200 bottles of beer and 201 doesn't. It also still allows for Potts et al.'s (2015) treatment of embedded scalar implicatures.

5. Analysis

Recall the literal meaning of Double Access sentences is undefined, thanks to the term $i|g_c(0)$.

(37) $[\![\textsc{pst}_k \text{ Dorothy say Tricia } \textsc{prs}_0 \text{ is sick}]\!]^c_s = \lambda h[g_c(k) < g_c(0)\ \&$
$\forall i \in \mathscr{A}_{g_c(k)} \cap \mathrm{DC}_{d,g_c(k),h}[\exists s[\text{sick}(s)(\omega(i))\ \&\ \tau(s) = \tau(i|g_c(0))]]]$

But Double Access is acceptable at sufficiently low *temporal resolution*, where we can (due to pragmatic enrichment) conflate ST and the past ET of the attitude verb, so that the Upper Limit Constraint is not violated. The fact that this low-resolution construal is necessary to rescue (1) explains its various interesting behaviors.

5.1. Step One: Temporal Resolution

Being at temporal resolution d (for the purposes of discussing Tricia's sickness) means we i) partition the temporal space into intervals of length d, and ii) ignore the possibility that Tricia's sickness state will change within any of the cells. This is modeled as a prevailing assumption; the discourse participants assume that if Tricia is sick at one moment within any of the partition-intervals, she is sick at all moments within said interval. This is the sense in which ST and the past ET of the attitude verb are conflated.

5.2. Step Two: Imprecision

Klecha's (2018) theory of imprecision assumes that any discourse's domain goals will provide a partition on the logical space, where that logical space is composed of worlds. But having enriched the logical space so that it is made up of histories, rather than worlds, per Klecha (2016), how does the partition work? For the most part, the same–histories are world-interval pairs, so partitioning can mostly continue by partitioning histories according to their world-components.

But what about histories who share a world component, but have different temporal components? Are they ever sorted into different partitions by the domain goals? I assume that a principle applies in these cases.

First, let us say that history h *branches* from actual history i if their world components are identical up to the endpoint of $\tau(i)$ and $\tau(i)$ ends prior to the end of $\tau(h)$.

(38) $i \sqsubset h := \omega(i) \approx_{RB(\tau(i))} \omega(h) \;\&\; RB(\tau(i)) < RB(\tau(h))$

In other words if h branches from i, then h is a continuation of i. Consider now a principle for determining whether branches ought to be lumped by a given partition or not.

(39) *Principle of Temporal Imprecision*
   a. If all $k \in P_\rho$ such that $i \sqsubset k$ and $t \in \tau(k)$ answer $p(t)$? the same
   b. and $i \sqsubset h$ and $t \in \tau(h)$
   c. h and i will not be distinguished by $p(t)$? in P_ρ

So in other words, if h is a branch of i, and $p(t)(h)$ is true, but $p(t)(i)$ is undefined because i does not extend far enough into the future to include t, then i will not be considered to answer $p(t)$? the same as h, unless it's also true that *all* live branches of i that do extend up to t answer the question the same way, where *live* means "in P_ρ", i.e., consistent with the prevailing assumptions of ρ.

5.3. Accounting for Double Access

So generally a history which extends only up to the past time of Dorothy's thinking will not be lumped in with one that extends up to ST. But if a prevailing assumption has been adopted that imposes a temporal resolution on the discourse that conflates Dorothy's thinking time with ST, such histories can be lumped together.

Thus, at such a context, the pragmatic interpretation of the embedded clause (40a) will contain (as usual) a bunch of histories extending up to speech time at which Tricia is sick at speech time (h_{5-8} in Fig. 3); but it will also include histories which do not extend up to speech time, so long as they extend at least as far the left boundary of the cell t_d in the temporal resolution which also contains speech time, and so long as Tricia is sick during the portion of t_d which is included in the history (h_{9-13} in Fig. 3). Since that now means that it contains worlds that are actual histories of Dorothy's saying time t_{say} (h_{12}, h_{13} in Fig. 3), (40a) can be embedded under *say*, where *say*'s evaluation time is t_{say}, without incurring a violation of the ULC.

(40) *Semantic and pragmatic values for* Tricia is sick *given model in Fig. 3*
   a. Tricia is sick.
   b. $[\![(40a)]\!]^c_s = \{h_2, h_3, h_4, h_5, h_6, h_7, h_8\}$
   c. $P_\rho \cap [\![(40a)]\!]^c_s = \{h_5, h_6, h_7, h_8\}$
   d. $K_{\rho(P_\rho)}([\![(40a)]\!]^c_s) = \{h_5, h_6, h_7, h_8, h_9, h_{10}, h_{11}, h_{12}, h_{13}\}$

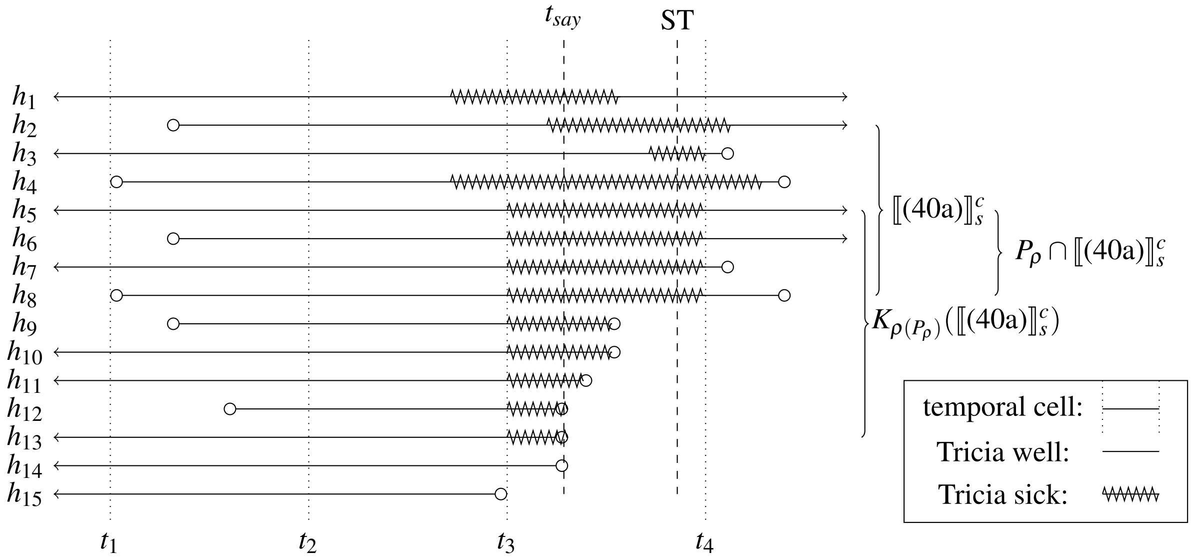

Figure 3: Pragmatic interpretation of (40a)

The inference modeled by (40d) is the Simultaneous Inference–because in all the histories that are actual histories of t_{say}, Tricia is sick at t_{say}.

(41) a. $[\![\text{Tricia is sick}]\!]^c_p = K_{\rho(P_\rho)}([\![\text{Tricia is sick}]\!]^c_s)$

b. $[\![\text{PST}_k \text{ say [Tricia is sick]}]\!]^c_s = \lambda x \lambda h[g_c(k) < g_c(0)\ \&$
$\forall i \in \mathscr{A}_{g_c(k)} \cap \text{DC}_{x,g_c(k),h}[i \in [\![\text{Tricia is sick}]\!]^c_p]]$

So the pragmatic enrichment obviates the ULC, and derives the Simultaneous Inference.

And what about the Speech Time inference? It is not properly a part of the meaning of the sentence itself, pragmatic or otherwise. But recall that Double Access sentences can only be interpreted if the context is one with an appropriate temporal resolution. If the context does not already have that resolution, it must be accommodated. Accommodating that resolution gives rise to the Speech Time Inference–it amounts to accommodating the presupposition that Tricia is either sick or well throughout the duration of each interval of the temporal partition.

This accounts for why a speaker who commits herself to believing the content of the attitude must also believe that the prejacent eventuality still holds at speech time. In order to utter the Double Access sentence in the first place, the speaker commits to a temporal resolution whereby the eventuality's runtime must include all or none of the interval spanning both the time of the attitude and speech time, in any world.

It also explains the time limit facts, since one would only adopt such a temporal resolution if they believed that the state of affairs in question was unlikely to change in the timespan of the relevant interval. And it goes further, in fact, predicting that sometimes the time limit would be shorter than others simply based on what temporal distinctions are relevant. For example, it generally predicts that while (42) is bad, (43) is good, as has been noted previously.

(42) #John told me Ted is pregnant a year ago.

(43) a. *A:* Ted hasn't been drinking lately because he's pregnant.
b. *B:* Whoa, wait, how is it you know that he's pregnant?
c. *A:* {A minute ago/Yesterday,} John told me he is.

This is because pregnancies generally remain stable from minute to minute or day to day, but not year to year. Thus a temporal resolution on the order of minutes or days is generally acceptable, but on the order of years is not.

However, the present theory also predicts that the temporal resolution *can* be even smaller than what the embedded predicate requires, and thus the embedded predicate provides only an *upper* bound on the time span for Double Access sentences. (44) bears this prediction out.

(44) a. *A:* Ted hasn't given birth yet; but he will sometime in the next few hours.
b. *B:* Whoa, wait, how is it you know that Ted's pregnant?
c. *A:* {A minute ago/#Yesterday}, John told me he is.

(44a) establishes a temporal resolution no coarser than a few hours, since (44a) makes an important distinction between the present moment, when Ted has not given birth, and a time a few hours from now when is expected to have done so. The *yesterday*-variant of (44c) is therefore bad, since it requires a temporal resolution broad enough to conflate ST with the previous day.

5.4. Preference for Eventives

The last thing to explain is the fact that eventive attitudes are much more common in Double Access sentences than stative ones (Altshuler et al., 2015). This can be explained in light of the assumption that there is a preference for the Present Tense over the Past Tense; Altshuler and Schwarzschild (2013) argue that the Present Tense is more informative than the Past Tense. It could also be that the Present Tense is inherently more relevant, in the sense that, all things being equal, information about the present is more likely to bear on the domain goals of any given discourse than information about the past. Or it could be that the Present Tense is simply less marked than the Past. In any case, this assumption is important to the logic of the present analysis of Double Access–pragmatic enrichment allows for the use of the Present-under-Past construction, but it for the most part gives rise to the same inference that Past-under-Past would. So there must be a reason for speakers to want to use Present-under-Past in the first place.

So, if our temporal resolution is coarse enough to conflate ST and ET, and thus use Present Tense in the embedded clause instead of Past, why then should it be that we don't also use Present Tense on the attitude verb? Since past and present are conflated, shouldn't *everything* be in Present Tense? Yes, and that's why Double Access is often bad with stative attitude verbs:

(45) a. #John thought Ted is pregnant.
b. John thinks Ted is pregnant.

The reason this doesn't carry over to eventive atittudes, is that episodic present tense with eventive verbs is impossible (Bennett and Partee, 1978).

(46) a. John discovered that Ted is pregnant.
b. #John discovers that Ted is pregnant.

Following Bennett and Partee (1978), I assume this is for type-reasons–ST is a moment, and the runtimes of events must be non-singleton intervals. Thus when an eventive VP composes with Present Tense, the result is a crash.

(47) $[\![\text{PRS}_0 \text{ Tricia get sick}]\!]^c_s = \lambda h[\exists e[\text{getsick}(e)(\omega(h)) \ \& \ \tau(e) \subseteq \tau(h|g_c(0))]] = \lambda h[\#]$

Lastly, a crucial point: The present proposal allows for the pragmatic enrichment of certain constituents as a way to rescue what might otherwise be a compositional crash. This could lead to the concern that pragmatic enrichment creates an escape hatch for type-clashes or presupposition failures–depriving semantic theory of its ability to predict infelicity of certain lexical combinations for semantic reasons. But this example illustrates why that concern would be misplaced–this particular clash cannot be remedied by pragmatic enrichment, because it happens below the clause level. And pragmatic enrichment generally can only rescue compositional mishaps that would otherwise happen at clause boundaries–this is because of the amendment to the Lasersohn (1999)/Potts et al. (2015) apparatus for pragmatic enrichment whereby enrichment only occurs to clause-typed constituents.

6. Conclusion

This paper presents a proposal by which Double Access is a special kind of loose talk. In particular, Double Access sentences can be felicitously used when the temporal resolution in the discourse is sufficiently coarse so as to conflate the event time of the attitude verb with speech time; in other words, in discourses where the interlocutors don't care to make the distinction between event and speech time for the purposes of discussing what they're discussing. This can be accounted for by simply allowing for the application of certain well-known pragmatic enrichments–imprecision and default inferences–to embedded clauses.

For reasons of space, no discussion of prior analyses of Double Access is presented, in particular, the dominant *de re* theory (Ogihara, 1995; Abusch, 1997). See Gennari (2003) for critique of these approaches. The biggest advantage of the present theory is that it keeps the semantic theory of tense quite simple. Some outstanding questions do still need to be answered, especially how the present theory bears on debates over relative and indexical treatments of tense.

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Hard cases of third readings in terms of the Standard Solution[1]

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Abstract. Schwager (2011) and Sudo (2014) argued that there are cases of the so-called third readings of attitude reports, initially discovered by Fodor (1970), that cannot be accounted for in terms of a theory of indexed world variables (Percus, 2000), which is often referred to as the Standard Solution. More complicated alternatives to the Standard Solution have been recently formulated in the literature in a number of papers. We argue that all the seemingly problematic cases can be naturally accounted for in terms of the Standard Solution, if we take into account the existence of previously unrecognized elided material in these reports.

Keywords: attitude reports, non-specific transparent, hard cases, Standard Solution.

1. Introduction

In this paper, we discuss so-called third readings of indefinites in attitude reports, originally discovered by Fodor (1970). Third readings exist in addition to the familiar *de re* and *de dicto* readings and combine some properties of both. The theory that is known in the literature as the Standard Solution straightforwardly accounts for third readings by introducing a mechanism of indexed world variables into the syntax. The hard cases for the Standard Solution are the challenging examples that were proposed by and discussed in Schwager (2011) and Sudo (2014). These authors argued that the hard cases called for more complicated alternatives to the Standard Solution.

Alternative theories have been formulated in terms of evaluating a property in the metaphysically closest worlds where the property is not empty (Schwager, 2011), substitution of contextually equivalent functions (Sudo, 2014), generalized concept generators (Baron, 2015), and a pragmatic account that assumes a modification of the context set of the conversation (Tiskin, 2016).

We will argue that all the seemingly problematic cases can be naturally accounted for in terms of the Standard Solution. We make an observation that in all of the problematic belief-reports the structure is more complex than was previously assumed. In a number of cases, there is elided material that needs to be reconstructed. We show how reconstructing this material allows the Standard Solution to deal with the problematic cases. We thus intend to show that more complicated treatments are not required to account for third readings.

The discussion in this paper will proceed as follows. In Section 2, we briefly introduce third readings. In Section 3, we discuss the Standard Solution and how it captures these readings. Section 4 presents two illustrative challenging cases from Schwager (2011). In Section 5, we demonstrate how those cases can be naturally accounted for in terms of the Standard Solution

[1] We would like to thank Seth Cable and Barbara Partee for all their help and the audiences at "Sinn und Bedeutung-22" (Berlin/Potsdam 7-10.09.2017) and UMass Semantics Workshop (20.09.2017, UMass Amherst) for their critical discussion and suggestions. All errors are our own.

given some independently motivated assumptions. In Section 6, we go over other known hard cases and show that our proposal can be successfully extended to those cases as well.

2. Third readings of attitude reports

Third readings of attitude reports are known to be a middle case between the more familiar *de re* and *de dicto* readings. Third readings combine some properties of a *de re* and some properties of a *de dicto* interpretation but cannot be reduced to either. Consider a simple example in (1).

(1) Mary wants to buy an expensive dress.

According to a *de re* interpretation of (1), there is a particular expensive dress and Mary wants to buy that dress. Mary is specific about the object that she wants to buy, but it is from the speaker's perspective that the object is an expensive dress. Mary might not be aware of its price or even that it is a dress. She might describe this object to herself differently.

The *de re* interpretation can be expressed in terms of an indefinite taking scope over the intensional verb (the idea goes back to (Russell, 1905). At LF, the indefinite *an expensive dress* undergoes quantifier raising as illustrated in (2) in the notation of Heim and Kratzer (1998).

(2) [[an expensive dress] [1 [Mary [wants [*PRO* to buy t_1]]]]]

Interpreting the indefinite in this position has two major effects on the interpretation of (1). The existential quantifier introduced by the indefinite scopes above the universal quantifier introduced by the attitude verb. This makes the *de re* reading of (1) *specific* (Mary wants to buy a concrete object). The descriptive content of the indefinite is evaluated in the actual world (and not in the worlds compatible with Mary's desires). This makes the *de re* reading *transparent* (the object that Mary wants to buy is an expensive dress from the speaker's perspective). *De re* readings of attitude reports are, thus, also known as *specific transparent.*

According to a *de dicto* interpretation, Mary wants to buy some expensive dress but she does not have a specific dress in mind.

Under the scope theory, this reading is expressed by interpreting the indefinite below the attitude verb (allowing it to raise only locally to avoid a type mismatch), as illustrated in (3):

(3) [Mary [wants [[an expensive dress] [1 [*PRO* to buy t_1]]]]]

The *de dicto* reading is known as *non-specific opaque* (because the indefinite scopes below the attitude verb and its descriptive content is interpreted in Mary's desire alternatives).

This sentence also has a third reading that is *non-specific transparent*: Mary does not have a concrete dress in mind and is choosing among what happens to be expensive dresses from the point of view of the speaker (but not necessarily in Mary's desire alternatives). The third reading thus shares the transparency of a *de re* interpretation (the objects that Mary is choosing from are judged as expensive dresses from the speaker's perspective) and the *non-specificity* of a *de dicto* interpretation (Mary does not want any particular dress).

Expressing this reading in terms of the scope theory is challenging and requires additional assumptions (see (Keshet, 2008; 2011)).

3. The Standard Solution

The third reading of the attitude report in (1) can be successfully modeled within a theory that is now known as the Standard Solution (Percus, 2000).

The two key ingredients of this theory are indexed world variables and lambda abstractors that bind those variables in the syntax at each clausal level. In this system, each predicate including the ones that are inside DPs comes with its own word variable. The world variable that a predicate inside a DP carries does not have to have the same index as the main predicate of the clause and therefore can be bound by a different lambda abstractor. The LFs of sentences containing propositional attitudes, like the one in (1), have two lambda abstractors: the matrix one and the embedded one.

A possible LF for (1) is given in (4) and the resulting interpretation of this LF is given in (5).

(4) LF: [λw_1 Mary wants-w_1 [λw_2 [an [expensive dress-w_1]] [1 PRO to buy-w_2 t_1]]]

(5) $\|(2)\|^g(w) = 1$ iff

$\forall w' \in$ Desire-Alt(Mary,w): $\exists$x(x is expensive dress in w & Mary buys x in w')

What we observe in (4) is that the DP "an expensive dress" stays within the embedded clause. The world variable that comes with the predicate "expensive dress" carries an index that is different from the index of the world variable on the main verb of the embedded clause and is bound by the matrix lambda abstractor. Thus, the existential quantifier is interpreted in the scope of the intensional verb, which accounts for the fact that Mary is not specific in her desire, but the predicate "expensive dress" is interpreted with respect to the actual world and not in Mary's doxastic alternatives, which accounts for the fact that she does not know that those dresses are expensive.

4. Two counterexamples to the Standard theory (Schwager, 2011)

In this section, we will discuss two illustrative examples from Schwager (2011).

4.1. Malte's jacket

One seemingly problematic example discussed by Schwager (2011) is given in (6).

(6) Adrian wants to buy a jacket like Malte's.

The context that makes this example problematic is as follows.

Context: Malte has a green Bench jacket. The attitude holder, Adrian, also wants a green Bench jacket but he does not know what kind of jacket Malte has.

Native speakers of English report that (6) is acceptable in this context.

The reading that (6) has in the context given above is a third reading: Adrian is not specific and what he wants to buy is described from the point of view of the speaker.

If third readings are generated by evaluating an embedded predicate with respect to the actual world, then the challenge here is that it is not clear what predicate we could evaluate with respect to the actual world to capture this judgment.

Since Adrian does not know what kind of jacket Malte has, evaluating "jacket like Malte's" with respect to Adrian's doxastic alternatives does not give us the right interpretation. However, as (Schwager, 2011) points out, evaluating this predicate with respect to the actual word does not help us either. In order to see this, let us consider the LF in (7), where the world variable on the predicate "jacket like Malte's" is bound by the matrix lambda abstractor.

(7) $[\lambda w_1$ Adrian wants-w_1 $[\lambda w_2$ PRO to buy-w_2 a [jacket like Malte's-w_1]]]

Interpreting this LF results in the truth-conditions given in (8).

(8) $||(7)||^g(w) = 1$ iff
$\forall w' \in$ Desire-Alt(Adrian,w):
$\exists x$(x is a jacket like Malte's in w & Adrian buys x in w')

The problem that Schwager notices here is that (8) predicts that, in his desire alternatives, Adrian has to choose from the actual green Bench jackets (under the reasonable assumption that "like" stands for "being of the same type and color"). This does not seem to be right. Since colors are not essential properties of objects, a jacket can have one color in one world and a different color in another world. The truth conditions in (8) predict that Adrian in his doxastic alternatives will buy a red Bench jacket as long as it is a green Bench jacket in the actual world. Thus, in the case of example (8), the Standard Solution seems to overgenerate. On the other hand, intuitively, if some jacket happens to be a green Bench jacket in one of Adrian's bouletic alternatives but is a red Bench jacket in the actual world, Adrian should be able to buy this jacket in that alternative world. This, however, is not captured by the truth-conditions in (8). According to (8), Adrian, in his bouletic alternatives, has to be buying one of those jackets that happen to be green Bench jackets in the actual world. Thus, the Standard Solution seems to undergenerate as well as overgenerate at the same time.

We can conclude that the predicted interpretation of the LF given in (7) does not reflect the fact that the sentence in (6) is intuitively true in the given context.

4.2 Burj Khalifa

Another difficult case discussed by Schwager is presented by the example in (9).

(9) Mary wants to buy a building with 192 floors.

The context that brings to light the problem with (9) is as follows.

Context: Mary is looking at Burj Khalifa, the building in Dubai that has 191 floors. No other currently existing building has more floors that that number. However, Mary does not know this. She also does not know how many floors Burj Khalifa has. She says, 'Wow, I want to buy a building that's even one floor higher!'

According to Schwager (2011), there are two possible LFs that the Standard Solution can give to this sentence. In the one given in (10), the DP "building with 192 floors" comes with the world variable that is bound by the embedded lambda abstractor. Schwager rejects this LF because Mary does not know the height of the building. The other option is the LF given in (11), where the world variable on the predicate "building with 192 floors" is bound by the matrix lambda abstractor. This ensures that the predicate is evaluated transparently (with respect to the actual world).

(10) [λw_1 Mary wants-w_1 [λw_2 PRO to buy-w_2 a [building with 192 floors-w_2]]

(11) [λw_1 Mary wants-w_1 [λw_2 PRO to buy-w_2 a [building with 192 floors-w_1]]

The problem with the LF in (11) is that the predicate "building with 192 floors" has an empty set as its extension in the actual world (because no such building exists in the actual world). This LF will get the interpretation shown in (12).

(12) $||(11)||^g(w) = 1$ iff
$\forall w' \in$ Desire-Alt(Mary,w):
$\exists$x(x a building with 192 floors in w & Mary buys x in w')

Since there are no worlds where the existential claim holds true, the entire sentence is true only if the set of Mary's desire-alternatives is empty. (This is due to the properties of the universal quantifier that is involved in the interpretation of the intensional verb "want" that yields true if its restrictor is empty).

4.3 Schwager's (2011) proposal

Schwager (2011) argues that the challenging cases discussed above require us to abandon the Standard Solution. She suggests that the problematic cases can be accounted for if we adopt the Replacement Principle in (13).

(13) *Replacement Principle*: For the sake of reporting an attitude, a property that is involved in the content of the attitude that is to be reported (the reported property) can be

replaced by a different property (the reporting property) as long as the reported property is a subset of the reporting property at all relevant worlds.

An important part of this proposal is the notion of a relevant world. Schwager (2011) suggests that the relevant worlds are those which are closest to the actual world and in which the reporting property is not empty.

This principle accounts for the Malte's jacket example because in every relevant world (i.e. the closest worlds in which there are jackets like Malte's–green Bench jackets–and Malte has the same jacket as he does in the actual world) the reported property (being a green Bench jacket), is a subset of the reporting property (being a jacket like Malte's).

The Burj Khalifa example is accounted for in a similar way. Even though the property of being a building that is one floor higher than Burj Khalifa is empty in the actual world, we are looking only at those worlds where there are 192-floor buildings and Burj Khalifa has 191 floors as it does in the actual world. So, in each of her bouletic alternatives, Mary ends up buying one of the 192-floor buildings from the closest worlds and the fact that the predicate *192-floor building* is empty in the actual world is no longer relevant.

Even though Schwager's analysis correctly captures the problematic cases, it may raise questions regarding its independent motivation. Invoking the notion of closest worlds only for the purposes of evaluating a predicate seems to be a technical tool that gives us the correct truth conditions but has no other relevant use. It is not also clear why appealing to these worlds gives us the right truth conditions. Deriving those readings from mechanisms that are more familiar and better understood would be preferable.

5. Analysis

In what follows, we argue that all the hard cases can be accounted for in terms of the Standard Solution. We employ one general strategy. In each case, we observe that the relevant attitude report contains an elided predicate or is equivalent to a report that is directly picked up from the context and contains an elided predicate. We reconstruct the predicate, allow it to be evaluated in the actual world in the spirit of Percus (2000), and derive the third reading.

5.1. Predicting the Malte's jacket example

We follow Schwager (2011) and assume that *being a jacket like Malte's* means being a jacket of the same brand and color. This suggests that we are dealing with an equative construction (Heim, 2000; Bhatt and Pancheva, 2004) that, like other comparative constructions, assumes comparative deletion (Bresnan, 1973; Lechner, 2014). For the purposes of this demonstration, we do not commit ourselves to any particular syntax associated with a *like*-comparative[2]. We only require that there be some kind of NP-ellipsis (or N'-ellipsis (Jackendoff, 1971)) in the relevant attitude report, as suggested in (14):

[2] But see (Matushansky and Ruys, 2007) for a discussion of the semantics of *same*, which is similar to the construction considered here.

(14) Adrian wants to buy a jacket like Malte's ~~jacket~~.

We assume that the elided NP, like all other NPs, comes with a world variable that can be bound by a matrix lambda operator. This makes (15) a possible LF for (14):

(15) [λw_1 Adrian wants-w_1 [λw_2 [a [jacket-w_2 like Malte's ~~jacket-w_1~~]] [3 [PRO to buy-w_2 t_3]]]]

In (15), the indefinite undergoes quantifier raising just to avoid a type mismatch and still remains within the scope of the attitude predicate.

We argue that (15) is an accurate report of Malte's desire in the context provided for this example. Since Malte's jacket in the actual world is a green Bench jacket, then being a jacket like Malte's jacket in the actual world is being a green Bench jacket in any world. And, whoever wants to buy a jacket like Malte's jacket in the actual world wants to buy a green Bench jacket.

To put it differently, (16) is equivalent to (15):

(16) [λw_1 Adrian wants-w_1 [λw_2 [a [green-w_2 Bench-w_2 jacket-w_2]] [3 [PRO to buy-w_2 t_3]]]]

The embedded clauses in (15) and (16), reproduced in (17) and (18), respectively, denote exactly the same set of possible worlds (assuming that w_1 is the actual world):

(17) [λw_2 [a [jacket-w_2 like-w_2 Malte's ~~jacket-w_1~~]] [3 [PRO to buy-w_2 t_3]]]

(18) [λw_2 [a [green-w_2 Bench-w_2 jacket-w_2]] [3 [PRO to buy-w_2 t_3]]]

And, since (16), as we said, straightforwardly describes the context, so does (15).

This analysis assumes that a cross-world comparison of predicates is possible. This assumption is independently motivated by the existence of reports like "I thought that your yacht is longer than it is" discussed in Russell (1905). Here, the degree to which the yacht is long in the attitude holder's doxastic alternatives is compared to the degree to which the yacht is long in the actual world.

5.2. Predicting the Burj Khalifa example

We apply similar reasoning to (19), repeated below:

(19) Mary wants to buy a building with 192 floors.

Context: Mary is looking at the Burj Khalifa, which has 191 floors. No other currently existing building has more floors. Mary doesn't know this. She also doesn't know how many floors Burj Khalifa has. She says, ‘Wow, I want to buy a building that’s even one floor higher!’

It seems uncontroversial that (20) correctly describes Mary’s desire because it represents the information that the speaker picks up directly from the context:

(20) Mary wants to buy a building that is one floor higher than Burj Khalifa.

We again assume ellipsis inside the embedded comparative construction. We reconstruct the elided material together with the world variable. We bind the variable by the matrix abstractor as illustrated in (21):

(21) [λw_1 Mary wants-w_1 [λw_2 [a building-w_2 that is one floor higher than Burj Khalifa ~~is high-~~$\cancel{w_1}$] [3 [PRO to buy-w_2 t_3]]]]

As for the problematic (19), we provide it with the LF in (22):

(22) [λw_1 Mary wants-w_1 [λw_2 [a building-w_2 that has 192 floors-w_2] [3 [PRO to buy-w_2 t_3]]]]

We argue that (21) and (22) are equivalent because their embedded clauses denote the same set of possible worlds.

To put it differently, in any world it is the case that buying a building with 192 floors is buying a building that is one floor higher than Burj Khalifa is in the actual world.

We are aware of the fact that we are proposing a *de dicto* LF in (12) for a case in which Mary would not herself describe her desire in terms of buying a 192-floor building. Our proposal here assumes that as long as she can desire to buy a building that is one floor higher than the actual Burj Khalifa, the structure in (22) truly and objectively describes that desire.

5.3. The Intersective Predicate Generalization is not violated

Keshet (2008) introduces a restriction on the indexation of world variables known as The Intersective Predicate Generalization. According to this restriction, the world variables on intersecting predicates cannot carry different indices. Our analysis does not violate this restriction because the elided predicate that we reconstruct with a world variable bound by the matrix abstract does not intersect with a predicate in which the index on the world variable is bound locally.

In the Malte’s jacket example, the elided NP is inside a DP. In the Burj Khalifa example the elided predicate is a subconstituent inside a comparative construction and does not intersect with any other predicate either.

6. Other cases

In this section, we explore two remaining difficult cases discussed in the literature and show that the line of argumentation proposed in Section 5 can be successfully extended to those cases as well.

6.1. The Curfew Example

The first example (23) is Schwager's (2011) adaptation of an example from Fodor (1970).

(23) The reporter wants to interview someone who broke the curfew.

The context that makes this example interesting is as follows.

Context: A reporter comes to a town N to interview people who could possibly witness a crime that happened after 6 p.m. She wants to talk to someone who was outside after 6 p.m. Unbeknownst to her, there is a curfew in N that starts at 6 p.m. and no one was out at that time.

If we try to give this sentence the LF in (24), where the world variable inside the DP *someone who broke the curfew* is bound by the matrix lambda abstractor, we will run into the same problem as the one observed in the Burj Khalifa example: the set of people who broke the curfew is empty in the actual world.

(24) [[λw_1 The reporter-w_1 wants-w_1 [[λw_2 PRO to interview-w_2 some [one who broke-w_1 the curfew-w_1]]]

As in all other cases, we observe that there are several predicates that can potentially carry world variables in this sentence. In particular, there is a DP inside the predicate *who broke the curfew* and the predicate inside this DP can carry a different world variable than the one on *break*. The LF we propose for (23) is given in (25).

(25) [[λw_1 The reporter-w_1 wants-w_1 [[λw_2 PRO to interview-w_2 some [one who broke-w_2 the curfew-w_1]]]

The report that is directly suggested by the context is given in (26) and its LF is shown in (27).

(26) The reporter wants to interview someone who was outside after 6 p.m.

(27) [[λw_1 The reporter-w_1 wants-w_1 [[λw_2 PRO to interview-w_2 some [one who was outside after 6 p.m.-w_2]]]

Since the interpretations of (28) and (29) below pick out the same set of worlds (assuming that w_0 denotes the actual world), they are interchangeable in intensional contexts.

(28) [[λw_2 PRO to interview-w_2 some [one who broke-w_2 the curfew-w_0]]

(29) [λw_2 PRO to interview-w_2 some [one who was outside after 6 p.m.w_2]]

Thus, the LFs in (25) and in (27) have equivalent interpretation and (23) can be truly used in the context.

If this analysis is on the right track, we need to accept the possibility that a law of one possible world can be broken (violated) in a different world. *Breaking* is understood here not as intentional violation, but merely as doing something that is not compatible with the law.

6.2 The same denomination example (Sudo, 2014)

The last example of a difficult case for the Standard Solution that we will discuss in this paper is from Sudo (2014). The example is given in (30).

(30) Mary thinks that Sue is Catholic.

This sentence is judged to be true in the following context.

Context: Mary is an atheist and quite ignorant in questions of religion. She does not differentiate between various branches of Christianity. She heard that our religious friend John started going out with a girl named Sue. Mary decided that Sue has to belong to the same denomination as John, but she does not know which. The speaker, unlike Mary, knows that John is Catholic.

The problem here is that Mary does not know that Sue is Catholic. Giving the predicate *Catholic* a world variable bound by the embedded matrix abstractor will not do. On the other hand, providing *Catholic* with a world variable bound by the abstractor of the main clause will result in the structure that violates Generalization X (Percus, 2000). According to this generalization, a world variable that a main predicate of a sentence carries has to be bound by the nearest lambda abstractor. The example from Percus (2000) that supports this generalization is given in (31).

(31) Mary thinks that my brother is Canadian.

If (31) could have an LF as the one given in (32), this sentence would be judged as true in a scenario where there is a person who Mary thinks is my brother (perhaps mistakenly) and who is a Canadian in the actual world, even if Mary does not know that. This sentence does not have this reading.

(32) [λw_2 Mary thinks-w_2 that [λw_1 my brother-w_1 is Canadian-w_2]]

Based on examples like (31), Percus concludes that there is a general restriction on binding the world variable on the main predicate of a sentence by a long distance lambda abstractor.

If the Generalization X is correct, the fact that (30) is acceptable in the described scenario is puzzling.

The solution proposed by Sudo (2014), like Schwager's solution, appeals to a replacement principle. He suggests that a predicate (say, the following predicate: [λw.λx. x and John belong to the same denomination in w]) can be replaced by another predicated in a belief-report as long as they are a contextually equivalent.The solution we propose here does not require any special replacement principles. It involves the following steps. First, we recover the belief-report that is picked up directly from the context (33).

(33) Mary thinks that Sue belongs to the same denomination as John.

Then we reconstruct the elided material and we get the LF given in (34).

(34) [□w_1 Mary thinks-w_1 [□w_2 Sue belongs-w_2 to the same denomination-w_2 as John ~~belongs-w_1 to~~]]

We observe that (35) and (36) denote the same proposition. This is because in every possible world having the same denomination as the denomination that John has in the actual world is being Catholic.

(35) [□w_2 Sue belongs-w_2 to the same denomination-w_2 as John ~~belongs-w_0 to~~

(36) [□w_2 Sue is Catholic-w_2]

This means that we can substitute (36) for (35) and the report has to stay true. If so, then (30) must be true if it is understood to have the LF in (37):

(37) [□w_1 Mary thinks-w_1 [□w_2 Sue is Catholic-w_2]]

Our solution to this puzzle does not violate Generalization X, because the main predicate of the sentence "Catholic" is interpreted *de dicto*.

7. Conclusion

In this paper, we considered the challenging cases of third readings of indefinites in attitude reports. We argued that all of the seemingly problematic examples can be naturally accounted for by the Standard Solution. In some of the cases, it was enough to reconstruct the elided material. In other cases, we had to consider a report that is directly suggested by the context, reconstruct the elided material and observe that the report that is considered to be problematic is semantically equivalent to it.

In our analysis, we used a principle of substitutivity that allowed us to replace one report with another. We believe that the principle we used is essentially different from the ones suggested in Schwager (2011) and Sudo (2014). The principle of substitutivity that we made appeal to is not a part of the theory that we suggest but is a metatheoretic principle–principle of compositionality–that is assumed by everyone doing compositional semantics.

Appendix

Of all the examples discussed above, the Standard theory applies in the most straightforward way to the case of Buyer's intensions and the Curfew example. In both of those cases, the relevant report contains a predicate that is evaluated with respect to the actual world. We repeat the two sentences from the earlier sections in (1) and (3) together with their LFs below.

(1) Adrian wants to buy a jacket like Malte's.

(2) [λw_1 Adrian wants-w_1 [λw_2 to buy-w_2 a [jacket-w_2 like-w_2 Malte's ~~jacket-w_1~~]]

(3) The reporter wants to interview someone who broke the curfew.

(4) [λw_1 The reporter wants-w_1 [λw_2 PRO to interview-w_2 some [one who broke-w_2 the curfew-w_1]]]

The more controversial cases are the cases of Burj Khalifa and Sue's Catholicism. For the case of Burj Khalifa, repeated in (5), we proposed the LF in (6):

(5) Mary wants to buy a building that has 192 floors.

(6) [λw_1 Mary wants-w_1 [λw_2 PRO to buy-w_2 a building-w+2 that has 192 floors-w_2]]

We observed that (6) was equivalent to (7), which was a possible LF for a report supported by the given context and provided in (8):

(7) [λw_1 Mary wants-w_1 [λw_2 PRO to buy-w_2 a building-w_2 that is one floor higher-w_2 than Burj Khalifa ~~is high-w_1~~]]

(8) Mary wants to buy a building that is one floor higher than Burj Khalifa.

The issue that someone might find bothersome here can be described as follows. In (6), the indefinite is interpreted under the intensional verb and the predicate inside this indefinite is bound by the embedded lambda operator. So, under this analysis, (5) is a pure *de dicto* report.

However, the context was set up in such a way that Mary does not know the height of Burj Khalifa and she would not accept (5). Moreover, double vision scenarios similar to the famous examples known from (Quine, 1956) can be constructed in this case. For example, it is conceivable that in a different context when she is shown a project of a building that has 192 floors, the same person Mary says, "I don't want to buy a building that is this high".

Similarly, in the example with Sue's Catholicism, we proposed the LF given in (9) for the sentence in (10):

(9) [λw_1 Mary thinks-w_1 [λw_2 Sue is Catholic-w_2]]

(10) Mary thinks that Sue is Catholic.

Again, we observed that that its interpretation is equivalent to that of (11) which is a possible LF for the report directly suggested by the context and given in (12):

(11) [λw_1 Mary thinks-w_1 [λw_2 Sue belongs-w_2 to the same denomination-w_2 as John ~~belongs to~~ w_1]]

(12) Mary thinks Sue belongs to the same denomination as John.

However, like in the previous case, (9) does not contain any predicate in the embedded clause that is evaluated transparently. This is a *de dicto* report that Mary herself would not accept.

And, even for the Curfew example, which does not require this kind of unusual *de dicto* analysis, it might still be argued that, in our proposed analysis, the predicate "break" is evaluated with respect to the worlds of the reporter even though the reporter does not know about the existence of a restriction that is being broken.

We explored the account that the Standard Solution could provide for all these cases. The abovementioned worrisome aspects of the analysis are the price that we have to pay if we want to apply the Standard Solution to all of the problematic cases. Yet, it is possible that the analysis in terms of the third readings might not be applicable to these last three cases in the first place.

Schwager (2011) makes an observation that all the hard cases except one, the Malte's jacket case, can be handled in terms of the *de qualitate* analysis. In a nutshell, the analysis in terms of *de qualitate* would require interpreting the property in the restrictor of the indefinite ("jacket like Malte's") in the transparent position. The sentence is predicted to be true if there is a concept such that in the actual world it picks the property of being a jacket like Malte's (the property given in (13)) and in the worlds of Adrian's doxastic alternatives picks a property of being a green bench jacket. This concept can be defined technically, however, it cannot reflect the way the property is cognitively given to the attitude holder. The scenario is set up in such a way that the property "be a jacket like Malte's" is not given to the attitude holder under any guise, Adrian does not have any cognitive contact with it.

(13) [$\lambda w.\lambda x.$ x is jacket-like-Malte's in w]

In this paper, we have shown that there is elided material in this report and when this material is taken into account, this example is no longer a hard case but is just another illustration of a third reading in a classical sense.

As for the remaining cases, it might, indeed, be quite possible to account for them in terms of a *de qualitate* analysis (Cresswell and Von Stechow, 1982) or in terms of generalized concept generators (Baron, 2015). However, we are not convinced that *de qualitate* analysis is necessary here. In the remaining part of this Appendix, we would like to outline an alternative *de re*[3] analysis of the three cases. We believe that, in each of the cases it is possible to find something that is not a property that can be interpreted as a *res* of a *de re* construal.

We suggest that, in the Burj Khalifa case, it is *192* that is interpreted *de re*. A possible LF for this example is given in (14). Following Percus and Sauerland (2003) and Charlow and Sharvit (2014), a variable G of the concept generator type is merged as a sister to *192* and is bound by the lambda abstractor at the edge of the embedded clause. A concept generator takes a number and returns a concept - a function from a world to a number. Quantification over concept generators is introduced by the intensional verb and it is relating the concept generator and the attitude holder. The resulting interpretation is given in (15).

(14) [λw_1 Mary wants-w_1 [λG λw_2 PRO to buy-w_2 a building-w_2 with [[G 192] w_2] floors-w_2]]

(15) $||(14)||^g(w)=1$ iff $\exists G$ such that G is a concept generator for Mary in w & $\forall w' \in$ Desire-Alt (Mary, w): $\exists y$. y is a building in w' and y has G(192)(w') floors in w' and Mary is buying y in w'.

One possible concept generator will map the number 192 to the concept given in (16).

(16) [$\lambda w'$. the number of floors in the building Mary is looking at in w' +1]

The belief-report in case of Sue's Catholicism can be represented as a *de re* attitude with respect to Catholicism under the assumption that the adjective "Catholic" can be further decomposed into two parts, one of which stands for "Catholicism" and the other one for "be the follower of". The truth conditions that (10) will be assigned in that case are given in (17):

(17) $||(10)||^g(w)=1$ iff $\exists G$ such that G is a concept generator for Mary in w &$\forall w' \in$ Dox(Mary, w): Sue is a follower of G(Catholicism)(w')

A possible context generator in this case could be the one that maps "Catholicism" into the concept given in (18).

(18) [$\lambda w'$. the religion that John has in w']

As for the Curfew example, Schwager (2011) does not discuss it in much detail. She says, however, that a *de re* analysis is not applicable, if the true *de dicto* report is (19) and what is to be interpreted as a *de re* report is (20).

(19) The reporter wants to talk to someone who was outside after 6 p.m.

(20) The reporter wants to talk to someone who broke the curfew.

[3] *De re* in this appendix is understood as a *de re* construal interpretation. It is a different notion of *de re* than the one used in Section 2, where it simply referred to the fact that an indefinite took scope above the intensional verb.

Under a *de dicto* interpretation, (19) asserts that the reporter interviews someone who was outside after 6 p.m. in each of her desire worlds. Under a *de re* interpretation of (20), only the speaker knows that 6 p.m. is the time of the curfew.

It is not immediately clear why a *de re* analysis would not be applicable in this case. Suppose the relevant concept is

(21) [λw'. the boundary of 6 p.m. in w']

This concept maps any possible world to 6 p.m. in that world by default. However, in the actual world, the boundary of 6 p.m. is identical to the boundary of the curfew, i.e. to the curfew itself. Therefore, breaking the 6 p.m. boundary (by being outside) in the actual world is breaking the curfew in the actual world.

We thus predict the following *de re* LF for (20):

(22) [λw_1 The reporter-w_1 wants-w_1 λG λw_2 PRO to interview-w_2 someone who broke-w_2 [G[the curfew-w_1] w_2]]

We conclude that if the ideas expressed here are on the right track, the so-called hard cases of third readings either can be straightforwardly accounted for in terms of the Standard Solution or they don't qualify for the analysis in terms of the Standard Solution to begin with but can be captured by a *de re* interpretation.

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Questioning speech acts[1]

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Abstract. We investigate the sentence-final particle *ho* from Cantonese, which can stack on top of other sentence-final particles indicating various types of speech acts. We argue that *ho* is a higher level question operator that operates at the level of speech acts. More concretely, it takes a speech act (assertion or question) and returns a new interrogative speech act asking whether the input speech act can be felicitously performed by the addressee. We take the presence of this kind of higher level question operator in natural language as novel evidence that a mechanism for operating on speech acts is needed. Building on Farkas and Bruce (2009), Rawlins (2010), Bledin and Rawlins (2017), we develop a mechanism in the style of Update Semantics for operating on speech acts.

Keywords: speech acts, sentence-final particles, Cantonese, update semantics.

1. Introduction

The function of mapping from the semantic content of an utterance to its convention of use (a division of labor first made by Frege (1956)) has been attributed to abstract speech act operators (also known as force operators), such as ASSERT, QUESTION, and COMMAND. These operators have been traditionally assumed to occupy the highest echelons of the clausal periphery. The precise formulation of these operators has attracted a lot of attention from semanticists, as they are crucial for formalizing the diverse discourse functions of speech acts (Farkas and Bruce, 2009; Farkas and Roelofsen, 2017; Malamud and Stepheson, 2015; Krifka, 2015). These high operators usually come packaged with two assumptions: i) they are not embeddable under other elements, and ii) they belong to the realm of pure pragmatics and not compositional semantics. Recent research in both semantics and syntax have challenged these assumptions (Krifka, 2015; Davis, 2011; Wiltschko, 2017; Heim et al., 2016). Based on evidence from a language with a rich array of sentence-final particles (SFPs), Cantonese, we argue in this paper that not only are abstract speech operators embeddable, it is also the case that we need compositional mechanisms in these high regions of the clause. We will investigate the SFP stacking phenomenon, and argue that such grammaticalized operations on speech act operators reveal the need for a system that can compose the content of an utterance with multiple particles that update the discourse in a number of different, non-trivial ways.

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2. The empirical landscape

2.1. Primary sentence-final particles in Cantonese

Cantonese is a language with a large repository of sentence-final particles. These sentence-final particles are standardly taken to be elements that serve the myriad functions that various intonational contours serve in Indo-European languages such as English (Wakefield, 2011). As such, one of their roles is to indicate illocutionary force, or speech acts (Cheung, 1972; Luke, 1990; Matthews and Yip, 2011; Fung, 2000). Note that different sentence-final particles may indicate the same speech act with slightly different flavors. Since the purpose of this subsection is to introduce the basic particles to be taken up later, we only include a small set of particles that we will use later.[2] To express an assertion, the particle *gaa* may be used, as shown in (1).

(1) Aaman sik haa gaa.
Aaman eat shrimp ASSERT
'Aaman eats shrimp.' *Assertion*

When expressing an interrogative, one may choose from a range of sentence-final particles, depending on the type of the interrogative. For example, a polar question may be accompanied by the particle *maa*:

(2) Aaman sik haa maa?
Aaman eat shrimp POLQ
'Does Aaman eat shrimp?' *Polar question*

To mark a *wh*-question or an alternative question, *ne* may be used, as shown in (3a) and (3b), respectively.

(3) a. Bingo sik haa ne?
who eat shrimp WHQ
'Who eats shrimp?' *Wh-question*
b. Aaman sik haa ding sik ju ne?
Aaman eat shrimp or eat fish WHQ
'Does Aaman eat shrimp or fish?' *Alternative question*

It is worth noting that sentence-final particles in general are an optional device to mark clause types. Strictly speaking, one can still get the intended clause type without using any sentence-final particle, especially in a more formal speech context or a written context. However, native speakers feel that having sentence-final particles helps make utterances more natural.

[2] We gloss this set of basic particles based on the type of speech acts they indicate, such as ASSERT for assertive particles, POLQ for polar question particles, and WHQ for *wh*-question and alternative question particles. All other sentence-final particles that are not the concern of this paper are glossed as SFP.

Now that we have acquainted ourselves with the primary sentence-final particles in Cantonese, we are ready to turn to a particle that may stack on top of a primary particle. The particle of interest is *ho*. We introduce *ho*'s interactions with different speech acts: with assertions in section 2.2, and with questions in 2.3.

2.2. *Ho* embedding assertions

Ho is an interrogative sentence-final particle in Cantonese. It is special because it may stack on top of another sentence-final particle, as shown in (4).

(4) Aaman sik haa gaa ho?
Aaman eat shrimp ASSERT HO
'Aaman eats shrimp. Right?' *Assertion + ho*

In this example, *ho* stacks on the assertion particle *gaa*. It has the effect of turning the assertion into a question, as pointed out in previous studies (Sybesma and Li, 2006; Lam, 2014; Tang, 2015). Following Lam (2014), this type of questions is roughly translated as an assertion plus a confirmation tag 'right?'. However, this is by no means a commitment to equating Cantonese *ho* and the English confirmation tag.

An *assertion+ho* question admits a range of responses also admitted by an ordinary polar question. For example, one may choose an affirmative answer like (5a), a negative answer like (5b), or indicate their ignorance with (5c).

(5) a. Hai aa.
yes SFP
'Yes, he does.'

b. Mhai aa
no SFP
'No, he doesn't'

c. ŋo mzi wo
I not.know SFP
'I don't know.'

At this point, one may be tempted to analyze *ho* as a polar question marker similar to *maa*. However, these two particles exhibit crucial differences with respect to their ability to stack on a primary particle. Observe that unlike *ho*, the polar question particle *maa* may not stack on an assertion particle, as evidenced by the unacceptability of (6).

(6) *Aaman sik haa gaa maa?
Aaman eat shrimp ASSERT POLQ
Intended 'Does Aaman eat shrimp?' *Assertion+ maa* [3]

We take the difference in stackability to be semantically grounded. While ordinary question parti-

[3] *Gaamaa* may be used as a complex assertive particle to indicate obviousness of the asserted content. In this case, it is a fusion of two assertive particles *ge* and *amaa*, rather than a fusion of an assertive particle and a polar question particle, as suggested by Matthews and Yip (2011).

cles like *maa* signal the mapping from semantic content to interrogative speech act, *ho* is a **'higher level' question particle embedding speech act** rather than just a semantic content. If this view is correct, then the ungrammaticality of (6) is expected, as *maa* indicates a transition from semantic content to a speech act—the input is already a speech act, as indicated by the presence of a sentence-final particle, so, in a sense, it is 'too big' to be operated on by *maa*. By contrast, *ho* is perfectly happy to operate on a unit already marked by a sentence-final particle, as shown in (4), because it is a 'higher level' question particle, one that takes a speech act as its input. We will undertake a formalization of the property of being a 'higher level' question operator in Section 3.3.

In addition, when *ho* takes an assertive speech act as its input, it indicates a **bias** towards the asserted content, another trait not shared by the polar question particle *maa*. Imagine a neutral context in which someone is trying to ask a pedestrian to fill out a survey. (7) may be used felicitously to make such a request, but (8) may not.

(7) Nei jau sigaan maa?
you have time POLQ
'Do you have time?' *Polar question*

(8) #Nei jau sigaan gaa ho?
you have time ASSERT HO
'You have time. Right?' *Assertion + ho*

If (8) is used, it conveys the message that the speaker has prior belief that the addressee has time to help, which comes across as impolite in this context. On the contrary, (7) does not have such a bias, so it does not have connotations of impoliteness in the same context.

2.3. *Ho* embedding questions

An even more interesting distributional fact is that *ho* may readily embed a *wh*-question or an alternative question (Lam, 2014).[4] Consider the following examples:

(9) Bingo sik haa ne ho?
who eat shrimp WHQ HO
'Who eats shrimp? Do you share the same question?' *Wh-question + ho*

(10) Aaman sik haa ding sik jyu ne ho?
Aaman eat shrimp or eat fish WHQ HO
'Does Aaman eat shrimp or fish? Do you share the same question?' *Alt question + ho*

[4]*Ho* may also embed other types of questions, but a more sophisticated context is required. We discuss this issue in Section 4.

When stacked on top of a question particle, as in (9)–(10), *ho* changes the question introduced by the lower question particle into another question asking roughly whether the addressee would rationally ask the same embedded question, irrespective of the type of the question. Since using a confirmation tag after a question does not sound felicitous to native speakers of English, we chose to translate the contribution of *ho* in interrogative cases by using another question, i.e., ‘do you share the same question?’

We would like to point out two notable facts about *question-ho* constructions. First, the range of responses this construction admits is quite different from the ones admitted by just using the embedded questions. Consider some responses to a *wh*-question like (11), illustrated in (12a)–(12c).

(11) Bingo sik haa ne?
who eat shrimp WHQ
‘Who eats shrimp?’

(12) a. Aaman lo.
Aaman SFP
‘Aaman.’

b. ŋo mzi wo.
I not.know SFP
‘I don’t know.’

c. #Hai lo.
yes SFP
‘Yes.’

If one knows the answer to (11), they may directly answer it, as in (12a). Alternatively, if one does not know the answer, they may indicate their ignorance with (12b). However, one may not answer *hai (lo)* ‘yes’ to such a question.[5]

After such a *wh*-question is embedded under *ho*, as in (13), the range of felicitous responses changes, as shown in (14a) - (14d).

(13) Bingo sik haa ne ho?
who eat shrimp WHQ HO
‘Who eats shrimp? Do you share the same question?’

(14) a. Aaman lo.
Aaman SFP
‘Aaman.’

b. #ŋo mzi wo.
I not.know SFP
‘I don’t know.’

c. ŋo dou mzi wo.
I also not.know SFP
‘I don’t know either.’

d. Hai lo.
yes SFP
‘Yes.’

[5] *Hai (lo)* ‘yes’ may be used when a continuation like *I don’t know either* is added. Anticipating the discussion of *ho* stacking on top of a question, which readily admits such as response without the need of a continuation like *I don’t know either*, we suggest that a canonical question may be turned into a higher, speech act-level question via some pragmatic means. The continuation can be seen as a trigger of the pragmatic means.

It is still possible to directly answer the *wh*-question, as shown in (14a). However, it is no longer felicitous to just answer *I don't know*, as shown in (14b). To indicate ignorance, the addressee has to show agreement with the speaker's ignorance, by using a response corresponding to *I don't know either*, as shown in (14c). Moreover, rather surprisingly, it is felicitous to answer *hai (lo)* 'yes', as shown in (14d).

Secondly, when *ho* embeds a question, it changes the felicity condition associated with the embedded question. Generally speaking, a speaker uses an interrogative speech act to signal the belief that the addressee may be able to answer the question. However, a speaker signals just the opposite when he or she uses *ho* to embed an interrogative speech act. That is, the speaker thinks it is possible that the addressee may *not* be able to answer the embedded question. We illustrate the contrast in the two types of questions with two storyboard scenarios borrowed from the UBC Syntax of Speech Acts Lab.

Scenario A: 'My friend was puzzled, too.'

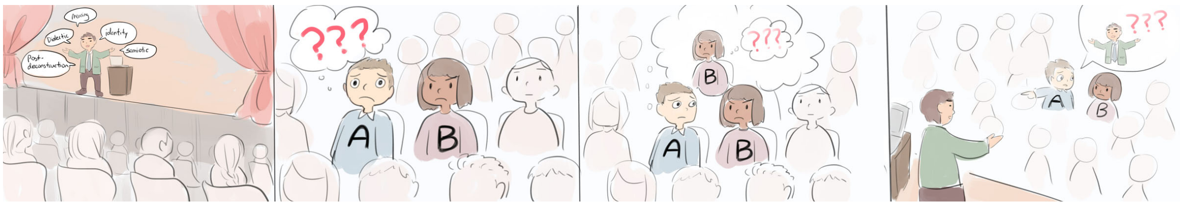

Figure 1: A famous scientist gave a talk on astrophysics. A, as a linguist, couldn't follow the talk. A's friend B was a poet, and it seemed to A that B did not understand the talk either.

Scenario B: 'My friend understood this.'

Figure 2: A famous scientist gave a talk on astrophysics. A, as a linguist, cannot follow the talk. However, A's friend B was a physicist and it seemed to A that B understood the talk quite well.

In the first scenario, A did not understand the content of the talk and thought that B did not understand it either. In this context, using a *wh*-question+*ho* like (16) is felt to be more felicitous than using a *wh*-question like (15), if A did not have obnoxious intentions. If A was being obnoxious and wanted to insult B for her ignorance, then he may use (15).

In the second scenario, A did not understand the content of the talk but thought that B understood it well. To inquire the content of the talk, it is more felicitous to use a *wh*-question like (15). Again, it is possible to use the *wh*-question+*ho* strategy in (16), but in a marked way. This time the markedness comes from the feeling that A was trying to get B to explain the content of the talk without admitting that B was in a privileged position to explain it.

(15) Keoi gong me ne?
he say what WHQ
'What did he say?' *Wh-question*
(Preferred in Scenario B: My friend was puzzled, too.)

(16) Keoi gong me ne ho?
he say what WHQ HO
'What did he say? Do you share the same question?' *Wh-question + ho*
(Preferred in Scenario A: My friend understood it.)

2.4. Synthesizing the two paradigms

The properties of *ho*-questions discussed in the previous subsections raise two theoretically interesting questions. First, what does it mean for a particle to operate on an assertion or a question? Assertions and questions are speech act-level objects. Operating on these objects at the very least calls for a mechanism for manipulating speech acts. While the traditional view is that speech acts are inoperable, pragmatic objects, this view has been challenged in recent years, by scholars such as Krifka (2015), Davis (2009), and Heim et al. (2016). These scholars hold the view that speech acts should in principle be amenable to semantic operations just like other semantic objects. The fact that there are sentence-final particles operating on speech acts provides independent support for such a view.

Secondly, questions and assertions make different contributions to context, but *ho* indiscriminately operates on both types of speech acts, not minding their differences. Nonetheless, *ho*-questions have quite different interpretive properties depending on whether the embedded speech act is an assertion or a question. In the case of an *assertion-ho*-question, it asks for confirmation of the asserted content; in the case of a *question-ho*-question, it asks whether the addressee shares the question or not. Logically speaking, one could posit two instances of *ho* that embed assertions and questions, respectively. If we make this move, however, we miss capturing a strong intuition that native speakers of Cantonese have: *ho*-questions are really a uniform class and that's why the same particle is used to embed assertions and questions.

We argue in the rest of the paper that there is no need to posit two different *ho*'s, as long as we take seriously the sentence-final particle stacking paradigm and treat *ho* as a higher-level question particle, one that embeds speech act rather than semantic content.

This way of cutting up the pie straightforwardly addresses the first question: *ho* may embed a question or an assertion because, as a speech act level question particle, it is in a position to do so. In addition, treating *ho* as a speech act level question particle buys us more than just a way to account for sentence-final particle stacking. It actually makes available a level, i.e., the speech act level, with which we can afford a unified semantics of *ho* in both the assertion embedding and question embedding contexts. We develop the concrete semantics of *ho* and a mechanism of speech act embedding in Section 3.

3. Proposal

We propose that *ho* embeds a speech act, which can be an assertion or a question. Following the dynamic semantics of discourse initiated in Farkas and Bruce (2009) and further developed in Rawlins (2010), Farkas and Roelofsen (2017) and Bledin and Rawlins (2017), speech acts are derived by combining speech act operators with corresponding semantic content. In section 3.1, we will lay out the formal preliminaries of the framework and define the speech act operators **assert** and **quest**. The speech act operators consist of two components: (a) an at-issue component, which instructs how a speaker updates the input context by acting on some semantic content; and (b) a non-at-issue component, which is a set of felicity conditions, which tests whether the speech act is felicitously performed. The semantics of *ho* is given in section 3.3. Briefly speaking, *ho* inherits the felicity condition of the speech act that it embeds, and generates a question for the addressee asking whether s/he is also able to felicitously perform the embedded speech act. This analysis can successfully capture the empirical patterns of *ho*, as demonstrated in section 3.3.1 and 3.3.2.

3.1. Preliminaries

Many studies have defined discourse contexts as a tuple consisting of different conversational components, like the Stalnakerian context set, a set of participants, commitment sets and so on (Gunlogson, 2001; Farkas and Bruce, 2009; Rawlins, 2010). Since not all of the conversational components are useful for our purpose, we define a context as a simple pair, consisting of a context set and a stack:

(17) A context c is a pair of $\langle \mathbf{cs}_c, \mathscr{T}_c \rangle$, where
  a. $\mathbf{cs}_c \subseteq W$ is a set of worlds (the context set)
  b. $\mathscr{T}_c$ is a stack of issues, i.e., a set of propositions.

Following Stalnaker (1978, 2002) and many others, the context set $\mathbf{cs}_c$ includes the possibilities that are compatible with what is known to the discourse participants for the purposes of the conversation. $\mathscr{T}_c$ is a stack of issues, i.e., a set of propositions, comparable to the Table component in Farkas and Roelofsen (2017) (cf. Farkas and Bruce, 2009; Malamud and Stepheson, 2015). The stack keeps a history of the utterances, i.e. the proposals for updating the context set, made by the discourse participants.[6] The motivation for this component, due to Farkas and Bruce (2009), is

[6]Other formulations may involve more fine-grained structuring of the stack to separate assertions and questions, for example, Rawlins (2010), Bledin and Rawlins (2017). We adopt a simpler version for our purposes.

that an assertion does not directly update the context set, but rather is a proposal to do so.

In this spirit, we define the speech act operator **assert** as shown below. It combines with a proposition and returns a context change potential, i.e., a function from an input context to an output context. The subscripts on the operator indicate the world parameter and the speaker parameter relative to which the speech act is evaluated.

(18) $c + \textbf{assert}_{w,\textbf{s}_c}(p) = \left\langle \textbf{cs}_c,\ \textbf{push}\Big(\{ \textbf{cs}_c \cap \{w' \mid p(w')\} \},\ \mathscr{T}_c \Big) \right\rangle$, defined only if $\textbf{s}_c$ believes that p is true in w

push is a standard operation on stacks, formally defined as follows (see Farkas and Bruce (2009) for similar uses).

(19) $\textbf{push}(e,\ \mathscr{T}) = e \cdot \mathscr{T}$, represents a new stack with e added to the top of $\mathscr{T}$.

According to (18), making an assertion involves pushing a proposal onto the stack. The proposal is modeled as a (singleton) set of contexts updated with the asserted proposition (cf. the *projected set* in Farkas and Bruce (2009)). In other words, an assertive update does not update the context set immediately, but rather makes a proposal pending the audience's response (confirm/reject). An assertive update is evaluated relative to two parameters, a possible world in which the speech act is defined and the author of the speech act.

This operator also comes packaged with an important felicity condition, which tracks the mental state of the speaker. Specifically, the felicity condition captures the intuition that a person appropriately asserts p in w only if they believes p is true in w. Thus, an assertive update is felicitous only in worlds in which the speaker believes in the validity of p and undefined otherwise.[7]

Moving on to questions, our questioning update is also formalized with use of a speech act operator—**quest**, defined as in (20). This operator takes a question Q and returns a context change potential. In this paper, we follow Hamblin/Karttunen's approach (Hamblin, 1973; Karttunen, 1977) and assume that a question denotes a set of propositions. Each proposition in the set can potentially update the context set. Therefore, asking a question involves making a proposal that contains multiple potential updates. Then, the addressee answers the question by choosing one update from the proposal.

[7]We are aware that this felicity condition makes a direct connection between true belief and the performance of an assertion, which cannot accommodate prevarication contexts (p.c. Manfred Krifka). In order to allow assertions in prevarication contexts, we can switch to a weaker felicity condition:

(i) $c + \textbf{assert}_{w,\textbf{s}_c}(p) = \left\langle \textbf{cs}_c, \textbf{push}\Big(\{ \textbf{cs}_c \cap \{w' \mid p(w')\} \},\ \mathscr{T}_c \Big) \right\rangle$, defined only if $\textbf{s}_c$ wants her fellow discourse participants to believe that she believes p is true in w

This switch has no bearing on our central thesis, and hence we use the stronger version for the sake of simplicity.

(20) $$c + \textbf{quest}_{w,\textbf{s}_c}(Q) = \Big\langle \textbf{cs}_c, \textbf{push}(\{\textbf{cs}_c \cap \{w' \mid p(w')\} \mid p \in Q\}, \mathscr{T}_c) \Big\rangle, \text{defined only if } \textbf{s}_c \text{ does not know the answer to } Q \text{ in } w$$

The questioning update has two felicity conditions. Presumably, a questioner can appropriately ask Q only if she does not already know the answer to Q.[8]

3.2. Formalizing Cantonese sentence-final particles

Before laying out the formal analysis of *ho*, we will apply the formal tools defined in the last section to distinguish declaratives and questions from Cantonese. Consider (21).

(21) Aaman sik haa gaa.
Aaman eat shrimp ASSERT
'Aaman eats shrimp.'

We assume that the sentence final particle *gaa* lexically encodes **assert**. The declarative sentence, then, has the following translation:

(22) $$c + \textbf{assert}_{w,\textbf{s}_c}([\![\text{Aaman eat shrimp}]\!]) = \left\langle \textbf{cs}_c, \textbf{push}\left(\left\{\textbf{cs}_c \cap \left\{w' \,\middle|\, \begin{array}{l}\text{Aman eat}\\ \text{shrimp in } w'\end{array}\right\}\right\}, \mathscr{T}_c\right)\right\rangle$$

defined only if $\textbf{s}_c$ believes Aaman eats shrimp in w

Accordingly, (21) means that the speaker proposes in world w to update the input context with the proposition denoted by *Aaman eats shrimp*. If the assertion is appropriately made in the world, the speaker must believe Aaman eats shrimp.

Turning to questions, we take (23) as an example. Like *gaa*, the question particle *ne* is also assumed to contain **quest** in its lexical semantics. Assuming that the possible answers to the question are Aaman eats shrimp and Waazai eats shrimp, we translate the question as (24).[9]

(23) Bingo sik haa ne?
who eat shrimp WHQ
'Who eats shrimp?'

---

[8]Note that these felicity conditions can be suspended in exam/quiz contexts and other non-standard scenarios like the rhetorical use of questions, and we have no new insight to offer regarding how suspension is allowed.

[9]For simplicity, we assume an unstructured domain of possible answers. However, our analysis is compatible with a more structured domain containing pluralities, as argued by Dayal (1996).

(24) $c + \textbf{quest}_{w,\mathbf{s}_c}(\llbracket \text{who eats shrimp} \rrbracket) =$

$$\left\langle \mathbf{cs}_c, \textbf{push}\left(\left\{ \begin{array}{l} \mathbf{cs}_c \cap \{w' \mid \text{Aaman eat shrimp in } w'\} \\ \mathbf{cs}_c \cap \{w' \mid \text{Waazai eat shrimp in } w'\} \end{array} \right\}, \mathscr{T}_c \right) \right\rangle$$

defined only if $\mathbf{s}_c$ does not know the answer to $\llbracket$who eats shrimp$\rrbracket$ in w

With the use of question (23), the questioner proposes that the input context can be updated with the proposition denoted by *Aaman eats shrimp* or the one denoted by *Waazai eats shrimp*. If the question is appropriately asked, the questioner must want to know its answer, as dictated by its felicity condition.

A note for clarification before we move on: although we take SFPs to lexically encode speech act operators like **assert** and **quest**, we by no means imply a unique mapping between a SFP and a speech act operator. As mentioned in Section 2.1, a sentence may be interpreted as a question or an assertion even without any SFP. Additionally, there is more than one assertion particle and question particle in Cantonese. In fact, in Section 4, we discuss two variants of the **quest** operator with slightly different felicity conditions.

3.3. Semantics of *ho*

Armed with these definitions, we can now present our analysis of *ho*. Consider the definition in (25), in which A is a variable for the speech act embedded by *ho*.

(25) $$c + ho(A)_{w,\mathbf{s}_c,\mathbf{a}_c} = \left\langle \mathbf{cs}_c, \textbf{push}\left(\left\{ \begin{array}{l} \mathbf{cs}_c \cap \{w' \mid A_{w',\mathbf{a}_c} \text{ is defined in } w'\}, \\ \mathbf{cs}_c \cap \{w' \mid A_{w',\mathbf{a}_c} \text{ is undefined in } w'\} \end{array} \right\}, \mathscr{T}_c \right) \right\rangle$$

defined only if $A_{\mathbf{s}_c}$ is defined in w

This definition says: *ho* takes the speech act A as its argument; then, it forms a new question asking whether the addressee $\mathbf{a}_c$ can felicitously perform A or not; this new question is formalized as a set of two possible updates; one is the intersection of the context set $\mathbf{cs}_c$ and the worlds in which $\mathbf{a}_c$'s performance of A is defined, i.e., updating $\mathbf{cs}_c$ with the proposition that $\mathbf{a}_c$ felicitously performs A; the other is the intersection of $\mathbf{cs}_c$ and the worlds in which $\mathbf{a}_c$'s performance of A is undefined, i.e., updating $\mathbf{cs}_c$ with the proposition that $\mathbf{a}_c$ does not felicitously perform A; finally, the composition of *ho* and A returns a new speech act, which is defined only if the speaker $\mathbf{s}_c$ can felicitously perform A. Thus, *ho* informally expresses two facts: i) that the speaker can felicitously perform a speech act and, ii) they are asking whether the addressee can felicitously perform the same speech act.

3.3.1. Assertion + *ho*

Let's use the familiar data point below as a concrete example to elaborate how the definition in (25) captures the Cantonese facts.

(26) Aaman sik haa gaa ho?
Aaman eat shrimp ASSERT HO
'Aaman eats shrimp. Right?' *Assertion + ho*

In this example, *ho* is attached to the assertion marked by *gaa*. With use of (25), we translate the sentence as follows:

(27) $c + ho(\textbf{assert}([\![\text{Aaman eat shrimp}]\!]))_{w,\mathbf{s}_c,\mathbf{a}_c} =$

$$\left\langle \mathbf{cs}_c, \mathbf{push}\left(\left\{ \begin{array}{l} \mathbf{cs}_c \cap \{w' \mid \mathbf{assert}_{w',\mathbf{a}_c}([\![\text{Aaman eat shrimp}]\!]) \text{ is defined in } w'\}, \\ \mathbf{cs}_c \cap \{w' \mid \mathbf{assert}_{w',\mathbf{a}_c}([\![\text{Aaman eat shrimp}]\!]) \text{ is undefined in } w' \} \end{array} \right\}, \mathscr{T}_c \right) \right\rangle$$

defined only if $\mathbf{assert}_{w,\mathbf{s}_c}([\![\text{Aaman eat shrimp}]\!])$ is defined in w

According to the felicity condition of **assert**, as in (18), if it is defined for $\mathbf{a}_c$ to assert Aaman eats shrimp, then $\mathbf{a}_c$ believes Aaman eats shrimp. Conversely, if it is undefined for $\mathbf{a}_c$ to assert Aaman eats shrimp, then $\mathbf{a}_c$ does not believe Aaman eats shrimp. Based on these deductions, we can predict the possible responses to (26), which are described in section 2.2 and repeated here:

(28) a. Hai aa.
yes ASSERT
'Yes, he does.'

b. Mhai aa
no ASSERT
'No, he doesn't'

c. ŋo mzi wo
I not.know SFP
'I don't know.'

When the addressee responds with (28a), it indicates that they also believe that Aaman eats shrimp. If the addressee does not share this belief with the speaker, they may know that Aaman does not eat shrimp or they may be ignorant about the propositional content. In the former case they can use (28b) to answer the question, while in the latter case they can use (28c).

In Section 2.2, we noted that an assertion-*ho* question bears a bias towards the asserted proposition, making it less felicitous than a default polar question (with *maa*) in a neutral context (see example (7) and (8)). The felicity condition of attaching *ho* to an assertion can capture the presence of this bias. In (27), if the speaker can felicitously assert that Aaman eats shrimp, then they believe that this proposition is true. It then entails that the speaker does not believe that the counterpart of the asserted proposition *Aaman does not eat shrimp* is true. A consequence of this belief in the validity of p over $\neg p$ results in a bias towards p over $\neg p$.[10]

[10]Without going into a lot of detail, the definition of bias we adopt for our purposes here is one that treats the asserted nucleus of a question as more salient in the speaker's doxastic domain than its counterpart. See Roelofsen and van Gool (2010), Biezma and Rawlins (2012), Krifka (2015), Xu (2017), Bhadra (2017) among others.

3.3.2. Question + *ho*

We now demonstrate how the proposed analysis can account for the patterns with questions embedded by *ho*. Consider (29), repeated from (9):

(29) Bingo sik haa ne ho?
who eat shrimp WHQ HO
'Who eats shrimp? Do you share the same question?' *Wh*-question + *ho*

Based on our assumption that *ne* lexically encodes **quest**, we translate the question in (9) as follows:

(30)
$$c + ho(\textbf{quest}(\llbracket\text{who eat shrimp}\rrbracket))_{w,\mathbf{s}_c,\mathbf{a}_c} =$$
$$\left\langle \mathbf{cs}_c, \mathbf{push}\left(\left\{\begin{array}{l} \mathbf{cs}_c \cap \{w' \mid \mathbf{quest}_{w',\mathbf{a}_c}(\llbracket\text{who eats shrimp}\rrbracket) \text{ is defined in } w'\}, \\ \mathbf{cs}_c \cap \{w' \mid \mathbf{quest}_{w',\mathbf{a}_c}(\llbracket\text{who eats shrimp}\rrbracket) \text{ is undefined in } w'\ \} \end{array}\right\}, \mathscr{T}_c\right)\right\rangle$$
$$\text{defined only if } \mathbf{quest}_{w,\mathbf{s}_c}(\llbracket\text{who eats shrimp}\rrbracket) \text{ is defined in } w$$

Accordingly, the result of uttering (9) is to push onto $\mathscr{T}_c$ the issue of whether or not the addressee $\mathbf{a}_c$ can felicitously ask the embedded question *who eats shrimp*. It comes packaged with the felicity condition that the speaker $\mathbf{s}_c$ can ask the embedded question felicitously.

In the scenario where $\mathbf{a}_c$ can felicitously perform the question act, it entails that they are ignorant of the answer. In this scenario, $\mathbf{a}_c$ may choose an answer like (31a), repeated from (14a), to indicate that the question act is defined for them. Alternatively, in a scenario where $\mathbf{a}_c$ cannot felicitously perform the question act, it entails just the opposite, namely, that they know the answer to the question. If this is indeed the case, then $\mathbf{a}_c$ may choose to answer the embedded question with something like (31b), repeated from (14b).

(31) a. Hai lo.
yes SFP
'Yes.'

b. Aaman lo.
Aaman SFP
'Aaman.'

Another way for the addressee to indicate that she may felicitously perform a question act is to acknowledge that she is *also* ignorant about the answer to the question, just like the speaker is. In this case, an answer like (32a), repeated from (14c), may be used and has the same effect as (31a). However, due to the binary nature of the choice, the addressee will never be ignorant about her ability to perform such a question act. In other words, the addressee either can ask the question or cannot ask the question. For this reason, an answer like (32b), which lacks the additive particle *dou* and hence indicates ignorance towards the matrix question, is judged to be infelicitous.

(32) a. Ngo dou mzidou wo.
I also not.know SFP
'I also don't know.'

b. #Ngo mzidou wo.
I not.know SFP
'I don't know.'

The present analysis can also capture the felicity of Q-*ho* questions. As described in section 2.3, a Q-*ho* question is appropriate when the speaker does not expect the addressee to know the answer to the question embedded by *ho*. The relevant example is repeated below:

> **Scenario:** A famous scientist gave a talk on astrophysics. A, as a linguist, could not follow the talk. A's friend B was a poet, and it seemed to A that B did not understand the talk either (see Figure 1).

(33) Keoi gong me ne ho?
he say what WHQ HO
'What did he say? Do you share the same question?'

(34) #Keoi gong me ne?
he say what WHQ
'What did he say?'

In the scenario, the *ho*-Q question, rather than the ordinary *wh*-question, is more felicitous. According to Farkas and Bruce (2009), the context state following an ordinary question is inquisitive with respect to the denotation of the sentence radical that is pushed onto $\mathscr{T}_c$. For example, uttering (34) indicates that the speaker would like to update the context in one of the relevant ways, i.e., intersecting $\textbf{cs}_c$ with different propositions contained in the set denoted by *what did he say*, but s/he is not sure which update matches the fact in the actual world. Therefore, in order to successfully update the context, the speaker expects the addressee to pick out one of the possible updates. In other words, the addressee is expected to provide an answer to the question. However, the given scenario implies that the speaker does not believe the addressee knows the answer. As a result, asking (34) is not felicitous.

By contrast, the speaker's inquiry is transformed when the question is embedded under *ho*, as in (33). According to the definition of *ho*, this question can be translated as:

(35)
$$c + ho(\textbf{quest}([\![\text{what did he say}]\!]))_{w,\textbf{s}_c,\textbf{a}_c} =$$
$$\left\langle \textbf{cs}_c, \textbf{push}\left(\left\{ \begin{array}{l} \textbf{cs}_c \cap \{w' \mid \textbf{quest}_{w',\textbf{a}_c}([\![\text{what did he say}]\!]) \text{ is defined in } w'\}, \\ \textbf{cs}_c \cap \{w' \mid \textbf{quest}_{w',\textbf{a}_c}([\![\text{what did he say}]\!]) \text{ is undefined in } w' \ \} \end{array} \right\}, \mathscr{T}_c \right) \right\rangle$$
$$\text{defined only if } \textbf{quest}_{w,\textbf{s}_c}([\![\text{what did he say}]\!]) \text{ is defined in } w$$

In this case, the speaker intends to update the context with one of the two possible mental states of the addressee's: either the addressee can ask *what did he say* or s/he cannot. The former entails the addressee's ignorance towards the question, while the latter entails the addressee's knowledge regarding the question. Therefore, the speaker does not need to expect the addressee to know the answer to the embedded question. In fact, if the speaker does have such a belief, she would use (34) instead of (33).

4. Other question particles

So far, we have discussed the question particle *ne*, and its interaction with *ho*. As mentioned in section 2.1, Cantonese has other question particles. For example, to indicate a polar question, the polar question particle *maa* may be used (36). There is also a particle *aa*, which can be used in wh-questions and alternative questions (37).

(36) Aaman sik haa maa?
Aaman eat shrimp POLQ
'Does Aaman eat shrimp?' *Polar question particle maa*

(37) Lei-go hai mei jisi aa?
this-Cl is what mean AA
'What does this mean?' *Wh/Alternative-question particle aa*

What is interesting about these particles is that a special context is required to use the questions resulting from stacking them under *ho*, or else a pragmatically marked flavor arises. The natural context to use questions like (38a) and (38b) is a 'switch addressee' context. In such a context, the question embedded by *ho* is directed to an addressee but the whole *ho*-question is directed to a different addressee. If not used in such a context, (38a) and (38b) are very marked, and almost seem like an indirect and somewhat pretentious way to get the addressee to provide an answer to the embedded question. In this paper, we do not formally deal with the 'switch addressee' context (but see footnote 12 for an informal discussion). However, we would like to suggest a way to derive the markedness of these questions when they are not used in a 'switch addressee' context.

(38) a. *maa + ho*
Aaman sik haa maa ho?
Aaman eat shrimp POLQ HO
'Does Aaman eat shrimp? Do you share the same question?'
Marked: addressed to the same addressee
Unmarked: addressed to different addressees

b. *aa + ho*[11]
Bingo sik haa aa ho?
who eat shrimp AA HO
'Who eats shrimp? Do you share the same question?'
Marked: addressed to the same addressee
Unmarked: addressed to different addressees

A related observation is that *maa* and *aa* may not be used when there is no addressee at all, but *ne* is

[11]This question is acceptable when the embedded question is used rhetorically. A related observation, due to Lam (2014), is that *ho* may stack on the biased polar question particle *me*. We leave rhetorical questions feeding *ho* for future studies.

fine in such a context. We take this to suggest that *maa* and *aa* have an additional felicity condition requiring the obligatory presence of an addressee who is expected to answer the question. It is this additional felicity condition that gives rise to the pragmatic flavor. To see this, let us define the **quest** operator corresponding to *aa* (*maa* can be defined in a similar manner). It is identical to *ne* except for an extra felicity condition in (b).

(39) $c + \textbf{quest}^{\text{aa}}_{w,\textbf{s}_c,\textbf{a}_c}(Q) = \langle \textbf{cs}_c, \textbf{push}(\{\textbf{cs}_c \cap \{w' \mid p(w')\} \mid p \in Q\}, \mathscr{T}_c)\rangle$, defined only if
a. $\textbf{s}_c$ does not know the answer to Q in w
b. $\textbf{s}_c$ believes that $\textbf{a}_c$ can answer Q in w

$\textbf{quest}^{\text{aa}}$ leads to the same inquisitive context as $\textbf{quest}^{\text{ne}}$ does, but it has one more felicity condition—the speaker believes that the addressee knows the answer to the embedded question. Accordingly, using an *aa*-question is only appropriate if the question is directed to a person that the speaker thinks is able to resolve the question. As a result, an *aa*-question can never be self-directed.

Combining an *aa*-question with *ho* results in an odd question. Take (38b) as an example. The denotation of this sentence is represented as (40).

(40) $c + ho(\textbf{quest}^{\text{aa}}(⟦\text{who eats shrimp}⟧))_{w,\textbf{s}_c,\textbf{a}_c} =$

$$\left\langle \textbf{cs}_c, \textbf{push}\left(\left\{\begin{array}{l} \textbf{cs}_c \cap \{w' \mid \textbf{quest}^{\text{aa}}_{w',\textbf{a}_c,\textbf{s}_c}(⟦\text{who eats shrimp}⟧) \text{ is defined in } w'\}, \\ \textbf{cs}_c \cap \{w' \mid \textbf{quest}^{\text{aa}}_{w',\textbf{a}_c,\textbf{s}_c}(⟦\text{who eats shrimp}⟧) \text{ is undefined in } w'\} \end{array}\right\}, \mathscr{T}_c\right)\right\rangle$$

defined only if $\textbf{quest}^{\text{aa}}_{w,\textbf{s}_c,\textbf{a}_c}(⟦\text{who eats shrimp}⟧)$ is defined in w

(40) updates the context by pushing onto $\mathscr{T}_c$ a question that can be paraphrased as: *can the addressee* $\textbf{a}_c$ *perform the aa-question felicitously or not*. We argue that the addressee would never pick the positive member in the set, because the positive member represents a set of felicity conditions that contradict the felicity conditions of accepting (40). Suppose to the contrary that (40) is accepted and $\textbf{a}_c$ picks the positive member, namely, that it is defined for $\textbf{a}_c$ to perform the *aa*-question. What this implies is that $\textbf{a}_c$ is ignorant of the answer to the question *who eats shrimp* and believes that their addressee (i.e., the speaker $\textbf{s}_c$) can provide the answer. This gives rise to a contradiction. The whole update characterized by (40) is defined only if $\textbf{s}_c$ is ignorant of the answer to *who eats shrimp* and expects $\textbf{a}_c$ to provide the answer. So, $\textbf{a}_c$ cannot reasonably believe that $\textbf{s}_c$ can provide the answer to the *aa*-question, prohibiting $\textbf{a}_c$ from picking the positive member.[12]

[12]In a 'switch-addressee' context, the additional felicity condition is not problematic because the speaker now only believes that the addressee of the embedded *aa*-question can provide an answer to the question. As a consequence, for the addressee of the *ho*-question to felicitously ask the *aa*-question, they only need to believe that the addressee of the embedded question, which is no longer the speaker, knows the answer to the *aa*-question. We have to leave the discussion of the 'switch-addressee' context informal primarily due to the lack of space for developing a mechanism for changing the addressee parameter of a speech act operator.

Since one of the proposed updates in (40) is defunct and will never be picked by the addressee, the *ho*-question is not a well-defined inquisitive update. Rather, it bears a pragmatic effect similar to that of a rhetorical question, namely, only one of the proposed updates is consistent with the context. In this case, the only plausible update is that asking the same *aa*-question is undefined for the addressee.

If we unpack what it means for the addressee to pick the undefined option, we will see why the whole *ho*-question is often used to coax the addressee into actually answering the embedded *aa*-question. First, the addressee cannot felicitously ask the *aa*-question for an obvious reason, namely, that their addressee (i.e., the speaker of (40)) cannot provide an answer to the question. It is not informative for the speaker. This is because if a speaker utters (40), he has already indicated that he does not know the answer to the embedded *aa*-question.

Second, if the addressee knows how to answer the *aa*-question, it is also infelicitous for them to use this question. In this case, assuming a cooperative conversational partner, the speaker expects the addressee to answer the *aa*-question directly. As a result, the speaker can use the *aa-ho*-question as an indirect way to elicit an answer to the embedded *aa*-question.

5. Conclusion

This paper pursued the claim that the grammatical embeddability of speech act operators under higher operators is based on a system of compositional semantics at the speech act level. Basing the discussion on Cantonese *ho*, we argued that *ho* operates on speech acts and returns a higher level speech act that has the effect of asking the addressee if they would like to perform the same speech act as the speaker. The contribution of this particle is modeled in an update semantics, whereby speech act operators have two components: an overt instruction regarding how to update the input context, as well as a mechanism of checking whether the speech act is felicitously performed. In future research, we seek to uncover such particles in other languages with a rich inventory of sentence-final particles, as well as to extend the speech act embedding mechanism developed here to account for other speech act phenomena.

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Distinguishing coercion and underspecification in Type Composition Logic[1]

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Abstract. This paper investigates the meaning adaptability of change of state (CoS) verbs. It argues that both coercion and underspecification are necessary mechanisms in order to properly account for the semantic adaptability observable for CoS verbs in combination with their complements. This type of meaning adaptability has received little formal attention to date, although some recent work has already led the way on this topic (Spalek, 2014; Lukassek and Spalek, 2016; Asher et al., 2017). Our paper is part of a cross-linguistic case study of German *einfrieren* and Spanish *congelar* ('freeze'). We model the meaning adaptability of this test case within Type Composition Logic (TCL) (Asher, 2011). We build on Asher's coercion mechanism and introduce an additional mechanism for underspecification that exploits the fine-grained type system in TCL.

Keywords: lexical semantics, change of state verbs, coercion, underspecification, Type Composition Logic.

1. Introduction

The verbs *einfrieren* in German and *congelar*[2] in Spanish ('freeze') refer to physical ((1a) and (1b)) and abstract ((2a) and (2b)) change of state events, as illustrated in the following examples.[3]

(1) a. Ida fror die Suppe ein. (physical event)
Ida froze the soup in
'Ida froze the soup.'
b. Ida congeló la sopa.
Ida froze the soup
'Ida froze the soup.'

(2) a. Die Gewerkschaft fror die Verhandlungen ein. (abstract event)
the union froze the negotiations in
'The union froze the negotiations.'

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[2]For the purposes of this paper we will stick to German and Spanish as languages of investigation, but will illustrate our points using mainly German data. Based on the Spanish data analysed in Spalek (2014), we assume that, except for some minor differences, *einfrieren* and *congelar* display comparable behaviour.
[3]German examples are from Das Deutsche Referenzkorpus (DeReKo) at the Institut für Deutsche Sprache, Mannheim, available at http://www.ids-mannheim.de/kl/projekte/korpora/. Examples with no indication of the source have been constructed by us.

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b. El sindicato congeló las negociaciones.
the union froze the negotiations
'The union froze the negotiations.'

The wide spectrum of events referred to by *einfrieren* and *congelar* is not exclusive to German or Spanish, but rather represents a general pattern to be found in many other languages, such as, for instance, English and Polish. We will discuss how this phenomenon is to be modelled and will argue for an underspecification mechanism that generates the two basic readings from one common lexical entry. In our account, we will understand underspecification as a free combinatorial choice that is lexically anchored. In addition to these free combinatorial choices, *einfrieren* ('freeze') also naturally appears in coercion contexts. These contexts involve a compositional clash between the verb and its complement that can be repaired. This combinatorial option has been discussed for the physical reading in English in Asher (2011). For German, an example like (3a) involves a reinterpretation from a container to its content. (3b), in turn, is an example of such a coercion context in the abstract reading. The state-denoting argument *Punktestand* 'scores' is reinterpreted as a development in scores and this development can be frozen.

(3) a. Ida hat die Flasche eingefroren.
Ida has the bottle in-frozen
'Ida froze the bottle.'

b. d. h. der Punktestand wird eingefroren...
that means the score is in-frozen
'that means that the score is being frozen...'
(https://goo.gl/Mnv17X)

Throughout this paper, we address what characterizes the different readings of *einfrieren* and *congelar*, how their multiple meanings correlate with the semantics of their complements and what theoretical status should be assigned to the multiple readings of the verb. These questions help disentangle cases of coercion from cases of underspecification. Formally, we understand underspecification as a lexically anchored dependent type whose specification hinges on the type of a parameter contributed by the complement's type. Coercion, in turn, arises from a combinatory conflict that triggers a repair mechanism licensed by a lexical polymorphic type in the verb introducing a suitable variable.

We proceed by first providing a description of the possible readings of *einfrieren* and *congelar*, taking into account the conceptual content as well as the lexical aspectual properties. Following this, we present more data concerning the combinatorial patterns of *einfrieren* and *congelar*. Finally, we provide a semantics for *einfrieren/congelar* by implementing the observations in Type Composition Logic (TCL) (Asher, 2011).

2. Distinguishing the two readings of *einfrieren*

Change of state (CoS) verbs are generally ambiguous between referring to physical and abstract events, as already observed for Spanish by Spalek (2014).[4] The reading systematically depends on the type of the internal argument.

(4) a. Die Vase / die Beziehung zerbrach.
the vase / the relationship broke
'The vase / the relationship broke.'
b. Der Bürgermeister schnitt den Faden / die Stromversorgung ab.
the mayor cut the cord / the electricity supply off
'The mayor cut off the cord / the electricity supply.'
c. Das SEK hat eine Scheibe / einen Schmugglerring zerschlagen.
the SEK has a window / a trafficking ring through-smashed
'The special law enforcement unit has smashed a window / a trafficking ring.'

In order to tease apart the different readings of *einfrieren*, we need to take a closer look at the factors that influence the different readings. In the following, we will first examine the conceptual content contributed by the verb and, second, focus on its aspectual properties in each reading.[5]

Firstly, *einfrieren* can describe conceptually different contents that bring about different result states. The physical reading denotes an event of change in temperature and consistency of the complement with the effect of making the complement non-perishable (5a). These properties, however, do not hold for the result state brought about by the abstract event *einfrieren*, as illustrated in (5b).

(5) a. Emil fror die Suppe ein. Sie war danach kalt, steinhart und haltbar.
Emil froze the soup in she was afterwards cold, rock-hard and non-perishable
'Emil froze the soup. Afterwards it was cold, rock-hard and non-perishable.'
b. #Die Gewerkschaft fror die Verhandlungen ein. Sie waren danach kalt,
the union froze the negotiations in they were afterwards cold
steinhart und haltbar.
rock-hard and non-perishable.
'The union froze the negotiations. Afterwards they were cold, rock-hard and non-perishable.'

The abstract reading, in turn, denotes an event of 'interruption'. The result state brought about by abstract *einfrieren* amounts to the complement event not taking place anymore, (6a). This result state does not arise in the physical reading, (6b).

[4] An analogous observation has been made by Asher et al. (2017: p. 137, (3)), who give possible contextual specifications for English *swallow* and *run*.

[5] A question that is outside the scope of this paper concerns the kinds of causation that are involved in each of the readings: issues such as direct vs. indirect causation or intentionality. These factors cut across the distinction between physical and abstract readings. For more discussion on this topic, see Spalek (2014).

(6) a. Die Gewerkschaft fror die Verhandlungen ein. Sie fanden danach nicht mehr statt.
the union froze the negotiations in she took afterwards not more place
'The union froze the negotiations. Afterwards they did not take place anymore.'
b. #Emil fror die Suppe ein. Sie fand danach nicht mehr statt.
Emil froze the soup in she took afterwards not more place
'Emil froze the soup. Afterwards it did not take place anymore.'

Abstract *einfrieren* has the same entailment pattern as *unterbrechen* 'interrupt'. Engerer (2014) (following ideas from Dowty, 1979) shows that aspectual verbs can be accounted for in terms of a common pattern of presuppositions and entailments displayed for *interrupt* in (7). According to these, *einfrieren* falls into the egressive class, like *unterbrechen*.

(7) Die Gewerkschaft hat die Verhandlungen eingefroren / unterbrochen.
the union has the negotiations in-frozen / interrupted
'The union froze the negotiations.'
$>>$ t_{i-1}: The negotiations are going on.
$\rightarrow$ t_{i+1}: The negotiations are not going on.

The two readings can be combined with two different types of modifiers. Instruments are only compatible with the physical reading, as the contrast between (8a) and (8b) illustrates, whereas only eventive *mit*-PPs can modify abstract readings of *einfrieren*, as shown in the contrast of (9a) and (9b). The fact that eventive *mit*-modifiers are only compatible with the abstract reading is due to the fact that these modifiers are generally restricted to events that are more abstract than the modifier event itself. They add a concrete conceptualization to their target, as observed by Lukassek (2015).

(8) a. Ida fror die Suppe mit Flüssigstickstoff ein.
Ida froze the soup with liquid nitrogen in
'Ida froze the soup with liquid nitrogen.'
b. Die Gewerkschaft fror die Verhandlungen #mit dem Telefon ein.
the union froze the negotiations with the telephone in
'The union froze the negotiations with the telephone.'

(9) a. Die Gewerkschaft fror die Verhandlungen mit einem Telefonanruf / mit einer Pressekonferenz ein.
the union froze the negotiations with a call / with a press conference in
'The union froze the negotiations with a call / with a press conference.'
b. Emil fror die Suppe #mit dem Ablegen im Gefrierfach ein.
Emil froze the soup with the depositing in the freezer in
'Emil froze the soup by depositing it in the freezer.'

Physical readings of *einfrieren* allow embedding under perception verbs (10a), since physical events can easily be perceived by our senses. This is not natural for abstract *einfrieren*-events, as example (10b) illustrates.

(10) a. Johann sah Emil die Suppe einfrieren.
Johann saw Emil the soup in-freeze
'Johann saw Emil freeze the soup.'
b. #Johann sah die Gewerkschaft die Verhandlungen einfrieren.
Johann saw the union the negotiations in-freeze
'Johann saw the union freeze the negotiations.'

The observations made so far thus clearly show that abstract *einfrieren* readings represent overall more abstract events than the physical *einfrieren*-events. Clear differences are also to be observed concerning lexical aspect. Earlier studies have classified English *freeze*, the equivalent of German *einfrieren*, as a prototypical CoS verb (Levin, 1993; Levin and Rappaport Hovav, 1995; Wright, 2002; Koontz-Garboden, 2009).[6] When applying classic aspectual diagnostics (Dowty, 1979), both readings of *einfrieren*, physical and abstract, are telic, and yet they differ with respect to Aktionsart, as the following tests illustrate: only the physical reading (11a) is compatible with interval adverbials, such as *in zwei Stunden* 'in two hours'.

(11) a. Ida fror die Suppe in zwei Stunden ein.
Ida froze the soup in two hours in
'Ida froze the soup in two hours.'
b. #Die Gewerkschaft fror die Verhandlungen in zwei Stunden ein.
the union froze the negotiations in two hours in
'The union froze the negotiations in two hours.'

Only the physical reading (12a) can be embedded under the aspectual verb *aufhören* 'stop', since only this fulfils the requirement of having a temporal extension, whereas abstract *einfrieren*-events lack temporal extensions (12b).

(12) a. Emil hörte auf, die Suppe einzufrieren, weil er doch Lust hatte, sie
Emil stopped up the soup in to freeze, because he after all desire had it
sofort zu essen.
immediately to eat
'Emil stopped freezing the soup, because after all he wanted to eat it immediately.'

b. #Die Gewerkschaft hörte auf, die Verhandlungen einzufrieren, weil der
the union stopped up the negotiations in to freeze, because the
Vorstand doch einlenkte.
board after all gave in
'The union stopped freezing the negotiations, because the board gave in after all.'

The adverb *fast* 'almost' differs in the way it can take scope over the different readings of *einfrieren*. Assuming Dowty's structure of accomplishments, in the physical reading (13a) *fast* can scope either over the CAUSE-component or over the BECOME of the CoS, entailing that either

[6] See Spalek (2014) for Spanish *congelar*.

Ida did not act at all or the soup did not freeze completely, respectively. The abstract reading of *einfrieren* (13b) displays a typical achievement behaviour with *fast* 'almost' conveying that the event actually did not take place and no other reading is possible.

(13) a. Ida fror die Suppe fast ein. (2 readings)
Ida froze the soup almost in
'Ida almost froze the soup.'
b. Die Gewerkschaft fror die Verhandlungen fast ein. (1 reading)
the union froze the negotiations almost in
'The union almost froze the negotiations.'

The abstract reading is furthermore hard to get in the progressive form,[7] as the contrast in (14) illustrates.

(14) a. Ida war am die Suppe einfrieren.
Ida was on the soup in-freezing
'Ida was freezing the soup.'
b. ?Die Gewerkschaft war am die Verhandlungen einfrieren.
the union was on the negotiations in-freezing
'The union was freezing the negotiations.'

The tests above clearly illustrate that the abstract reading of *einfrieren* patterns together with achievements, whereas the physical reading patterns together with accomplishments. We conclude this section with the observation that the conceptual and aspectual differences are good reasons to consider the two readings as discrete. We will now turn to a more detailed analysis of the combinatorial patterns of *einfrieren* and *congelar*.

3. Meaning contribution of the complements

In Spalek (2014), we find a detailed description of *congelar* that clearly illustrates how the complement plays a crucial role in specifying the interpretation of the verb and what can be considered compositional clashes. In this section, we provide a detailed analysis of the combinatorics of *einfrieren* for each reading. In addition, we discuss possible lexical meanings for the two readings of *einfrieren* to be spelled out in TCL.

3.1. Physical readings

Asher (2011: 9.3) discusses two types of physical readings of English *freeze*. First, he describes the compositional variant that is covered by the selectional restriction LIQUID for the internal argument. This selectional restriction effectively accounts for the physical cases discussed so far. Second, he identifies a coercion reading (15) that is based on a coercion from a container to its content. The container-type noun *bottle* does not satisfy the selectional restriction LIQUID that

[7] German does not have a regular progressive. However, the dialectal *Rheinische Verlaufsform* corresponds to the English progressive and is standardly applied as an aspectual test.

freeze imposes and thus a compositional conflict arises.

(15) The bottle froze.
The liquid in the bottle froze.
(Asher, 2011: p. 248, (9.12a))

This conflict, however, can be resolved by introducing an argument of suitable type. More precisely, within Asher's TCL, coercions have a lexical anchor insofar as compositional conflicts can be resolved via lexically encoded dependent types. The verb *freeze*, for instance, features a dependent type that takes a CONTAINER-type argument and yields an argument of LIQUID-type that is the content of the container. According to Asher, *freeze* is just one of many examples that strengthens the argument for understanding coercion as a lexically based operation.

Yet, even the restriction to liquids on the one hand and an option for coercion on the other are still too limited to account for the possible combinations in the physical domain, and examples such as in (16) and (17) prove that German *einfrieren* combines with all sorts of physical objects, e.g. *Spargel* 'asparagus' or *Hagelkorn* 'hailstone', that do not justify the type presupposition LIQUID. Furthermore, none of these cases plausibly involves a coercion from a container to its content.

(16) Kann man Spargel eigentlich auch einfrieren?
can one asparagus actually also in-freeze
'Is it actually possible to freeze asparagus?'
(*Im Wohnzimmer lauert das Grauen*, Süddeutsche Zeitung, 22.07.2011)

(17) Jay Lawrimore ... lobte die schnelle Reaktion der Bewohner Auroras, die das
Jay Lawrimore praised the quick reaction of the inhabitants of Aurora who the
überdimensionale Hagelkorn eingesammelt und eingefroren hatten.
oversized hailstone collected and in-froze had
'Jay Lawrimore, the head of the committee, praised the quick reaction of the inhabitants of Aurora, who had collected and frozen the colossal hailstone.'
(*Das größte Hagelkorn war fast so groß wie ein Handball*, spektrumdirekt, 05.08.2003)

Asher's proposal thus only covers a part of the combinatory potential that the physical reading of *einfrieren* actually displays. The two examples indicate that the selectional restriction on the internal argument is more liberal than anticipated and has to be opened to all physical objects. Thus, the mere change from a liquid to a solid state of a substance cannot be an exhaustive description of the physical reading of *einfrieren*. In fact, the examples discussed so far suggest that the result state of the physical reading comes in three different manifestations: 1) with liquids, like *soup*, the relevant change of state amounts to the physical object changing from a liquid to a solid state, 2) with solid objects, like *asparagus*, *freezing* mainly involves a reduction in their temperature, and 3) with atmospherically fragile solid objects, like *hailstones*, freezing essentially denotes preservation, e.g. by making sure their temperature stays below zero. We can thus conclude that for the result state of the physical reading, three component predicates have to hold of the complement, cf. (18). If a *soup* is frozen, its temperature is below zero, it is solid, and it is preserved. The same holds for *asparagus* and *hailstone*.

(18) $\text{frozen}_p(x) = \text{temperature}(x) < 0 \wedge \text{solid}(x) \wedge \text{preserved}(x)$.

Whereas the result state is identical in all three cases, the change of state that leads to the result differs. It might involve the change of one or more component predicates of the result. This means that the presupposition about the state of the complement before the reference time is underspecified. At least one of the three components does not apply at the time before the result state holds. Which of the components is targeted depends on the specific type of the complement.

Further, Asher's proposal for the second reading, which involves container-content-coercions, has a shortcoming too. In his account, this type of coercion is licensed by a dependent type that is anchored in the lexical semantics of *freeze*. His proposal predicts that the container-content-coercion is an idiosyncrasy of *freeze*. However, this type of coercion appears to be very systematic and ranges over distinct verb classes, as the examples in (19) to (21) prove: all these verbs select for liquids and in all cases a container complement is acceptable. In much earlier work, Apresjan (1974) already pointed out that the container-content-metononymy is a regular polysemic pattern that can be found in many contexts.

(19) Emil hat die ganze Flasche / Tasse getrunken.
Emil has the whole bottle / cup drunk
'Emil has drunk the whole bottle / cup.'

(20) Er hat die Flasche / das Glas verschüttet.
he has the bottle / the glass spilled
'He has spilled the bottle / the glass.'

(21) Die Männer ließen sich noch eine weitere Flasche durch die Kehle laufen.
the men let self still a next bottle through the throat run
'The men swallowed yet another bottle.'

If we take Asher's endeavour to clarify the role of the lexicon in coercive operations seriously, the potential for a container-content-coercion cannot be part of the lexical entry of *einfrieren*. Rather, the interpretation of (15) has to be explained on independent grounds that lie outside of the scope of this paper, as they do not concern the lexical semantics of *einfrieren* per se.

Based on the discussion so far, we propose the lexical semantics for the physical interpretation of *einfrieren* in TCL-style[8] in (22). Three features are central here. First, the result state of *einfrieren* is decomposed into the components *solid*, *temperature below zero* and *preserved*. We use FROZEN as a type label for these three components. Second, *einfrieren* selects an internal

[8] In TCL, meaning representations consist of two levels. The external semantics is a regular λ term with a standard model-theoretic interpretation. The internal semantics features rich typing information on the variables of the term. It has a proof-theoretic interpretation. Both layers are integrated into one linear representation. The internal semantics is managed via an additional argument π that stores and passes all typing information throughout the composition. Type information is concatenated by the operator $*$.

argument of type P, i.e. a physical object. Third, contrary to Asher's proposal, the physical reading of *einfrieren* does not feature a polymorphic type that could license a container-content-coercion.

(22) $[\![\text{einfrieren}_p]\!] = \lambda\Psi\lambda\Phi\lambda e\lambda\pi\exists s.\Phi(\pi)(\lambda x\lambda\pi_1.\Psi(\pi_1{*}\text{ARG}_3^{freeze}{:}\text{P})(\lambda y\lambda\pi_2.$ $\text{freeze'}(e,x,y,\pi_2{*}\text{ARG}_1^{freeze}{:}\text{BECOME}) \wedge \text{result'}(s,e,\pi_2{*}\text{ARG}_1^{result}{:}\text{FROZEN})))$

In the physical reading (22), *einfrieren* takes two generalized quantifiers, Ψ (the internal argument) and Φ (the external argument), and an event variable *e* as arguments and introduces a resultant state *s* that is existentially bound. On the type level, *einfrieren* passes the type requirement P to its complement. The referential argument *e* is typed as BECOME and the result state *s* is of FROZEN-type. On the term level, *einfrieren* contributes a freeze'-predicate with the referential argument *e*, the internal argument *y* and external argument *x*. The result state *s* is related to the event *e* via the result'-predicate. The meaning computation for sentence (23) is given in (24). This will give us a first impression of how the compositional apparatus works.

(23) Das Mädchen fror den Tee ein.
the girl froze the tea in
'The girl froze the tea.'

In (24a), *einfrieren* is applied to the internal argument DP *den Tee*. The internal argument has a standard generalized quantifier representation. It is typed as LIQUID. This typing information stems from the lexical typing of the noun *Tee*. The predicate selects for a physical object in this position. This type presupposition is passed onto the complement via the π-parameter, which is applied to the π-parameter within the complement DP. As liquids are subtypes of physical objects, functional application is possible and the composition proceeds. In (24b), the subject DP is integrated. As the combinatorics with the subject is of no concern here, we do not specify the type information on this argument in the interest of readability. After the subject has been integrated, the referential argument is existentially closed and type presuppositions are bound (24c).

(24) a. $[\![\textbf{einfrieren}]\!]([\![\textbf{den Tee}]\!])=$
$[\lambda\Psi\lambda\Phi\lambda e\lambda\pi\exists e.\Phi(\pi)(\lambda x\lambda\pi_1.\Psi(\pi_1{*}\text{ARG}_3^{freeze}{:}\text{P})(\lambda y\lambda\pi_2.\ \text{freeze'}(e,x,y,\pi_2{*}$ $\text{ARG}_1^{freeze}{:}\text{BECOME}) \wedge \text{result'}(s,e,\pi_2{*}\ \text{ARG}_1^{result}{:}\text{FROZEN})))]$
$(\lambda P\lambda\pi'\exists!t.\ \text{tea'}(t,\pi'{*}\text{ARG}_1^{tea}{:}\text{LIQUID}) \wedge P(\pi')(t)) =$
$\lambda\Phi\lambda e\lambda\pi\exists s.\Phi(\pi)(\lambda x\lambda\pi_1.\exists!t.\ \text{tea'}(t,\pi_1{*}\text{ARG}_3^{freeze}{:}\text{P}{*}\text{ARG}_1^{tea}{:}\text{LIQUID}) \wedge$
$\text{freeze'}(e,x,t,\pi_1\ {*}\text{ARG}_1^{freeze}{:}\text{BECOME}) \wedge \text{result'}(s,e,\pi_1{*}\ \text{ARG}_1^{result}{:}\text{FROZEN}))$

b. $[\![\textbf{den Tee einfrieren}]\!]([\![\textbf{das Mädchen}]\!])=$
$[\lambda\Phi\lambda e\lambda\pi\exists s.\Phi(\pi)(\lambda x\lambda\pi_1.\exists!t.\ \text{tea'}(t,\pi_1{*}\text{ARG}_3^{freeze}{:}\text{P}{*}\text{ARG}_1^{tea}{:}\text{LIQUID}) \wedge$
$\text{freeze'}(e,x,t,\pi_1{*}\text{ARG}_1^{freeze}{:}\text{BECOME}) \wedge \text{result'}(s,e,\pi_1{*}\ \text{ARG}_1^{result}{:}\text{FROZEN}))]$
$(\lambda Q\lambda\pi'\exists!g.\ \text{girl'}(g,\pi') \wedge Q(\pi')(g)) =$
$\lambda e\lambda\pi\exists!g\exists!t\exists s.\ \text{girl'}(g,\pi) \wedge \text{tea'}(t,\pi{*}\text{ARG}_3^{freeze}{:}\text{P}{*}\text{ARG}_1^{tea}{:}\text{LIQUID}) \wedge$
$\text{freeze'}(e,g,t,\pi{*}\text{ARG}_1^{freeze}{:}\text{BECOME}) \wedge \text{result'}(s,e,\pi{*}\ \text{ARG}_1^{result}{:}\text{FROZEN})$

c. **Existential closure of *e* and binding presuppositions**:
$\lambda\pi\exists!g\exists!t{:}\text{LIQUID}\exists e{:}\text{BECOME}\exists s{:}\text{FROZEN}.\ \text{girl'}(g,\pi) \wedge \text{tea'}(t,\pi) \wedge$
$\text{freeze'}(e,g,t,\pi) \wedge \text{result'}(s,e,\pi)$

When all arguments are integrated, the type presuppositions on the variables can be bound. This yields the meaning representation in (24c) for (23). There is exactly one *g*, exactly one *t* of type LIQUID, an event *e* of type BECOME and a state *s* of type FROZEN such that *e* is a freezing event where the girl *g* freezes the tea *t* and *s* is the result of *e*.

3.2. Abstract readings

We have seen that the parallelism of the abstract reading of *einfrieren* to aspectual verbs like *interrupt*, German 'unterbrechen', is well motivated by the common entailment patterns in (7). Similarly, both *unterbrechen* and *einfrieren* combine with events that have a temporal extension (activities and accomplishments) while excluding states (25c) and achievements (25d).

(25) a. Die Gewerkschaft hat die Gespräche unterbrochen / eingefroren.
the union has the talks interrupted / in-frozen
'The union has interrupted / frozen the talks.'
b. Die Regierung hat den Straßenbau unterbrochen / eingefroren.
the government has the road construction interrupted / in-frozen
'The government has interrupted / frozen the road construction.'
c. *Der Friseur hat das Schön-Sein unterbrochen / eingefroren.
the hair dresser has the beautiful be interrupted / in-frozen
'The hair dresser has interrupted / frozen being beautiful.'
d. *Herr Schmidt hat das Ankommen des Zuges unterbrochen / eingefroren.
Mr Schmidt has the arriving of the train interrupted / in-frozen
'Mr Schmidt has interrupted / frozen the arriving of the train.'

These tests show that an eventive selectional restriction overgenerates, because *einfrieren*, like *unterbrechen*, only selects for temporally extended events in its complement position. We use the type label TRANSITION for these two Aktionsarten. German corpus data mirrors this generalization, because most of the complements we found were events with a temporal extension such as *Siedlungstätigkeit* and *Friedensprozess*. Formally, we model these combinatorial cases as standard compositions via functional application.

(26) ... wenn Israel seine Siedlungstätigkeit einfriere.
... if Israel its settlement activity freezes
'... if Israel stops the settlement politics.'
(*Israel räumt Teil der Siedlungen*, Die Presse, 14.10.1999)

(27) Wenn man den Friedensprozess einfriert, verhindert man die Gründung eines
if one the peace process in-freezes, inhibits one the founding of a
palästinensischen Staates.
Palestinian state
'Freezing the peace process inhibits the foundation of a Palestinian state.'
(*Früchte des Zorns*, Süddeutsche Zeitung, 27.10.2004)

However, corpus data from Spanish (Spalek, 2014) and German show that the combinatorial patterns are still more diverse. Value-denoting nouns, such as *Eintrittspreise* (28), abound in both languages. The interpretation of this example involves the inhibition of an increase in the prices.

(28) Bei soviel Preisstabilität in der Branche hat auch die Düsseldorfer Messe ihre
with so much price stability in the branch has too the Düsseldorf trade fair its
Eintrittspreise zum dritten Mal eingefroren.
entry prices for the third time in-frozen
'Given the prices are stable in the branch, the Düsseldorf trade fair has frozen its entry prices for the third time.'
(*Bei der weltgrößten Wassersportmesse "boot '91" können sich 400000 Interessenten auf 1800 Boote freuen*, Nürnberger Nachrichten, 15.01.1991)

Example (28) with the value-denoting noun *Eintrittspreise* 'entry prices' also falls into the compositional class. Following Löbner (2015), we classify *Eintrittspreise* together with other value-denoting nouns such as *temperature*, which can receive a reading as a function from times to individual values. That is, it is inherent to values that they change over time. An indicator for the presence of this function is the fact that verbs like *rising* can be predicated over value-denoting nouns. *Eintrittspreise* and other value-denoting nouns we encountered with *einfrieren* also pass this test.[9]

A combinatorial pattern that does not straightforwardly fit the TRANSITION restriction is (29) with the state-denoting complement *Punktestand*.[10] This might seem surprising given the tests in (25). Yet intuitively, the interpretation involves the inhibition of an expected change in the scores, in other words a transition.

(29) d. h. der Punktestand wird eingefroren...
that means the score is in-frozen
'that means that the score is being frozen.'
(https://goo.gl/Mnv17X)

Interestingly, genuine Kimian states (Maienborn, 2005; Bücking, 2012), such as *Schön-Sein*, *Ähneln* and *60-Kilo-Wiegen* in (30), are not appropriate complements of abstract *einfrieren*. The

[9]Note that we assume that value-denoting nouns actually have two readings: they can either denote a concrete value or a function from times to values. In TCL, this kind of ambiguity is encoded as a Dot-type; cf. the co-predication test *The admission price is 20 Euros and rising every year.*

[10]The German word *Punktestand* is overtly marked as a state by the second component of the compound. The English translation does not reflect that fact.

reason for the ungrammaticality is that a presupposition of an inherent change is incompatible with the sortal properties of Kimian states. They are abstract entities without internal structure and lack potential for change.[11]

(30) Man friert #das Schön-Sein / #das Ähneln / #das 60-Kilo-Wiegen ein.
one freezes the beautiful-being / the resembling / the 60-kg-weighing in
'One freezes the being beautiful / the resembling / the weighing 60 kg.'

We can thus formally assume that (29) involves a meaning enrichment through an interpolation of a transition based on *Punktestand*. What is interpolated here is the development of the scores over time. 'Freezing the scores' then means inhibiting any development in the value of the scores. We model this example as a coercion in TCL terms. This coercion is possible within well-defined boundaries: only Davidsonian States can be coerced into events. Abstract *einfrieren* thus displays a similar behaviour to aspectual verbs, which are well known for their eventive selectional restriction and their ability to license a coercion from complements of other types to events (Pustejovsky, 1995; Egg, 2003; Asher, 2011).

Now that the combinatorial options in the abstract reading have been clarified, we turn to the properties of the result state brought about by abstract *einfrieren*. In the previous subsection, we argued that the result state of the physical reading is tripartite and comprises the properties of having a temperature below zero, being solid and being preserved. Of these three properties, only one is not restricted to the physical domain, namely the property of being preserved. Both physical objects and states of affairs as part of a transition can be preserved. This property functions as a conceptual bridge from the physical to the abstract reading. The other two component parts of physical freezing are omitted in the abstract reading.

We now have all ingredients to propose a meaning representation for the abstract reading. Our proposal has three central features. First, abstract *einfrieren* requires its complement to be of type TRANSITION. Second, in this argument position, coercion is lexically licensed. In order to model this, we integrate a polymorphic $\tau\rho$ type into the type presupposition for the complement. It licenses a coercion in complement position if the selectional restriction is not met. The basis for complement coercion is restricted. Abstract *einfrieren* determines that only states are a suitable type from which transitions can be interpolated. Third, the result state FROZEN corresponds to the property of being preserved in the abstract reading.

(31) $[\![\text{einfrieren}_a]\!] = \lambda\Psi\lambda\Phi\lambda e\lambda\pi\exists s.\Phi(\pi)(\lambda x\lambda\pi_1.\Psi(\pi_1{*}\text{ARG}_3^{freeze}{:}\text{TRANSITION}–$
$\tau\rho(\text{HD}(\Psi)\sqsubseteq\text{STATE}))(\lambda y\lambda\pi_2.\text{freeze'}(e,x,y,\pi_2{*}\text{ARG}_1^{freeze}{:}\text{BECOME}{*}\text{ARG}_1^{\Psi}{:}\text{TY}^{PS}(\Psi))\wedge$
$\text{result'}(s,e,\pi_2{*}\text{ARG}_1^{result}{:}\text{FROZEN})))$

Abstract *einfrieren* has the same external semantics as the physical reading. It takes two

[11] In contrast, tropes in the sense of Moltmann (2013) as inherently changing entities are acceptable complements of *einfrieren* (i).

(i) Man friert die Schönheit / die Ähnlichkeit / das Gewicht ein.
one freezes the beauty / the resemblance / the weight in
'One freezes the beauty / the resemblance / the weight.'

Tropes are concrete property manifestations on a holder; cf. Moltmann (2013).

generalized quantifiers (Ψ and Φ) and an event argument e and introduces an existentially bound state argument s. It contributes a freeze'-predicate and a state that is the result of the freezing event. Abstract and physical readings differ only in their internal semantics. The complement is restricted to being of type TRANSITION. Furthermore, abstract *einfrieren* features a polymorphic type for coercions from states to transitions. The meaning computation for a compositional abstract reading thus follows the line of the physical variant in (24).

In (34), we give the meaning computation for the coercion-case in (32): *einfrieren* is applied to the state-denoting complement *Punktestand*, which does not satisfy the verb's selectional restriction *transition*. In order to repair the conflict, the interpolation of a suitable argument is licensed by the polymorphic type $\tau\rho$. The polymorphic type licenses coercion only if the given complement is of STATE type. This restriction is met by *Punktestand* and the coercion operation can proceed.

(32) Der Organisator fror den Punktestand ein.
the organizers froze the score in
'The organizers froze the score.'

In (34a), abstract *einfrieren* is applied to the DP *den Punktestand* 'the score', which has the referential variable c in our representation. This variable is typed as STATE. The required type for the third argument of freeze is TRANSITION. With this typing information, a conflict on the variable c arises. As abstract *einfrieren* features a polymorphic type, the type presupposition can be accommodated by interpolating a suitable argument of TRANSITION type. The coercion functor in (34b) is a deduction from the polymorphic type based on the TCL rule for type accommodations with polymorphic types, see (33).

(33) Type Accommodation with Polymorphic Types (Asher, 2011: p. 225):

$$\frac{\phi(v,\pi) \qquad \pi \text{ carries } \textsc{arg}_i^P{:}\delta(\alpha,\beta){*}\textsc{arg}_j^Q\,\alpha/\beta \qquad v \in \textsc{arg}_i^P \cap \textsc{arg}_j^Q}{\mathscr{D}(\lambda w \lambda \pi_1.\phi(w,\pi_1))(\pi)(v)}$$

The functor introduces the variable e_1 that is a transition depending on the score. This dependency is expressed by the type information on e_1. It has to be of type $\tau\rho(\text{SCORE})$, which is a very specific type of transition, namely one that is a transition of scores. Typically, coercion functors in TCL introduce an underspecified predicate ϕ that requires contextual specification. This predicate relates the newly introduced variable e_1 to the original state argument c. The underspecification of the predicate gives us the possibility to determine a concrete transition in the given context.

In (34c), the result of the application of the coercion functor is given. The freeze'-predicate now has e_1 as its third argument. This variable meets the type requirements on the complement of abstract *einfrieren*. Nevertheless, the original state variable c is still present in the meaning representation and it has kept its original type. That is, the *score*-DP itself is still intact. The conflict has been solved locally in the nuclear scope of the quantifier, which is characteristic for TCL-style coercions.[12] In (34d), the subject argument is integrated via regular functional

[12]Although Asher (2011) gives a series of reasons why coercion should be local, computationally the locality has to

application.

(34) a. **⟦einfrieren⟧(⟦den Punktestand⟧)** =
$[\lambda\Psi\lambda\Phi\lambda e\lambda\pi\exists s.\ \Phi(\pi)(\lambda x\lambda\pi_1.\ \Psi(\pi_1 * \text{ARG}_3^{freeze}\text{:TRANSITION}-$
$\tau\rho(\text{HD}(\Psi)\sqsubseteq\text{STATE}))(\lambda y\lambda\pi_2.\ \text{freeze'}(e,x,y,\pi_2 * \text{ARG}_1^{freeze}\text{:BECOME} * \text{ARG}_1^{\Psi}\text{:}$
$\text{TY}^{PS}(\Psi)) \wedge \text{result'}(s,e,\pi_2 * \text{ARG}_1^{result}\text{:FROZEN})))]$
$(\lambda P\lambda\pi'\exists!c.\ \text{score'}(c,\pi' * \text{ARG}_1^{score}\text{:STATE}) \wedge P(\pi')(c)) =$
$\lambda\Phi\lambda e\lambda\pi\exists s.\ \Phi(\pi)(\lambda x\lambda\pi_1\exists!c.\ \text{score'}(c,\pi_1) \wedge \text{freeze'}(e,x,c,\pi_1$
$* \text{ARG}_1^{freeze}\text{:BECOME} * \text{ARG}_1^{score}\text{:STATE} * \text{ARG}_3^{freeze}\text{:TRANSITION}-\tau\rho(\text{SCORE})) \wedge$
$\text{result'}(s,e,\pi_1 * \text{ARG}_1^{result}\text{:FROZEN}))$

b. **Coercion functor**:
$\lambda P\lambda z\lambda\pi'\exists e_1\text{:}\tau\rho(\text{SCORE}).\ P(\pi')(e_1) \wedge \phi_{\tau\rho(score)}(e_1,...,z,\pi')$

c. **Local conflict resolution via coercion functor**:
$\lambda\Phi\lambda e\lambda\pi\exists s\exists e_1\text{:}\tau\rho(\text{SCORE}).\ \Phi(\pi)(\lambda x\lambda\pi_1\exists!c.\ \text{score'}(c,\pi_1) \wedge \text{freeze'}(e,x,e_1,\pi_1$
$* \text{ARG}_1^{freeze}\text{:BECOME} * \text{ARG}_1^{score}\text{:STATE} * \text{ARG}_3^{freeze}\text{:TRANSITION}-\tau\rho(\text{SCORE})) \wedge$
$\text{result'}(s,e,\pi_1 * \text{ARG}_1^{result}\text{:FROZEN}) \wedge \phi_{\tau\rho(score)}(e_1,...,c,\pi_1))$

d. **⟦den Punktestand einfrieren⟧(⟦der Organisator⟧)**=
$\lambda e\lambda\pi\exists!o\exists!c\exists s\exists e_1\text{:}\tau\rho(\text{SCORE}).\ \text{organizer'}(o,\pi) \wedge \text{score'}(c,\pi) \wedge \text{freeze'}(e,o,e_1,\pi$
$* \text{ARG}_1^{freeze}\text{:BECOME} * \text{ARG}_1^{score}\text{:STATE} * \text{ARG}_3^{freeze}\text{:TRANSITION}-\tau\rho(\text{SCORE})) \wedge$
$\text{result'}(s,e,\pi * \text{ARG}_1^{result}\text{:FROZEN}) \wedge \phi_{\tau\rho(score)}(e_1,...,c,\pi)$

e. **Existential closure of *e* and binding presuppositions**:
$\lambda\pi\exists!o\ \exists!c\text{:STATE}\exists e\text{:BECOME}\exists s\text{:FROZEN}\exists e_1\text{:}\tau\rho(\text{SCORE}).\ \text{organizer'}(o,\pi) \wedge$
$\text{score'}(c,\pi) \wedge \text{freeze'}(e,o,e_1,\pi) \wedge \text{result'}(s,e,\pi) \wedge \phi_{\tau\rho(score)}(e_1,...,c,\pi)$

In (34e), we give the final meaning representation for (32). There is exactly one o, exactly one c of type STATE, an e of type BECOME, an s of type FROZEN and an e_1 of a TRANSITION type depending on scores such that the organizer o freezes an underspecified transition e_1 that is related to the score c and the FROZEN type state s is the result of e. The underspecified transition predicate $\phi_{\tau\rho(score)}$ is still to be specified. The specification of this predicate hinges on contextual information, but is restricted to transitions that have scores as an argument. One specification for this transition could be an increase in the scores.

4. An integrated lexical semantics for physical and abstract readings

So far, we have developed two separate lexical entries for the physical and the abstract readings. In this section, we will discuss the pros and cons of a unified lexical semantics for both readings of *einfrieren* and make a proposal for its implementation in TCL.

The discreteness of the two readings seems to be a good reason to argue for two independent

be stipulated, i.e. the relevant type information from the π-parameter in the complement quantifier's restrictor has to be copied into the nuclear scope, where it can be adapted locally. In order to anchor this operation lexically and avoid a pure stipulation, we use the type function $\text{ARG}_1^{\Psi}\text{:ARG}^{PS}(\Psi)$ in our lexical entries, which systematically transfers the relevant type information to the right place and thus designates the coercion as local. This method gains additional support from the fact that there are coercion phenomena where the operation is not local and has to be lexically designated as global (Bücking and Buscher, 2015).

lexical entries for *einfrieren*: physical freezing means lowering the temperature and abstract freezing means interrupting an ongoing event. More precisely, we have observed that the two readings bring about different result states and belong to different aspectual classes. Whereas physical *einfrieren* is an accomplishment, abstract *einfrieren* patterns with achievements. With this in mind, the assumption of two independent lexical entries has some initial motivation. However, postulating two independent lexical entries for *einfrieren* would miss the conceptual relation between the two readings. Physical and abstract *einfrieren* share the conceptual core PRESERVED. This component represents the conceptual bridge that allows for the transfer from the physical domain to the abstract domain. Furthermore, this kind of ambiguity between physical and abstract change of state events is very systematic. We have seen that the ambiguity occurs with different CoS verbs, too. Moreover, it is parallel across languages; cf. Spanish *congelar*, English *freeze*, French *geler* and Polish *zamrażać/zamrozić*, to name just the languages we have intuitions for. We would disregard a systematic lexical pattern if we considered the ambiguity to be a case of homonymy. We take these observations to be arguments enough for a unified lexical semantics for both readings of *einfrieren*. This lexical entry has to be semantically adaptable to different types of argument input. The combination of the lexical semantics of the verb with the semantics of the complement will tell us which inferences to draw in each case.

Our proposal for a unified semantics of the CoS verb *einfrieren* builds on the common assumption that CoS verbs have the underlying class-specific lexical template BECOME and differ in the idiosyncratic result state.[13] The unified lexical semantics for *einfrieren* is given in (35). It uses both a coercion and an underspecification mechanism. The two mechanisms have a lexical anchor in the internal semantics of *einfrieren*. Underspecification accounts for the dichotomy between physical and abstract readings, and we model it as a dependent type. Dependent types are complex types that are already envisaged within TCL. A type qualifies as a dependent type if it has another type as its parameter. We use a dependent FROZEN-type with the complement's type as its parameter for the result state of *einfrieren*. This means that the actual type of the result state is assigned only upon combination with the complement. The type assignment is driven by the general type FROZEN in (35b). If the parameter is a physical object, FROZEN will be specified to the tripartite type SOLID $\wedge$ TEMP<0 $\wedge$ PRESERVED. If the parameter is a transition, the general type FROZEN yields a specification to PRESERVED. These two parameter types are the only types that are lexically licensed. This is provided for by the type presupposition on the complement. It allows exclusively physical objects or transitions.

The combinatorial peculiarities we identified in the abstract reading are modelled along the lines proposed for coercion in Asher (2011). The lexical entry features a polymorphic type for the complement position. This polymorphic type comes into play in well-defined cases. If the overt complement does not justify the selectional restriction, the compositional conflict can be repaired if the overt argument is a state. The polymorphic type then licenses the interpolation of a TRANSITION type argument. This newly introduced argument justifies the selected TRANSITION type in the complement position. The coercion operation is lexically determined to be local and non-destructive, i.e. the conflict resolution does not change the type of the complement DP itself.

[13] We represent the CoS via the type BECOME for the referential argument. BECOME is underspecified with regard to the exact aspectual class; see Dowty (1979).

(35) a. ⟦einfrieren⟧ =
$\lambda\Psi\lambda\Phi\lambda e\lambda\pi\exists s.\ \Phi(\pi)(\lambda x\lambda\pi_1.\ \Psi(\pi_1{*}\mathrm{ARG}_3^{freeze}{:}\mathrm{P}\vee\mathrm{TRANSITION}{-}\tau\rho(\mathrm{HD}(\Psi)\sqsubseteq \mathrm{STATE}))(\lambda y\lambda\pi_2.\ \mathrm{freeze'}(e,x,y,\pi_2{*}\mathrm{ARG}_1^{freeze}\mathrm{BECOME}{*}\mathrm{ARG}_1^{\Psi}{:}\mathrm{TY}^{PS}(\Psi))\wedge \mathrm{result'}(s,e,\pi_2{*}\mathrm{ARG}_1^{result}{:}\mathrm{FROZEN}(\mathrm{ARG}_3^{freeze}))))$

b. General type FROZEN:
$(\mathrm{P}\Rightarrow\mathrm{SOLID}\wedge\mathrm{TEMP}<0\wedge\mathrm{PRESERVED})\vee(\mathrm{TRANSITION}\Rightarrow\mathrm{PRESERVED})$

The difference between underspecification and coercion is visible on the type level, i.e. in the internal semantics. Underspecification is modelled as a dependent type and coercion as a polymorphic type. Whereas dependent types are types of some variable that is already present in the representation and whose specification hinges on the type of their parameter, polymorphic types are types of a variable that has to be interpolated depending on the parameter in order to satisfy the selectional restrictions of the functor featuring the polymorphic type. With this formal representation of underspecification and coercion, we mirror well-established conceptions of these two mechanisms. Other authors (Piñango and Deo, 2016; Egg, 2003; Dölling, 2003) understand underspecification as a semantically foreseen slot for contextual enrichment. In our account, dependent types do the same job on the type level: they systematically provide a semantic slot for contextual specification. The advantage of using dependent types is that we do not introduce variables that might end up being reduced to the identity function. Coercion is commonly understood as a repair mechanism for combinatorial conflicts that results in the introduction of a new variable only if it is necessary; cf. Pustejovsky (1995), de Swart (2011) and Asher (2011). Our TCL-style coercion functor fulfils the same task. However, none of the cited accounts treats these two mechanisms as measures to model different sorts of phenomena. They are usually treated as mutually exclusive alternatives. Our account integrates these two mechanisms into one system and does it on linguistically well-established grounds.

5. Summary

We have presented a case study of a wide-spread phenomenon in predication that shows that combinatorial adaptability is almost ubiquitous. With this case study, we have illustrated that even the most mundane composition requires both underspecification and coercion. In our account, underspecification is modelled in terms of a dependent type that receives a specification upon the combination of functor and argument,[14] whereas coercion is modelled in terms of a polymorphic type that resolves compositional conflicts by introducing an additional variable.

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[14]Other approaches have discussed similar ideas under the label co-composition; cf. Pustejovsky (1995) and Asher et al. (2017).

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Degrees as nominalized properties: Evidence from differential verbal comparatives in Mandarin Chinese[1]

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Abstract. Whether degrees should be modeled as simple semantic primitives or ontologically complex entities has been an issue in recent formal semantic research. This article aims to make a contribution to this scholarly enterprise by investigating the Differential Verbal Comparative (DVC) construction in Chinese. DVCs exhibit peculiar properties : (i) obligatory differentials, and (ii) DPs as differentials(e.g., *liang ben xiaoshuo* 'two CL novel'). We propose that a degree is the entity correlate of a property that is formed on the basis of a measure, akin to Chierchia-style kind. This new kind of degree, coupled with a difference function-based semantics for comparatives, correctly predicts the behaviors of DVCs which would otherwise remain formally inscrutable. This article's contributions are twofold: (i) it provides direct support for the degree-as-kind analysis by extending its empirical scope; and (ii) by combining degrees as kinds with a difference function-based semantics, it represents an improvement over the previous degree-as-kind analysis based on linear ordering.

Keywords: comparatives, degrees, kinds, Mandarin Chinese, differential verbal comparatives.

1. Introduction

Over the past several decades, there has been a significant amount of discussion on what exactly degrees are. Approaches to this question roughly fall within two schools, which bear distinct (though not completely incompatible) consequences for the semantics of comparatives.:

(1) Two approaches to degrees: *primitive* vs. *complex*

(i) The *standard* approach: Degrees are semantic primitives formalized as points or intervals on an abstract scale, akin to real numbers (cf., Seuren, 1973; von Stechow, 1984; Heim, 1985; Kennedy, 1999; Schwarzschild and Wilkinson, 2002; Kennedy and McNally, 2005; Kennedy, 2007; Beck, 2012);

(ii) The *not-so-standard* approach: Degrees are not semantic primitives, but rather ontologically complex entities. Research within this approach treats degrees as equivalence classes (Cresswell, 1976), as tropes (Moltmann, 2009), oras kinds (Anderson and Morzycki, 2015; Scontras, 2017). The interested reader can also refer to Grosu and Landman (1998) and Castroviejo and Schwager (2008) for relevant discussion.

There are many unresolved issues on this topic. For example, do all comparatives make use of the same kind of degree?If not, is it possible for some comparative constructions to make

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use of degrees as points, while other comparative constructions make use of degrees as kinds? Is there any empirical evidence for the degree-as-kind vs. degree-as-point dichotomy? If so, what regulates between them?

These issues get more complicated in the face of data from Mandarin Chinese. Recently, one case of within-language variation among comparative constructions in Mandarin Chinese has been identified and intensively studied: comparative constructions making use of degree ordering along some scale vs. comparative constructions making use of direct comparison of two sets of individuals with no reference to, or mediation by, degrees. While comparative constructions such as the *bi* adjectival comparative (AC) and the transitive comparative have been argued to represent the first comparison strategy (Xiang, 2005; Lin, 2009; Grano and Kennedy, 2012), Li (2009, 2015a) takes the differential verbal comparatives (DVCs) in Mandarin Chinese to exemplify what she calls "degreeless comparison", which in her analysisinvolves one-to-one mapping between two sets of individuals. The degree-based comparison vs. degreeless comparison is exemplified by the examples in (1)-(2), respectively:

(2) Degree-based comparatives: *bi* adjectival comparatives (ACs)
Zhangsan bi Lisi gao (san gongfen).
Zhangsan BI Lisi tall (three centimeters)[2]
'Zhangsan is (three centimeters) taller than Lisi.' Lin (2009); Grano and Kennedy (2012)

(3) Degreeless comparatives: differential verbal comparatives (DVCs)
Zhangsan bi Lisi duo du-le *(liang ben xiaoshuo).
Zhangsan BI Lisi DUO read-ASP two CL novels
'Zhangsan's reading exceeded Li's reading by two novels.' Li (2015)

DVCs () differ from ACs in two respects: (i) differentials in DVCs are obligatory, while differentials in ACs are optional, and (ii) differentials in DVCs can take the form of DP, e.g., *liang ben xiashuo* 'two CL novels', while differentials in ACs can only be measure phrases (MPs), e.g., *san gongfen* 'three centimeters'. These two peculiarities of DVCs stand out and challenge the standard semantics of degrees and DPs.

This article aims to offer a motivated explanation for the seemingly inscrutable properties of DVCs: Why do DVCs allow DP-like differentials? Why are differentials obligatory in DVCs? Setting in a broader cross-linguistic context, we note that DPs -- and their close cousins, relatives clauses (RCs) -- denoting degrees are widely attested across languages. In light of recent studies on gradability and comparison (especially Anderson and Morzycki, 2015; Scontras, 2017), we motivate an analysis that treats degrees as equivalence classes (Cresswell, 1976), or Chierchia-style quantity- and quality-uniform properties (Chierchia, 1998; McNally, 2001; Scontras, 2017). However, adopting a degree-as-kind analysis does not tackle all the problems raised by DVCs. One standing issue has to do with the semantic composition: since kinds, unlike points, are not linearly ordered, the compositionality becomes a non-trivial issue in this degree-as-kind analysis. To fix this problem, we take a *revisionist* strategy.On the one

[2] Abbreviations are as follows: ASP: aspectual markers; BI: *bi* (a marker to introduce the standard of comparison); CL: classifiers; DE: modification marker *de;* DEM: demonstratives; DUO: *duo*. To eliminate controversy, in this article, we gloss *duo* simply as DUO, although it has been glossed either as 'more' or 'many/much' in the literature.

hand,e follow the most recent works such as Anderson and Morzycki (2015) to treat degrees as kinds. On the other hand, we discard their semantics for comparatives based on linear ordering. Instead, we adopt a difference function-based semantics for comparatives. We demonstrate that this new semantics that combines degree-as-kind with difference functions not only correctly predicts the behaviors of DVC sentences, but desirably circumvents the problems faced by Anderson and Morzycki (2015).

2. Differential Verbal Comparatives in Mandarin Chinese

A typical DVC sentence comprises four components: (i) a target of comparison (DP_1), (ii) an optional standard-of-comparison phrase introduced by the morpheme *bi* ([*bi* DP_2]), (iii) a verb introduced by *duo* or *shao*, and (iv) an obligatory differential phrase, as exemplified by *liang-ben xiaoshuo* 'two CL novels' in (4b).

(4) a. DP_1 (*bi* DP_2) *duo/shao* V *(differential phrase)
b. Zhangsan bi Lisi duo du-le liang ben xiaoshuo
Zhangsan BI Lisi DUO read-ASP two CL novel
'Zhangsan read two more novels than Lisi did.'

At least three features merit further discussion. First, although as shown in (4b), some DVC sentences can be translated into amount comparatives in English,[3] DVCs and amount comparatives are by no means alike. Suppose, for instance, both Zhangsan and Lisi went for shopping, Zhangsan bought one cellphone and one Surface Pro, Lisi only bought one Surface Pro. The following sentence in (5), taking the form of DVC, can be felicitously used to describe this situation, while the same situation cannot be felicitously expressed by amount comparative in English::

(5) a. Situation: Zhangsan bought a cellphone and a Surface Pro, Lisi only bought a Surface Pro:
b. Zhangsan bi Lisi duo mai-le shouji.
Zhangsan BI Lisi DUO buy-ASP cellphone
✓ 'Zhangsan bought one more thing than Lisi, which is cellphone.'
× 'Zhangsan bought more cellphone than Lisi.'

Second, besides regularMPs such as *san mi* 'three meters', *san gongjin* 'three kilos', differential phrases in DVCs can take almost all forms of DPs: an indefinite DP, a kind-denoting term (realized as bare nouns in Chinese), and even a proper name, as illustrated by (6a-c), respectively:

(6) a. *Differential phrase = indefinite DP:*
Zhangsan bi Lisi duo du-le liang ben xiaoshuo
Zhangsan BI Lisi DUO read-ASP two CL novel
'Zhangsan read two more novels than Lisi did.'
b. *Differential phrase = kind-denoting term:*
Zhangsan bi Lisi duo mai-le shouji.
Zhangsan BI Lisi DUO buy-ASP cellphone

[3] For more about amount comparatives, see Morzycki 2016 (Ch. 6) and references therein.

'Zhangsan bought one more thing than Lisi, which was a cellphone.'
c. *Differential phrase = proper name:*
Zhangsan bi Lisi duo qu-le New York.
Zhangsan BI Lisi DUO go-ASP New York
'Zhangsan went one more place than Lisi, which was New York.'

By contrast, for ACs, differential phrases can only take the form of MP:

(7) Zhangsan bi Lisi gao {liang limi / *liang ben shu}..
Zhangsan BI Lisi tall two centimeters/ two CL books
'Zhangsan is {two centimeters/*two books} taller than Lisi.' Li (2015)

Third, as pointed out by Li (2015a), unlike *bi* ACs, differentials in DVCs are obligatory.

The differences between DVCs andACs can be summarized as follows:

Table 1: A variation between comparatives in Chinese: DVCs vs. ACs

	Standard marker	Predicates of comparison	Obligatory differentials	MP differential s	DP differentials
ACs	*bi*	Gradable adjectives	-	+	–
DVCs	*bi*	*Duo/shao* + V	+	+	+

Obviously, DVCs pose non-trivial challenges for both the standard semantics of degrees (as points on a scale) and DPs (presumably referring to mere individuals). Here is a *Comparative Puzzle* in Chinese:

(8) *A Comparative Puzzle*
(i) If both DVCs and ACs are comparisons of degrees, then we are forced to accept the conclusion that DPs have the same denotations as MPs, i.e., both refer to degrees, contracting the standard view that DPs refer to individuals.
(ii) If DVCs are fundamentally different from ACs, then we miss a unified account of comparatives, and we are unable to explain the commonalities between them, for example, why both take the comparative form and involve the same standard marker *bi*.

In the literature, Li (2009, 2015a) is the first serious attempt to provide a detailed empirical description and semantic analysis of DVCs. Before presenting our account, a critical reviewof her analysis is in order.

3. The previous analysis

3.1 Li's (2015) mapping-based account of DVCs

Li's analysis of DVCs is largely based on two assumptions: (i) when the verb following *duo/shao* is transitive or di-transitive, the differential DP in the DVC sentence is individual-denoting DP, which presumably does not denote a degree; and (ii) different from (direct or indirect) comparison of degrees, comparison of two sets of individuals calls for mapping between two sets, rather than degree ordering.[4] According to this analysis, the predication of the verb on the subject (DP_1) yields a set A, and the predication of the verb on the standard-of-comparison phrase (DP_2) yields another set B. *Duo* establishes a mapping relation whereby every element in set B is paired with a unique and different element in set A. The differential DP denotes the subset of set A whose elements are left unpaired with those in set B. Formally, Li defines the semantics of *duo* as in (9a), where "○" is an overlap relation.

(9) a. $[\![\text{duo}_f]\!]^g =$

$$\lambda P_{<e,<et>>}\lambda k_e \lambda y_e \lambda x_e.\forall z_e[P(z)(y)\rightarrow \exists t_e[t=g(f)(z)\wedge \text{PROPER}(g(f))\wedge P(t)(x)\wedge P(k)(x)\wedge\neg t\circ k]]$$

b. PROPER is a function (of type <<e,e>,t>) which is true of g(*f*) iff g(*f*) preserves the taxonomic level introduced by the differential phrase.

The definition of *duo* in the DVC construction requires four semantic arguments: (i) a two-place predicate *P* corresponding to the verb V in (4a), (ii) an individual *k* corresponding to the differential phrase, (iii) an individual *y* corresponding to DP_2, and (iv) an individual *x* corresponding to DP_1. The function *f* in the definition is a mapping function, whose value is assigned by the assignment function *g*. This definition involves a mapping between two sets of individuals to which DP_1 and DP_2 relate by way of the predication as specified by V. It identifies the difference between the two sets with the denotation of the differential phrase. In addition, Li's analysis requires, by way of a PROPER function as defined in (9b), that all the individuals under mapping be of the same taxonomic sort/level. The taxonomic information is specified by the differential phrase.

The LF structure that Li assumes for the above semantics of *duo* is given in (10) (Li (2015a): Ex. (48)). On this account, the morpheme *bi* projects a PP, and it is semantically vacuous. The standard-of-comparison phrase is a simple PP complement. It does not have any clausal syntactic structure, and does not denote a degree argument. The semantic interpretation of the sentence is spelled out in (11). It states that for each novel read by Lisi, Zhangsan read a matching copy, and that there are two novels that Zhangsan read but for which Lisi did not read matching copies.

(10) $[_S$ [liang ben xiaoshuo $[_S$ λi $[_{VP}$ $[_{DP}$ Zhangsan] $[_{VP}$ $[_{PP}$ bi Lisi] $[_{VP}$ $[_V$ duo du-le] t_i]…

(11) $[\![$*Zhangsan bi Lisi duo du-le liang ben xiaoshuo*$]\!]$

$$= \exists x_e[\text{novel}(x)\wedge \#x\geq 2\wedge \forall z_e[\text{read}(z)(\text{Lisi}) \rightarrow \exists t_e[t=g(f)(z)\wedge \text{PROPER}(g(f))\wedge \text{read}(t)(\text{Zhangsan})\wedge \text{read}(x)(\text{Zhangsan})\wedge\neg t\circ x]]]$$

Li (2009, 2015a) claims that compared to a degree semantic account, her degreeless, mapping-based approach to the DVC construction fares better in accommodating important differences observed between the *bi* ACs and the DVC. First, as shown above, *duo* and *shao* are the only two elements that can be used right before a verb to form a DVC sentence, and other gradable adjectives or adverbs cannot ((12), repeated from 63(a-b) in Li (2015a)). Li's

[4] Li (2009, 2015a) takes *duo* to be ambiguous depending upon the argument structure of the verb and, relatedly, the lexical category of the differential phrase. For the sake of simplicity, our primary focus in this paper is on cases where the verb following *duo/shao* is a transitive verb and where the differential phrase is not a measure phrase or factor phrase.

explanation is that gradable adjectives and adverbs like *kuai* 'fast' and *renzhen* 'attentively' are standardly analyzed to involve relations between individuals and degrees. She argues that the difference in semantic type disallowss gradable predicates other than *duo* and *shao* in the DVC construction.

(12) a. *Zhangsan bi Lisi kuai pao-le liang gongli.
Zhangsan BI Lisi fast run-ASP two kilometer
b. *Zhangsan bi Lisi renzhen du-le liang ben shu.
Zhanagsan BI Lisi attentively read-ASP two CL books

Second, recall that a differential phrase is required in a DVC sentence, whereas it is optional in a *bi* AC sentence. On Li's mapping-based account, in addition to denoting the relevant difference, the differential phrase is needed in the DVC so as to mark the taxonomic sort/level whereby mapping is done. According to Li's analysis, without a differential phrase, mapping would be random and baseless. For degree comparison, the dimension along which comparison is performed comes from the gradable predicate, and no separate taxonomic information is required for the comparison to be meaningful.

3.2 Problems with Li's degreeless analysis

Li's analysis is motivated by two assumptions: (i) differential DPs DVCs are semantically akin to genuine individual-denoting DPs occurring in non-comparative contexts; (ii) DPs do not denote degrees. We demonstrate that both of the assumptions are challenged by empirical data.

Differential DPs in DVCs are by no means like DPs in non-comparative contexts. Evidence comes from two observations: (a) pronominalization: a differential DP in a DVC sentence cannot be referred back to by individual-denoting pronouns or empty categories, but can be referred back to by a degree/kind anaphor; (b) topicalization: differential DPs in DVCs cannot be topicalized, unlike genuine individual-denoting DPs in non-comparative contexts. Given these two empirical observations, Li's evidence for treating differential DPs as individual-denoting does not warrant the conclusion that she intends for.

First, if differential DPs in DVC sentences have exactly the same semantics as genuine individual-denoting DPs occurring in non-comparative contexts, we should expect that they can be referred back to by pronouns or empty categories. This prediction is not borne out: (13) is at best marginally acceptable and stands in stark contrast with the perfectly acceptable sentence in (14).

(13) a. Zhangsan bi Lisi duo du-le [liang ben xiaoshuo]$_i$.
Zhangsan BI Lisi DUO read-ASP two CL novel
??/* [Tamen/*e*]$_i$ dou hen haokan.
they/e DOU very interesting
Intended: 'Zhangsan read [two more novels]$_i$ than Lisi did. They$_i$ are both very interesting.'
b. Zhangsan bi Lisi duo du-le [liang ben xiaoshuo]$_i$.

Zhangsan BI Lisi DUO read-ASP two CL novel
??/*Wangwu ye duo du-le [tamen]$_i$.
Wangwu also DUO read-ASP them
Intended: 'Zhangsan read two more novels than Lisi did. And Wangwu read them, too.'

(14) Zhangsan jintian mai-le [liang ben xiaoshuo]$_i$.
Zhangsan today buy-ASP two CL novel
[Tamen/*e*]$_i$ dou hen haokan
they/e DOU very interesting
'Zhangsan bought [two novels]$_i$ today. They$_i$ are very interesting.'

By contrast, degree anaphors like *zheme* "such (this)" and *na'me* "such (that)" can be used to refer to differential DPs in DVC sentences.

(15) Zhangsan bi Lisi duo du-le [liang ben xiaoshuo]$_i$.
Zhangsan BI Lisi DUO read-ASP two CL novel
Wangwu ye duo du-le [na'me$_i$ duo].
Wangwu also DUO read-ASP that many
'Zhangsan read two more novels than Lisi did. Wangwu read these two novels more/that many more, too.'

Second, topicalization provides another compelling piece of evidence that differential DPs in DVCs are not individual-denoting. It has been widely accepted that topics in Mandarin Chinese are subject to a definiteness constraint (Chao, 1968; Li and Thompson, 1981). When this constraint is met, a DP can be topicalized, as shown in (16) below:

(16) a. Zhangsan du-le *Jane Eyre*.
Zhangsan read-ASP *Jane Eyre*
b. [$_{\text{Topic}}$ *Jane Eyre*], Zhangsan du-le *e*.

If differential DPs in DVCs were indeed parallel to DPs in non-comparative contexts, then they should be able to be topicalized, provided that the definiteness constraint is satisfied. This prediction is not borne out, again. Even when differential DPs in DVC sentences take the form of proper names or demonstrative phrases, they normally cannot be topicalized:.

(17) a. Zhangsan bi Lisi duo du-le zhe ben xiaoshuo.
Zhangsan BI Lisi DUO read-ASP Dem CL novel
b. */?? [$_{\text{Topic}}$ Zhe ben xiaoshuo], Zhangsan bi Lisi duo du-le *e*.

As a further note, genuine degree expressions cannot be topicalized in Mandarin Chinese:

(18) a. Zhangsan bi Lisi gao liang limi.
Zhangsan BI Lisi tall two centimeters
'Zhangsan is taller than Lisi by 2 centimeters.'
b. *Liang limi, Zhangsan bi Lisi gao.

Based on the above evidence, we postitulate that differential DPs in DVC sentences still involve degrees, not individuals alone. (19) below is another natural example demonstrating that differential DPs in DVC sentences denote degrees. In the context of talking about paper product consumption, (19) can be understood to mean that paper consumption in America exceeds that in China by the amount of xylem fiber worth of the forest in question can produce, not the physical forest itself.

(19) Meiguo yi nian yao bi zhongguo duo xiaohao yan-qian zhe pian senlin.
US one year will BI China DUO consume eye-before this CL forest
'The US will consume the-forest-before-us-worth more (paper) than China in one year.

Our observation that differential DPs in DVC sentences involve degree semantics actually reconfirmations the long-held view that DPs can have a degree component. Grosu and Landman (1998: 132) cites the English example in (20) (originally due to Heim (1987)) whose most natural reading is about drinking the same amount of champagne as was spilled, though one can imagine a stretched situation in which people, like curly dogs, are licking up the ground.

(20) It will take us the rest of our lives to drink [$_{DP}$ the champagne that they spilled that evening].

Furthermore, degree-denoting DPs are widely attested in many languages, most of them are typologically unrelated to Mandarin Chinese. Rett (2014) reports a number of cases in English in which DPs denote degrees, not individuals (21) (see also Cresswell, 1976). The Romanian example (22), repeated from Rett's (15) (due to Grosu (2009)), illustrates the same pattern. According to Grosu, the gap associated with the *wh*-phrase *cât* "is the internal argument of a predicate that selects degrees (on a scale that the predicate specifies)". Degree-denoting DPs are also found in Hindi-Urdu, which employs a correlative (which takes the form of a DP) to convey comparison between two degrees. (23) is from Bhatt and Takahashi (2011: 593). Degree-denoting DPs taking the form of relative clauses are also attested in Japanese, a language geographically close but genetically unrelated to Mandarin Chinese. According to Sudo (2015), the complement of *yori* in (24) should be analyzed as a relative clause headed by a covert element that denotes a degree.

(21) English (Rett 2014)
a. Four pizzas is more than we need. [degree interpretation]
b. Many guests is several more than Bill anticipated. [degree interpretation]

(22) Romanian (Grosu 2009)
(Cele) nouă kilograme cât cântăreste bagajul tău de mână nu
DEM nine kilos how-much weighs luggage-the your of hand not
te vor împiedica să te urci in avion
you will-PL prevent SUBJ REFL climb-1SG in plane
'[$_{DP}$ (The) nine kilos that your handbag weighs] won't prevent you from boarding the plane.'

(23) Hindu-Urdu (Bhatt and Takahashi 2011)

[Pim-ne kal jitnii kitaabe parh-i:] [Tina-ne aaj
Pim-Erg yesterday how.many.f books.f read-Pfv. FPl Tina-Erg today
us-se zyaadaa kitaabe parh-i:].
that-than more books read-Pfv.FPl
Lit.: 'How many books Pim read yesterday, Tina read more books than **that** today.'

(24) Japanese (Sudo 2015)
John-wa [[Bill-ga katta]-yori] takusan hon-o katta
John-top Bill-nom bought-than many book-acc bought
'John bought more books than the amount of books that Bill bought.'

In this section, we have demonstrated that the assumptions motivating Li's degreeless analysis of DVCs are unwarranted. Nextwe will provide an account that takes degrees to be individual correlates of properties (i.e., nominalized properties) to accommodate the observed facts in relation to DVCs.

4. Toward a new kind of degree

In the standard degree-based framework, degrees are "abstract representation of measurement", modeled as points along an abstract scale, akin to real numbers (Seuren, 1973; von Stechow, 1984; Schwarzschild and Wilkinson, 2002; Kennedy and McNally, 2005; Beck, 2012; Morzycki, 2016). [5] We agree with Li (2009, 2015a) that DVCs in Mandarin Chinese, which allow DPs to function as differential phrases, pose non-trivial challenges for this degree-as-point analysis. At the same time, as we have shown, Li's alternative degreeless analysis relying on the one-to-one mapping between two sets also runs into difficulty. An adequate account of the DVC facts calls for a reconsideration of the ontology of degrees.

An early alternative approach to the degree-as-point analysis can be traced back to Cresswell (1976), which places degrees in the model, but does not treat them as primitives. Cresswell analyzes the plural count noun *men* as at times denoting "x is a set of men" and at other times denoting "x is a y-membered set of men", where y is a variable over cardinalities (pp. 277-278). He defines degrees as equivalence classes, viz., groups of individuals that are the same with respect to some measure (a particular gradable property) such as weight and height. (p. 281). *180 centimeters*, for instance, is the class of pairs of a world *w* and an individual *x* such that individual *x* is 180 centimeters tall in world *w* (Castroviejo and Schwager, 2008).

Cresswell's seminal idea ushered in an approach that adopts a richer ontology of degrees. For example, Grosu and Landman (1998) treat degrees as tuples of an individual, a property, and a measure, Moltmann (2009) takes degrees to be tropes, Anderson and Morzycki (2015) argue for a deep connection between degrees and kinds. Most recently, Scontras (2017) studies the degree noun *amount* in English and proposes that a degree is an individual correlate of a property that is formed on the basis of some measure. Consider:

(25) a. I ate that amount of apples every day for a year.

[5] An alternative view is to taking degrees as intervals (Wilkinson and Schwarzschild 2002). It should be noted that taking degrees as intervals does not circumvent the challenges posed by DVCs, since both degree-as-point analysis and degree-as-interval analysis are based on the notion of cardinality (Kennedy 2007, 2009).

b. I ate the amount of apples that you ate.
c. I want the amount of apples that Bill received.

In (25a), it is weird that the speaker eats the same apples each day. Similarly, for (25b), it is highly unlikely that the speaker and the addressee eat the same apples. In (25c) *the amount of apples* refers to some abstract amount, say, 3 kilos of apples.. It is clear that in these existential interpretations, there are two semantic components: an abstract amount/measure, and the objects that instantiate the amount/measure.

Exactly the same pattern is observed for DPs in Chinese. Depending on predicate types, DPs are open to different interpretations. In (26a), *san men ke* '3 CL course' refers to a set of courses, whose cardinality is three. In (26b), *san men ke* '3 CL course' is used as a differential in a DVC construction, which receives an existential interpretation, just like *amount* does in (25).

(26) a. Zhangsan xuan-le san men ke.
Zhangsan take-ASP three CL course
'Zhangsan took three courses.'
b. Zhangsan bi Lisi duo xuan-le *(san men ke).
Zhangsan BI Lisi DUO take-ASP three CL course
'Zhangsan took three more courses than Lisi did.'

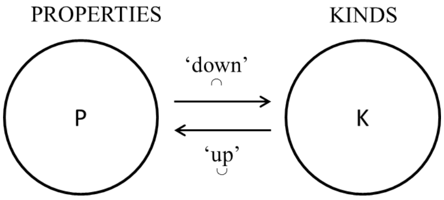
The standard knowledge of DPs is that they refer to individuals. The semantics of *san men ke*, for example, can be defined as:

(27) $[\![$*san men ke*$]\!] = \lambda x.\ \#x{=}3 \wedge {}^{*}\mathrm{course}(x)$

However, *san men ke* '3 CL course' in (26b) does not merely refer to individual courses: it cannot be referred back to by pronouns; nor can it be topicalized. At the same time, *san men ke* in (26b) does not refer to mere numbers (i.e., cardinality), either, because (26b) does not mean there is a set of numbers that Zhangsan took but Lisi didn't take. On the contrary, *san men ke* is a "combination" of both the measure and individuals: the speaker specifies a cardinality/measure, which is instantiated by courses. Treating it either as mere individuals or mere numbers would yield the wrong result.

Breaking away from the standard degree-as-point analysis, Scontras (2017) treats degrees as nominalizations of quantity-uniform properties. That is, degrees reference both abstract representation of measurement and the objects that instantiate that measurement. In short, degrees are entity correlates of properties (McNally 2009). Scontras employs the conceptual machinery of "properties" and "kinds" in Chierchia's (1998) to flesh out this idea. Chierchia posits that all first order properties have counterparts in the entity domain such that for any natural property, like the property of being a dog, there corresponds a kind, viz. the dog kind. He defines two semantic operations which relate properties to their entity correlates, and vice versa. The first one is the nominalization process which derives kinds from properties via the "down" operator $^{\cap}$, and the second one, the predicativization process, operates in the opposite direction, which retrieves properties from kinds via the "up" operator $^{\cup}$. The semantics for these two operators are repeated as below (Chierchia 1998: 349):

(28)



where properties are of type <s, <e, t>> and kinds of type e
Example: ${}^{\cap}$PANDA=k ${}^{\cup}$k=PANDA

Chierchia conjectures that for any atomic type, there is a kind counterpart. But what exactly is a kind? The kind PANDA consists of all possible (instantiations of) pandas (all the pandas in every possible world). More precisely, the kind is a function from a world to a (typically plural) individual consisting of all the pandas in that world. Correspondingly, to be a realization of the kind PANDA is simply to be a member of the plurality of pandas in a world. This idea echoes with what Cresswell (1976) envisions about the deep connection between individuals and degrees. For him, the degree '6 feet tall' is an equivalence class – it contains the plurality of individuals that are 6 feet tall. More specifically, we could think of '6 feet tall' as a function from a world to the plurality of 6-foot-tall individuals in that world. This is essentially a Chierchia-style kind. Intensionalizing equivalence classes, we arrive at a Chierchia-style kind:

(29) $[\![$ *6 feet man* $]\!] = {}^{\cap}\lambda x.\ \mu_f(x) = 6$ feet $\wedge$ man (x)

For every kind *k*, there is a corresponding property satisfied by all and only its realizations. ${}^{\cup}k$ is the property counterpart for a kind *k*, where ${}^{\cap}P$ is the kind corresponding to a property *P*. If *k* is a degree-kind of being 6 feet tall, then ${}^{\cup}k$ is a property of being 6 feet tall (viz. a set of individuals whose height is 6 feet).

(30) ${}^{\cup\cap}\lambda x.\ \mu_f(x) = 6$ feet $\wedge$ man (x) = $\lambda x.\ \mu_f(x) = 6$ feet $\wedge$ man (x)

For our current purposes, we adopt a simplified version of Scontras' definition of degree (Scontras 2017: 178):

(31) DEGREE := ${}^{\cap}\lambda x.\exists k[\mu_f(x)=n \wedge {}^{\cup}k(x)]$
(where k is kind, μ_f is a contextually-specified measure)

The definition in (31) treats degrees analogously to Chierchia-style kinds. Degrees are conceived of as information bundles with four coordinates $<\mu, n, k, {}^{\cup}>$: a measure realized by the measure function μ (e.g., the kilogram measure, the meter measure, etc.), a value in terms of numbers *n*, a kind *k*, and the Chierchia-style "up" ${}^{\cup}$ operator which applies to a kind and returns the property from which the kind is built. In other words, degrees are quantity- and quality-uniform properties, they reference both the abstract measure/amount and the real world objects that instantiate the measure/amount. This new *kind* of degrees as kinds promises a more motivated account of DVC facts, as to be shown in the rest of this work

5. The semantics of DVC sentences

Having settled on the semantics of degrees, the next task is to determine how this new semantics of degree enters into the semantic composition of DVC sentences to derive the correct truth conditions. This is by no means straightforward.

Anderson and Morzycki (2015) have sketched a semantics for comparatives in a degree-as-kind analysis. They assume the comparative morpheme *–er* to have the semantics in (33)

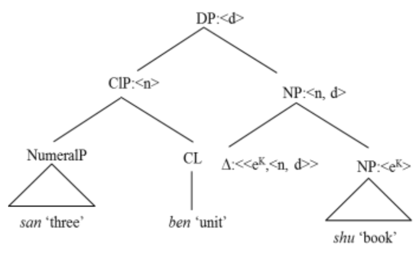
(32) a. Floyd is taller than Clyde is.
   b. $[_{\text{DegP}}$ –er $[_{\text{CP}}$ than Clyde ~~is tall~~]] [Floyd tall]

(33) $[\![\textit{–er}]\!] = \lambda k \lambda s'.\ \exists k'[^{\cup}k'(s') \wedge k' >_{s'} k]$

This semantics is conceptually problematic. Since degrees are kinds, not as real numbers along an abstract scale, it is mysterious how kinds are compared and ordered, as shown by the expression "$k' >_{s'} k$". Applying the "up" $^{\cup}$ operator to retrieve properties from kinds would not help, either, because it is the extensions of a property, not the property itself, are compared and ordered. In other words, the denotation in (33) name entities of the wrong sort. In the following, we provide a semantics for the DVC sentences that discards this semantics based on linear ordering while still conceiving of degrees as kinds.

First, look at the semantics of differential DPs. Take *san-ben shu* 'three-CL book' as an example. For its syntax, we simply assume that it is some DP-like projection. The "Num-CL" sequence *san-ben* functions as the modifier to the root noun *shu* 'book', which is a kind (type $<e^k>$). The degree reading of *san-ben shu* comes from a covert measure operator Δ (modeled after Scontras' (2017) *amount*, read as *amount* or *worth*), which connects a kind-denoting term with the measure of the instantiation of that kind. The semantic derivation proceeds as in (35).

(34)



(35) a. $[\![\textit{shu}]\!] = \texttt{book}$ $(<e^k>)$
   b. $[\![\Delta]\!] = \lambda k \lambda n \lambda d[d = {}^{\cap}\lambda x.\mu_f(x) = n \wedge {}^{\cup}k(x)]$ $(<e^k, <n, d>>)$
   c. $[\![\Delta]\!]([\![\textit{shu}]\!]) = \lambda n \lambda d[d = {}^{\cap}\lambda x.\mu_f(x) = n \wedge {}^{\cup}\texttt{book}(x)]$ $(<n, d>)$
   d. $[\![\textit{san ben}]\!]$: 3 $(<n>)$
   e. $[\![\textit{[san ben [}\Delta \textit{ shu]]}]\!] = \lambda d[d = {}^{\cap}\lambda x.\mu_f(x) = 3 \wedge {}^{\cup}\texttt{book}(x)]$ $(<d>)$
   $= {}^{\cap}\lambda x.\mu_f(x) = 3 \wedge {}^{\cup}\texttt{book}(x)$

The end result is a degree as nominalized properties. It references both the measure/cardinality (n=3) and the books that instantiate the measure.

Now consider how the differential DPs (as degree kinds) interact with the structures of DVC sentences in which they participate. To repeat one previous example:

(36) Zhangsan bi Lisi duo du-le *(san ben shu).
Zhangsan BI Lisi DUO read-ASP three CL book
'Zhangsan read three more books than Lisi did.'

Since DVC sentences are about measuring events, we adopt a Kratzerian VoiceP (Kratzer, 1996). The matrix subject *Zhangsan* start from a low, VoiceP-internal subject position. We also follow Lin (2009) to assume that *bi Lisi* is adjoined to the VoiceP. No more conceptual machinery is needed to derive the structure of (36).

The crucial part is to settle down the exact semantic of *duo* 'more'. Before proceeding, consider the following situation:

(37) Situation: John had a cup of coffee and a donut for this morning. Mary only had a cup of tea.

(38) John bi Mary duo chi-le tian-tian-quan.
John BI Mary DUO eat-ASP donut
'John's consumption exceeded Mary's by one donut.'

The scenario depicted in (37) can be felicitously expressed by (38), which means John had one more thing (i.e., a donut) than Mary did This semantics can be expressed by means of *difference*:

(39) *Difference*: A is different from B with respect to donut (x) such that A had x but B did not ⇒ In terms of what A and B had, A had x but B did not ⇒ A exceeded B by having x.

Obviously, a difference-based analysis entails the A-not-A analysis (Schwarzschild, 2008). We assume that the major semantic function of *duo* 'more' or *shao* 'less' in DVC sentences is to express the difference between two individuals *x* and *y* with respect to a certain property (or its kind counterpart *k*). In the formal literature, there have been some proposals that take comparative morphemes as difference functions (cf. Kennedy and McNally, 2005; Svenonius and Kennedy, 2006; Kennedy and Levin, 2008, among others). In standard degree-based semantics, a difference function is a measure function to measure the degree to which two objects diverge relative to a scalar dimension (Grano and Kennedy, 2012: 235-238). We extend the difference function from the domain of degrees as points to the domain of degrees as kinds. The difference function-based lexical entry of *duo* is defined in (40):

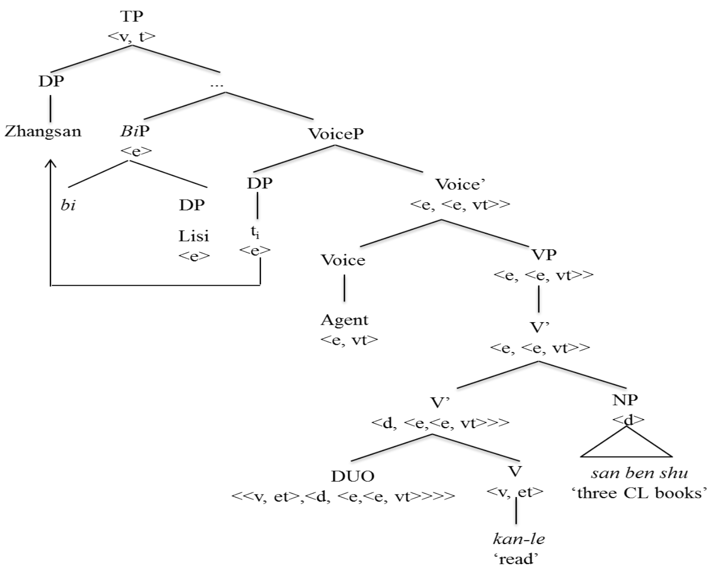
(40) $[\![duo]\!] = \lambda P_{<v,\, et>}\lambda d\lambda x_e\lambda y_e\lambda e_v.P(e)(^{\cup}d)\frac{\Box}{x}(y)$

As shown in (40), *duo* takes five arguments: a predicate P, a target of comparison y, a standard of comparison x, a degree d, and an event e. In prose, (40) states that an individual y is different from x with respect to P relative to some measure d such that y holds of P at d but x does not. Actually, this semantics entails an A-not-A analysis.

(41) $P(e)\ (^{\cup}d)\frac{\Box}{x}(y) = 1$ iff $\exists d \in D_n^{\Box}[P(e)(^{\cup}d)(y)=1 \wedge P(e)(^{\cup}d)(x)=0]$

The semantic composition DVC sentences becomes straightforward on this analysis. To illustrate, consider (42) below:

(42)



The step-by-step semantic derivation is provided as in (43):

(43) a. $[\![$*san ben shu*$]\!] = {}^{\cap}\lambda u.\mu_f(u) = 3 \wedge {}^{\cup}\mathtt{book}(u)$

b. $[\![$ *du-le*$]\!] = \lambda e\lambda z.$ **read(e)**$\wedge$**Theme**$(e) = z$

c. $[\![duo]\!] = \lambda P_{<v,\, et>}\lambda d\lambda x_e\lambda y_e\lambda e_v.P(e)(^{\cup}d)\frac{\Box}{x}(y)$

d. $[\![$ *duo du-le*$]\!] = \lambda d\lambda x_e\lambda y_e\lambda e_v.$ **read**$(e)(^{\cup}d)\frac{\Box}{x}(y)$

e. $[\![$*duo du-le san ben shu* $]\!]$

$= \lambda x_e\lambda y_e\lambda e_v.$**read** $(e)\ (^{\cup\cap}\lambda u.\mu_f(u)=3 \wedge {}^{\cup}\mathtt{book}\ (u)\ )\frac{\Box}{x}(y)$

f. $[\![$*Zhangsan bi Lisi duo du le san ben shu*$]\!]$

$= \lambda e_v.$**read** $(e)\ (^{\cup\cap}\lambda u.\mu_f(u)=3 \wedge {}^{\cup}\mathtt{book}\ (u)\ )\frac{\Box}{LS}(ZS)$

(44) $[\![$*zhangsan bi Lisi duo du le san ben shu*$]\!]=1$ iff $\exists d \in D_n^{\Box}\ [P(^{\cup}d)(ZS)=1 \wedge P(^{\cup}d)(LS)=0]$

$= \exists x[\mu_f(x)=3 \wedge {}^{\cup}\ \mathtt{book}\ (x) \wedge$ **read** $(x)(ZS) \wedge \neg$**read** $(x)(LS)]$

Overall, (44) says that "Zhangsan bi Lisi duo du-le san ben shu'' is true iff there is some instantiation x of the book kind whose cardinality is 3 such that Zhangsan read x but Lisi did not read (the same thing).Needless to say, this semantics delivers the right truth conditions.

6. Explaining the facts

The present analysis garners one immediate advantage: Since kinds can be freely turned into properties via *predicativization*, with the familiar *Derived Kind Predication (DKP)*, this analysis nicely captures the double behaviors of DPs whereby they reference individuals and reference degrees as kinds at the same time (cf., (26a) and (26b)).[6] The present analysis also answers the challenges that DVC sentences pose for the standard semantics. We have shown before that differential DPs in DVC sentences do not manifest the full range of properties associated with individual-denoting DPs. For example, differential DPs in DVC sentences cannot be referred back to by pronouns or empty categories, while they can be referred back to by the degree/kind modifier *na'me* 'that such'. To repeat one previous example:

(45) Zhangsan	bi	Lisi	duo	du-le	[liang	ben	xiaoshuo]$_i$.
Zhangsan	bi	Lisi	DUO	read-ASP	two	CL	novel
??/* [Tamen/*e*]$_i$		dou	hen	haokan.			
they/e		DOU	very	interesting			

This is expected on the present account. Differential DPs denote degrees, and degrees have a different semantics than individuals, and this is why they cannot be referred back to by pronouns/empty categories in DVC sentences. This is further entrenched by the fact they can be referred back to the degree modifier *na'me*, as shown before.

Another challenge is why differentials are obligatory in DVC sentences. According to Li (2009, 2015a), differential DPs in DVC sentences "indicate at what taxonomic level a mapping relation is established." More specifically, Li argues that certain differential DPs in DVC sentences encode taxonomic information that is necessary for the semantic computation of those sentences.She claims that this extra taxonomic requirement lends support to separating such differential DPs from degree-denoting MPs.

We agree with Li's idea that the standard degree-as-point analysis fails to capture the taxonomic information in differential DPs. But her objection should not apply to the present analysis. On the present account, degrees are quantity- and quality-uniform properties, which means they have two semantic components: besides the measure component, they have another component that contributes properties. Taxonomic information in the different DP is maintained in the present analysis. For example, *Jane Eyre he Pride and Prejudice* 'JE and PP' and *Little Women he Wuthering Heights* 'LW and WH' are two distinct pluralities and should not be confused with each other.

This idea provides a natural explanation for the obligatory status of differential DPs in DVC sentences, and relatedly, it also helps reveal what regulates between degrees as kinds and degrees as points. Consider the contrast between (46a) and (46b) below. Recall one essential

[6] Due to limitation of space, we have to leave the details aside. Interested readers can consult Chierchia (1998) for details about the shifting between individuals and kinds.

contribution of the gradable adjectives is to provide the dimension along which a scale structure is formed (Kennedy and McNally 2005). The example in (46a) is uninterpretable out of the blue. Lacking an adjective to supply a proper dimension, "three meters" in (46a) is unspecified: it is not clear what it measures (width, length, or height?).

(46) a. *Zhe zhang zhuozi san mi.
Dem CL table three meters
b. Zhe zhang zhuozi san mi chang.
Dem CL table three meters long
'This table is three meters long./ The length of this table is three meters.'

In our analysis, neither *duo/shao* nor the verbal predicate in the DVC construction provides the necessary dimension for comparison. It falls on the differential phrase to supply the dimension information necessary for the comparison to be facilitated. Take (47) for example. (47a) lacks a proper dimension and sounds unnatural. Adding the differential phrase *san gongli* 'three kilometers' would supply the dimension of *distance*, and adding *liang ge xiaoshi* 'two hours' would supply the dimension of temporal duration. When the verbal predicate is transitive, the differential phrase has the additional function of serving as the object of the verb. Therefore, like Li, we conclude that differential phrases are obligatory in DVC sentences because they provide the dimension information needed to make the comparison meaningful.

(47) a. *Zhangsan bi Lisi duo pao le.
Zhangsan BI Lisi DUO run ASP
b. Zhangsan bi Lisi duo pao-le san gongli / liang ge xiaoshi.
Zhangsan BI Lisi DUO run-ASP three kilometers / two CL hours
'Zhangsan ran three kilometers/two hours more than Lisi did.'

On the present account, differential DPs are obligatory in DVCs because they provide the sortal information needed to establish the dimensions of comparison. By contrast, in ACs, because gradable adjectives already contain the information about the dimensions for comparison, differentials become optional. The variation between ACs and DVCs can thus be reduced to how the dimensions for comparison are established, which can be ultimately couched in a theory involving some independently motivated principle of economy (cf., Chierchia's (1998) *Blocking Principle* and Kennedy's (2007) *Interpretive Economy*). We leave this topic for future research.

7. Conclusion

This article reexamines the Differential Verbal Comparative (DVC) construction in Mandarin Chinese. DVCs exhibit some peculiar properties: (i) obligatory differentials, and (ii) differentials taking the forms of DPs. Li (2015a) claims that the DVC construction is amenable to a mapping-based semantics that compares the individuals in two sets, rather than the cardinalities in two sets. This article takes issue with this degreeless, mapping-based analysis on the ground that the differential DPs in DVC sentences do not manifest the full range of properties of individual-denoting DPs in non-comparative contexts. Building on recent proposals on the ontology of degrees (Anderson and Morzycki, 2015; Scontras 2017), this article proposes that a degree is the entity correlate of a property that is formed on the basis of a measure, akin to Chierchia-style kind. We demonstrate how this new kind of degree, plus a difference-based semantics for comparatives, nicely explains a wider range of empirical data concerning DVCs and is an improvement over the previous degree-as-kind analysis such as Anderson and Morzycki (2015).

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Time in probabilistic causation: Direct vs. indirect uses of lexical causative verbs[1]

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Abstract. It is traditionally assumed that lexical causative verbs (e.g. *kill*) express direct causation only, while periphrastic (bi-clausal) causatives (e.g. *cause to die*) may also express indirect causation. In favour of this constraint, Fodor famously observed that the (change of) state introduced by lexical causative verbs is not accessible for separate adverbial modification by temporal (or manner) adverbials. In this paper, I present old and new arguments against the direct causation constraint under the definitions of directness of Fodor and Wolff. I then propose a new definition of directness in terms of *ab-initio causal sufficiency* framed in Kvart's probabilistic account of singular causation. I argue that directness so redefined is an implicature rather than an entailment of lexical causative verbs, which enables me to account for old and new data. Furthermore, I account for why the constraint on separate modification by temporal adverbials can be relaxed with eventuality-denoting subjects.

Keywords: lexical causative verbs, direct vs. indirect causation, causal sufficiency, probabilistic theories of causation, semantics/pragmatics interface.

1. The direct causation constraint

It is traditionally assumed that lexical causative verbs (e.g. *kill*) express *direct* causation only, while periphrastic (bi-clausal) causatives (e.g. *cause to die*) may also express *indirect* causation. This constraint associated to lexical causative verbs, which I will call the 'direct causation constraint', has been defended under various forms by Ruwet (1972), Levin and Rappaport Hovav (1999) and Wolff (2003) among others. In favour of this constraint, Fodor (1970) famously observed that the (change of) state introduced by lexical causative verbs is not accessible for separate adverbial modification by temporal (or manner) adverbials, see (1).

(1) a. *Floyd ***melted*** the glass **on Sunday** by heating it **on Saturday**.
    b. Floyd ***caused*** the glass ***to melt*** on **Sunday** by heating it on **Saturday**.

According to Fodor, this syntactic constraint ultimately reflects a semantic restriction on the type of causation events that lexical causatives describe; namely, the causal relation they encode may only have *temporally adjacent events* as relata.[2] The same view is endorsed by Katz (1970), who

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[2]As he put it, '*One can cause [something to melt] by doing something at a time which is distinct from the [melting event]. But if you melt something, then you melt it when it melts*.' (Fodor 1970: 433)

 In: Uli Sauerland and Stephanie Solt (eds.),
Proceedings of Sinn und Bedeutung 22, vol. 2, ZASPiL 61, pp. 107–124. ZAS, Berlin.

argues that the sentence in (2b) is false in what I will call the 'Wild West story' (2a), to which I will come back on several occasions below.

(2) a. *The sheriff's six-shooter is faultily repaired by the gunsmith. As a result, two days later, the sheriff's gun jams during a gunfight with the terrible Fred in a sordid pub, and the sheriff is shot to death.*
b. The gunsmith **killed** the sheriff.

Fodor and Katz understand directness as requiring temporal adjacency between the cause and the effect, so that no third event is allowed to intervene. But an alternative definition has been provided by Wolff (2003). In section 2, I present old and new arguments against the direct causation constraint under both definitions of directness. I then offer a new definition of directness in section 3, framed in Kvart's (2001) probabilistic account of singular causation, and argue that directness so redefined is an implicature rather than an entailment of lexical causative verbs, what will enable me to account for the data presented in section 2. Finally, in section 4, I explain why separate modification by temporal adverbials is possible in some cases.

2. Against the direct causation constraint

Neeleman and Van de Koot (2012) offer a rich list of examples where the causing event is separated from its result by intermediate events, see e.g. (3). Note that most of these examples involve event- or state-denoting subjects.[3]

(3) a. NHS supplies chaos **killed** my brother.
b. The gunsmith's negligence **killed** the sheriff.
c. Opening bus lanes to motorcycles will **redden** the streets of London with cyclists' blood.

In the tradition of discourse theory, Danlos (2001) relatedly observed that lexical causative verbs can be used when indirect causation is involved, as long as the restriction on separate adverbial modification observed by Fodor is respected, see her example (4).

(4) Fred **killed** Masha. He fired a shot at her on Sunday. She had an hemmorhage. She died on Monday.

Rappaport Hovav and Levin (2001: 783) also mention in passing that subevents of lexical causatives need not be temporally adjacent, observing that in their example (5), the act of putting arsenic in the coffee does not extend to the point where the drinker dies.

[3]As already observed by R. Truswell in a p.c. reported in Neeleman and Van de Koot (2012: fn. 9). Neeleman and Van de Koot (2012) claim that this is not a condition for licensing indirect causal chains with lexical causatives, which I agree with, but it often facilitates this reading, what will be accounted for in section 3.

(5) The widow **murdered** her guest by putting arsenic in his coffee.

But in fact, even the restriction on separate adverbial modification can be relaxed in some contexts.[4] For instance, my English and French informants all converge in the view that in presence of an event-denoting subject, separate adverbial modification *is* possible, see the English contrast (6a/b), as well as the French contrast (7).

(6) a. Fred accidentally shot his dog on December 23! #He eventually **killed** him on December 25.

b. Fred accidentally shot his dog on December 23! This gunshot eventually **killed** him on December 25.

(7)

M.	Roy$_i$	a	secoué$_j$	son	bébé	de	3	mois.	Résultat,	**69**	**jours**	**après**,	**#il**$_i$/ ^{OK}**ça**$_j$
Mr	Roy	has	shaken	his	baby	of	3	months	as a result	69	days	later	he/ this

a	fini	par	le	tuer.
has	finished	by	him	kill

‘Mr Roy shook his 3 months old baby. As a result, 69 days later #he/^{OK}this eventually killed him.’

In both (6) and (7), the version with an individual-denoting subject is generally judged not acceptable.[5] On the other hand, however, the version with an event-denoting subject is acceptable (under the relevant reading where the event denoted by the subject of the second clause refers back to the event introduced in the first clause, and thus takes place days *before* the time specified by the temporal adverbial in the second clause).[6]

In (7), the presence of the verb *finir par P*, translatable by *end up P-ing* or *eventually/ultimately P*, is not innocent. This verb seems to facilitate the indirect reading of lexical causative verbs, as does the adverbial *eventually* in (6b). To illustrate the point more explicitly, I borrow from Lauer and Nadathur (2017) one of their scenarios repeated under (8).[7] In this scenario, (8a) is inappropriate, but (8b/c), which contain the adverbial *en fin de compte* ‘eventually/ ultimately’ or the implicative verb *finir par*‘end up’, are much better, if not completely fine.

[4] See also Beavers (2012: 923) for a related observation.

[5] This version is only possible under the irrelevant reading where a killing event performed by the subject’s referent takes place at the time specified by the time adverbial in the second clause, *not* identified with the action described in the first clause.

[6] The example (7) is adapted from a real occurrence found on `https://tinyurl.com/y7geq6dh`

[7] Lauer and Nadathur (2017) focus on the semantic differences between different subtypes of periphastic causatives, namely the English causatives *make* and *cause*, as well as the German causative *lassen*. The contrast obtained for French between (8a) and (8b/c) is very similar to what they observe for German *lassen* and English *make*.In particular, they claim that in the context (8), *Das Erdbeben hat den Leuchtturm einstürzen lassen* ‘The earthquake made the tower collapse’ is false, while *Der starke Sturm hat den Leuchtturm einstürzen lassen* ‘The strong storm made the tower collapse’ is true.

(8) *The lighthouse was built in a very sturdy foundation, designed to withstand high winds at the tower top, but the foundation sustained structural damage in an earthquake about ten years ago. Even that would have been fine, but this year, we had record-setting winds and the worst hurricane season anyone can remember, and given the prior damage, it could not take the extra strain provoked by the storms.*

a. #Le tremblement de terre **a** **détruit** le phare.
the earthquake has destroyed the lighthouse
'#The earthquake destroyed the lighthouse.'

b. **En fin de compte**, ce tremblement de terre **a** **détruit** le phare!
ultimately this earthquake has destroyed the lighthouse
'**Ultimately**, this earthquake destroyed the lighthouse!'

c. Et ce tremblement de terre **a** **fini** **par** **détruire** le phare!
and this earthquake has finished by destroy the lighthouse
'And this earthquake **eventually** destroyed the lighthouse!'

Similarly, the sentence in (9) is generally judged more acceptable in the Wild West scenario (2a) than Katz's original sentence (2b) (or its French counterpart).[8]

(9) **En fin de compte**, l'armurier **a** **fini** **par** **tuer** le shériff.
at the end of the day the gunsmith has finished by kille the sheriff
'At the end of the day, the gunsmith ended up killing the sheriff!'

A final new relevant observation is that the indirect reading of lexical causatives is also facilitated in contexts such that the (change of) state described by the verb is taken for granted—through, for instance, clefting—while what is under issue is the responsibility of the subject's referent, and/or what the ultimate causing event is. For instance, (10a) takes the lighthouse's destruction for granted through the clefting and the focusing of the subject, and is much better in the lighthouse scenario (8). Similarly, (10b) is also more acceptable in the Wild West scenario (2a); see also the attested French example (11).[9]

(10) a. C'est le [*tremblement de terre*]$_F$ qui **a** **détruit** le phare!
it is the earthquake that has destroyed the lighthouse
'It is the earthquake that destroyed the lighthouse!'

b. It is the [*gunsmith ('s mistake)*]$_F$ that **killed** the sheriff!

[8]Interestingly, many of the examples through which Neeleman and Van de Koot (2012) argues for the felicity of the indirect reading of lexical causative verbs also contain the adverbial *eventually*.

[9]The example (11) is taken from an interview with Luz, a caricaturist of *Charlie Hebdo*, see https://tinyurl.com/y8eptebu

(11) On a fait deux ou trois une sur Mahomet en quarante ans d'histoire
We have made two or three front page on Mahomet in fourty years of history

de Charlie. C'est ça qui a été mis en avant par les médias, et **c'est ça**
of Charlie this is this that has been put to the fore by the media and this is this

qui a tué nos amis.
that has killed our friends

'We made a couple of front pages on Mahomet in fourty years of Charlie's history, and this is what has been put to the fore by the media, and this is what killed our friends.'

Wolff (2003) famously proposed an alternative definition of direct causation, satisfied not only when there are no intermediate entities between the causer and the final causee, but also, if any intermediate entities are present, when those can be construed as an *enabling condition* rather than an intervening causer (that is, 'does something that is concordant with the tendency of the causer'). However, the direct causation constraint is not respected in the examples discussed above even under this redefinition of directness. For example, (9) or (10b) are acceptable in the Wild West scenario (2a) although the intermediate causer cannot be conceived as 'an enabling condition', as illustrated by the inappropriateness of the paraphrase in (12a) in the relevant context; also, (12b) is not an adequate paraphrase of (11).[10]

(12) a. Fred enabled the gunsmith to kill the sheriff.
b. The terrorists enabled the front pages to kill our friends.

To summarize, the causal relation expressed by lexical causative verbs may take place not only between two temporally adjacent eventualities, but also between two eventualities separated by intermediate events, even when intermediate causers are not enabling conditions in Wolff's sense. The indirect reading of lexical causative verbs is favoured by the adverbials *en fin de compte* 'ultimately, at the end of the day', the verb *finir par* 'end up, manage to' as well as contexts where the occurrence of the state reported by the lexical causative is taken for granted (through, e.g., the clefting of the subject). Explaining the facilitating effect of these constructions on the indirect reading is the topic of section 3. Moreover, Fodor's constraint on separate adverbial modification is relaxed with subject-denoting events, which I account for in section 4.

3. Time in probabilistic causation

3.1. Introduction

Let us compare again the following two sentences in the context of Katz's Wild West story:

(13) a. Fred **killed** the sheriff in the bar (by shooting him).
b. (By his negligence), the gunsmith **killed** the sheriff.

[10]The possibility to paraphrase *x V-ed y* by *z enabled x to V y*, *z* being the intermediate causer, is the main independent criterium provided by Wolff (2003) to check whether the intermediate entity can be conceived as an enabling condition.

Let the variable c represent the causing event, and c_S the event the subject's referent participates in (the shooting in (13a), the repair of the gun in (13b)). The causing event c can either be identical to c_S, or include c_S as a proper part if there is an intermediate event c_I between c_S and the outcome o. In the latter case, $c = c_S \oplus c_I$.

Let us assume a context such in both (13a/b), the constraint of temporal adjacency between c_S and o is violated. For instance, an intermediate event intervenes between c_S (the act of Fred or the gunsmith) and the sheriff's death o (a lethal internal bleeding the day after the gunshot in (13a), a gunfight in a bar in (13b)). Still, in such a context, the causal relation expressed in (13a) feels more direct than the one expressed in (13b), and I suspect that subjects would be more willing to accept the lexical causative in (13a) than in (13b) when temporal adjacency is not satisfied. How, then, should directness be defined, if not by temporal adjacency?

An obvious difference between (13a) and (13b) has to do with the causal impact of the event involving the subject c_S. In (13a), c_S—the shooting—can be easily conceived as a sufficient cause for the sheriff's lethal bleeding and his ensuing death. In (13b), however, c_S (the repair) is certainly not sufficient for the sheriff's death in the given scenario. A second related difference has to do with the way c_S 'indicates' the sheriff's death if we restrict knowledge to the facts that pertain up to *t'*, the right temporal boundary of c_S.[11] On one hand, Fred's shooting of the sheriff objectively points towards the sheriff's death, in that it raises the objective chance that the sheriff will die in the epistemic context up to *t'*. Let us say that when c_S raises the probability of o in the epistemic context up to *t'*, c_S '**ab-initio causes**' o. On the other hand, the gunsmith's repair, which is not known to be faulty at the time up to *t'*, does *not* raise the probability of the sheriff's death at the time of the repair—it rather points to the contrary. That is, the gun's repair does not ab-initio cause the sheriff's death. It is only from a *retrospective* perspective, without limitations of knowledge of facts up to *t'*, once the intermediate history between the gun's repair and the sheriff's death is taken into account (and the gunsmith's mistake identified), that the causal role of the gunsmith can be assessed. Let us say that in that case, c_S '**ex-post-facto causes**' the outcome o.

Ab-initio vs. ex-post-facto causality and the related statements will be defined more precisely below in the framework of Kvart's (2001) probabilistic account of singular causation. This ultimately will enable us to define causal directness independently from temporal adjacency, and to account for the data presented in the introduction.

3.2. Kvart's theory of causation and the evolution of probabilities in time

'Probabilistic causation' refers to a family of theories defining the relationship between cause and effect with the tools of probability theory. Central to these theories is the idea that causes change the probabilities of their effects, and more particularly that the occurrence of a cause increases

[11] See Varasdi (2014) on the notion of indicative properties. Indicativity will here be defined through probabilities, but the notion is not very different from Varasdi's notion of indicativity.

the probability of the effect. Particularly interesting for us are the theories of causation between event particulars that depend on the way probabilities change over time, such at the theory of Kvart (2001, 2004).[12]

Assume that the propositions C_S and O are descriptions of the events c_S and o respectively, and let be W_{C_S} the world history just before c_S occurs.[13] How should probability increase be defined to capture the notion of cause? As Kvart observes, the most natural idea is to interpret probability increase as in (14). That is, given the world history up to C_S, the probability of O given C_S is higher than the probability of O given $\neg C_S$.

(14) $P(O|C_S.W_{C_S}) > P(O|\neg C_S.W_{C_S})$ (ab-initio probability increase)

One of Kvart's crucial claims is that (14) is *not* an appropriate analysis of C_S being a ***cause*** of O, despite the fact that this assumption is made in probabilistic theory such as Lewis's.[14] The reason is that (14) is a function of the world up to C_S, but not at all a function of $W_{C_S,O}$, the intermediate history from C_S to O (which justifies his label **ab-initio probability increase** for the condition (14)). In other words, from C_S, O, and W_{C_S}, (14) fixes whether C_S is a cause of O, 'regardless of what else transpires between' C_S and O. And as Kvart forcefully argues, this does not do justice to the fact that whether C_S is a cause of O very much depends on what happens within the intermediate history. Kvart (2004) therefore proposes an alternative definition of probability increase to capture the notion of cause that takes the intermediate history between C_S and O into account. He calls this notion **ex-post-facto probability increase**, which is 'a sort of *hindsight* probability increase, from a bird's eye view, with the intermediate history unfolded' (Kvart 2004: 394). I illustrate the difference between ex-post-facto and ab-initio probability increase through three cases.

Case 1. Ex-post-facto probability increase can be easily illustrated through cases of ab-initio probability *decrease* (with '<' instead of '>' in (14)). Ex-post-facto probability increase despite of ab-initio probability decrease obtains when there is an intermediate event c_I which increases the probability of o when added to both sides of the ab-initio probability decrease condition, see (15a). Kvart calls such an intermediate event c_I an **increaser**.

(15) a. $P(O|C_S.C_I.W_{C_S}) > P(O|\neg C_S.C_I.W_{C_S})$ (ex-post-facto probability increase)
b. Sasha's bet improved her financial position.

[12]See also Eells (1991), and Hitchcock (2010) for an introduction to probabilistic causation in general and singular causation and the evolution of probabilities in time in particular, on which I partly rely in the presentation.

[13]The probability function P takes propositions as its arguments, but 'events' is the formal term for these arguments in probability theory. In the case of singular causation, these 'events' correspond to what event semanticists call events (or to facts for some other authors). But since the formalism requires to make use of negation, disjunction or conjunction on these relata, these must be propositional entities. I assume that the (upper case) variables C and O correspond to propositions that are descriptions of the events picked up by the corresponding (lower cases) variables.

[14]See Kvart (2001, 2004) for detailed criticisms of Lewis's analysis of cause. The longer term project I do not have the space to pursue here is to offer a definition of Davidson's predicate cause used in section § 4 in terms of Kvart's approach.

Kvart illustrates ex-post-facto probability increase despite ab-initio probability decrease through an example similar to (15b) in a context such as the following. The Comeback Team had been weak for a long time, with few chances of improving during the next months. Nevertheless, Sascha bets a large portion of her financial worth on its winning (c_S). Later but before the games start, a wealthy Hungarian start-upper bought the team, and acquired first-rate Belgian players. As a result, the team's performance was the best ever in the season (c_I). Sascha won her bet, and o occurred—she improved her financial position. In this scenario, at the time of c_S, c_S yielded a probability decrease of o (since betting a lot of money on a weak team amounts to a waste of money). But *given* c_I, c_S ***ultimately*** yielded a higher chance of o.

Case 2. Suppose now that ab-initio probability increase condition (14) obtains. For instance, in our previous lighthouse scenario (8), c_S (the earthquake) is a probability increaser for o (the lighthouse's destruction). Kvart's proposal is that in order to check whether c_S is a ***cause*** of o, we need to check in the intermediate history between c_S and o if there is an intermediate event c_I such that, if taken into account in the condition on both sides, *reverses* the inequality in (14), as in (16):

(16) $P(O|C_S.C_I.W_{C_S}) < P(O|\neg C_S.C_I.W_{C_S})$

If there is no such c_I (that is, if the condition (16) does not obtain for *any* intermediate event), then *ex-post-facto probability increase* obtains, and c_S is a **stable** increaser; c_S can then be a cause of o.[15] In the lighthouse scenario (8), there is indeed no such decreaser. The event c_S can therefore be a cause of o, which corresponds to the intuition.[16]

Recall that the lexical causative statement (8a) is not felicitous in the lighthouse scenario. This confirms previous observations that the fact that c_S is a cause of o does not suffice to make the lexical causative acceptable in a default context (i.e. in absence of adverbials like *ultimately*, etc., see section 1). I will argue below that c_S must be a ***sufficient*** **ab-initio cause** of o for the lexical causative to be acceptable in a default context.

Case 3. Suppose again that (14) obtains but that there is a *neutralizer* intermediate event c_I, i.e. an event for which the condition (17) obtains:

(17) $P(O|C_S.C_I.W_{C_S}) = P(O|\neg C_S.C_I.W_{C_S})$

Imagine for instance that after the earthquake (c_S), the city attributes funding to Mary because of the lighthouse's historical and artistic value. The lighthouse is fully and extensively renovated (c_I). (Nevertheless, Mary's former husband intentionally burned it down for the insurance money and

[15]Cf. Kvart's (2001) THESIS 2: If (14) obtains, and (16) does not obtain for any intermediate event, then the requisite ex-post-facto probability increase obtains, and thus c_S is a cause of o (numbers and variables mine).

[16]As Kvart emphasizes, the existence of a stable increaser is a necessary but not sufficient condition for something's being a cause (see in particular Kvart 2004: section 3). c_S must also be *causally relevant* to o. This happens if there is no intermediate event that *neutralizes* the potential causal relevance of c_S to o. See Case 3 below for the definition of neutralizers.

it gets completely destroyed (o).) In this variant of the lighthouse scenario, the full renovation c_I 'screens off' c_S from o; that is, the earthquake c_S loses its ab-initio causal impact on o ex-post-facto. The event c_S is *not* a cause of o, despite being an ab-initio probability increaser for o. This, again, corresponds to the intuition. Similarly, imagine in the lighthouse scenario that the storms in themselves were strong enough to destroy the lighthouse. Again, the earthquake loses its ab-initio causal impact on o ex-post-facto, and is not a cause for o.

In sum, for c_S to be a cause of o, it must have a stable increaser, *and* there should be no neutralizing intermediate event. Kvart (2001, 2004) discusses a number of additional cases to which I cannot do justice here. But I hope that this brief presentation showed how causal relations between events depend on the way in which probabilities evolve with time, and that the notion of 'some ab-initio positive causal impact' has to be distinguished from the notion of 'overall ex-post-facto positive causal impact'.

In the course of the linguistic analysis, I firstly argue that lexical causative statements by default trigger the implicature that c_S is a *sufficient* ab-initio cause of o given the world history W_{C_S} up to c_S. In other words, they by default imply that it is already clear from the *ab initio* perspective that c_S suffices to trigger the outcome o. Secondly, I claim that the constructions which increase the acceptability of the indirect use of lexical causatives, like *en fin de compte/finalement* 'ultimately, eventually' or *finir par* 'end up, manage to', or the clefting of the subject, all cancel this default inference (i.e., indicate that c_S is *not* a sufficient ab-initio cause of o), and convey that c_S's causal impact is considered from a retrospective —*ex-post-facto*—perspective, once the intermediate history between c_S and o is taken into account.[17]

3.3. The inference of directness of lexical causative verbs

Let me now outline the main ingredients of the analysis. Firstly, I propose to redefine the linguistically relevant notion of causal directness through *ab-initio sufficiency*.[18] That is, causal directness is satisfied when (18) below obtains. The condition (18) is satisfied if, given the world history W_{C_S} immediately before c_S, the probability of O given C_S =1 at t', the right temporal boundary of c_S.[19]

[17]The difference between the ab-initio and ex-post-facto causal impact of the event involving the subject's referent is also crucial to account for the fact that the so-called 'zero-change of state' reading of causative predicates is easier to obtain with agentive than with non-agentive subjects (see Martin 2015 and references therein): agentive subjects help to adopt the ab-initio perspective, while non-agentive ones often impose the ex-post-facto perspective.

[18]Lauer (2010: 21) already suggests that the inference of directness of lexical causatives (that he analyses as an implication rather than an implicature) may result from the fact that these predicates express causal sufficiency as well as causal necessity (as he puts it, 'a cause that is both necessary and sufficient cannot be very far from its effect'). Here, I do not commit to the view that lexical causatives express causal necessity.

[19]Note the condition (18) can be satisfied although c_S is *not* a cause of o. This is where scenarios of causal overdetermination or preemption are relevant. For instance, Mandel (2003) ran an experiment involving a story in which the protagonist is first lethally poisoned, but then intentionally killed in a car accident, before the poison could yield its certain outcome. In this scenario, the administration of the poison ab-initio increases the probability of death to 1, but is not judged a cause of the death by the subjects tested. Therefore, causal directness is not reduced to the condition (18). Rather, (18) defines what has to be the case for c_S to be a **direct** cause of o, while it is independently established

(18) $P(O|C_S.W_{C_S}) = 1$ (ab-initio probability increase to 1)

Secondly, I propose that *in absence of information to the contrary*, lexical causative statements trigger a *defeasible inference* (rather than an entailment) that causal directness (18) is satisfied. That is, *in a default context*, lexical causative statements require the event involving the subject's referent c_S to be a sufficient ab-initio cause for o, *regardless* of what happens between c_S and o (this is the ab-initio requirement). Without entering into the details, I assume that this inference is obtained *via* a Gricean reasoning through the competition of lexical causatives with the corresponding periphrastic causatives (e.g. *cause/ make*), which I suspect to strongly imply, and perhaps presuppose, that directness as I propose to redefine it through (18) is *not* satisfied, since they often involve an intervening causer with a causal contribution to o not automatically triggered by c_S.[20]

The inference of directness as defined through (18) accounts for previous observations on the distribution of lexical causatives. Firstly, it accounts for the recurrent claim that lexical causatives involve something like physical manipulation of the object's referent by the subject's referent *S*. For the condition (18) is more likely to be satified when *S* physically acts on the object's referent than when the object's referent is a full agent that *S* incites to act: in the former case, but not the latter, c_S can be conceived as a sufficient cause for o in the epistemic context up to *t'*. Take for instance the sharp contrast in (19), due to Ruwet (1972: 139).

(19) a. Delphine **a fait entrer/a entré** la voiture dans la garage.
'Delphine made enter/entered the car in the garage.'
b. Delphine **a fait entrer/# a entré** les invités dans le salon.
'Delphine made/let enter/#entered the guests in the living room.'

Given the world history W_{C_S} immediately before c_S, it is easy to conceive Delphine's action on/with the car as a sufficient cause for the car's change of location, while it is odd to conceive Delphine's incentive to enter as a sufficient cause for the guest's change of location. This accounts for the fact that the lexical causative is felicitous in (19a) only (and note that the lexical causative in (19b) gets fine if the guests are in wheelchairs that they cannot drive themselves).

Secondly, the same condition (18) is also more easily satisfied if c_S and o are temporally adjacent or partly overlapping, for then, that o obtains given that c_S obtains can more easily be assessed regardless of the intermediate history, since the intermediate history is by definition empty in this case. This may explain the recurrent claim that lexical causatives require something like temporal adjacency between cause and effect.

that c_S is a cause of o. This, as Kvart argues, requires ex-post-facto probability increase, which is not obtained in presence of a neutralizer such as the car accident in the scenario above.

[20] I owe to J.-P. Koenig the suggestion that directness is implied rather than entailed by lexical causatives. The competition between lexical and periphrastic causatives (addressed e.g. in Benz 2006) is out of the scope of this paper. A standardly overlooked difference between lexical causative statements and *faire/make*-statements is that *with an agentive subject*, the latter are not implicative; e.g. *J'ai fait lire ton papier par les étudiants* 'I made the students read your paper' does not entail (but rather strongly implies) that the students read your paper, while *La curiosité a fait lire ton papier par les étudiants* 'Curiosity made the students read your paper' does.

However, the condition (18) can also be satisfied when c_S and o are temporally disjoint. Lee Oswald shot John Kennedy on November 22 1963 at 12.30, and Kennedy died at 13.00 the same day. But a bullet reached and crossed Kennedy's brain during the gunfire; his death was therefore certain before it actually took place (ignoring major violations of the laws of nature).

Thirdly, (18) is more easily satisfied with an intentional than with an accidental agent (such as the gunsmith in Katz's original scenario), because, as Copley (2018: fn. 5) underlines, causation associated with intention is *robust*: an intentional agent can adapt to changes in the environment in order for his chain of actions to be a sufficient cause for the intended outcome o. This contributes to explain Neeleman and Van de Koot's (2012) previous observation that lexical causatives are more acceptable in contexts where temporal adjacency is violated when the subject's referent is an intentional agent.

Fourthly, we expect subjects to vary in the way they judge lexical causatives to be acceptable under the indirect reading, since the same variation is observed with other types of true but pragmatically infelicitous statements (Noveck 2001 a.o). Subjects more sensitive to the inference of directness (18) are expected to be reluctant to endorse a lexical causative statement when (18) is not satisfied. For instance, the gun's repair by the gunsmith is not an ab-initio cause of the sheriff's death o (i.e., (14) is not satisfied as the gun's repair is not a probability increser for o up to *t'*), and *a fortiori* not a sufficient ab-initio cause for it. Therefore, we expect the lexical causative statement (2b) to be rejected by these speakers sensitive to the inference of directness. In the lighthouse scenario (8), the earthquake *is* an ab-initio cause of the lighthouse's destruction, but not a *sufficient* one (i.e., $P(O|C_S.W_{C_S}) \neq 1$) ; we therefore also expect some speakers to reject (8b) in this scenario. Finally, Danlos's and Levin and Rappaport's examples (4)/(5) leave open the possibility that (18) is satisfied, since it may be that the shooting (or the poisoning) was an ab-initio-sufficient-cause of death. These examples are therefore expected not to raise a difficulty.

Fifthly, we also expect lexical causatives to be judged inappropriate by subjects more sensitive to the implicature in a context making clear that c_S cannot raise the probability of o to 1 regardless of what happens in the intermediate history between c_S and o. This is the case in the example (20a).

(20) a. Paul **killed** Ana #by forcing Sue to shoot her. (inspired from Jackendoff 1972)

b. #La presse lui **a donné** le prix Nobel.
the press her has given the prize Nobel
'#The press coverage gave her the nobel Prize.'

In a default context, the *by*-clause in this example strongly suggests that Paul's action was not sufficient for Ana's death o; Sue also contributed to o in a crucial way.[21] Similarly, (20b) is weird, because the press coverage is not easily conceived as a sufficient cause for a Nobel Prize's attribution to an author.

[21] And note that in a context such that Paul *physically forces* Sue to shoot Ana, so that c_S is more likely to be a sufficient ab-initio cause for o, the acceptability of (20a) increases.

3.4. Cancelling the inference of directness

The inference of directness triggered by lexical causatives is, however, cancellable. I argue below that the linguistic constructions that facilitate the use of lexical causatives in the indirect reading—the adverbials *en fin de compte/ au bout du compte* 'ultimately, eventually', the implicative verb *finir par* 'end up, manage to'—do so because they indicate that (18) is *not* fulfilled.[22] That is, these elements all convey that c_S is not a *sufficient ab-initio* cause for o in the epistemic context up to *t'* (the right temporal boundary of c_S), and that the causal impact of c_S on o is established from a retrospective perpective only, while the intermediate history between c_S and o is taken into account. I will call these constructions ***markers of delayed causation***. Since, by assumption, the violation of the directness inference is the reason why lexical causatives are unacceptable in indirect causation contexts, the problem vanishes when this inference normally associated with lexical causatives is not triggered or is cancelled. Hence the fact that markers of delayed causation make the indirect reading of lexical causatives acceptable.

Let us first look more closely at causative statements of the form '*en fin de compte/ au bout du compte P/ finir par P*' 'ultimately P, eventually P' (insightfully paraphrased as *P after a series of other things are taken into consideration* by the Merriam Webster dictionary). In such statements, markers of delayed causation may have high or low scope, i.e. have either the whole causal chain on their scope, including the event involving the subject's referent, see (21a), or the causation event only, see (21b). When they help to license the indirect reading of lexical causatives, markers of delayed causation have their low scope reading.

(21) The executioner **ultimately killed** the prisoner.

a. After a series of events the executioner performed his job. (high scope)
b. After a series of events the executioner's job caused the prisoner's death. (low scope)

I argue that these markers contribute in two crucial ways to the lexical causative statement that contains them. Firstly, such lexical causative statements imply that c_S with an intermediate event c_i are *together jointly* sufficient for o, see (22a). For instance, (22b) implies that the operation *together* with an intermediate event (e.g. subsequent complications) cause the dog's death.[23]

[22] Lauer and Nadathur (2017: §3.2) relatedly propose that adverbials such as *ultimately* can shift what they call the evaluation time of periphrastic causative statements. They propose that this time is by default the time of the cause, which may correspond to the proposal made here that lexical causative statements are by default interpreted as ab-initio causal statements.

[23] This inference does not seem to be part of the assertive content of *finir par P* 'ultimately P', for denials do not seem to be able to target it, as suggested by the infelicity of the following dialogue:

i. A. This operation ultimately killed the dog. ii. #B. It's not true; it killed the dog right away—this vet is a true butcher!

Also telling is the fact that *ultimately* or *eventually* are not felicitous in the post-verbal position (cf. *?This operation*

(22) a. $P(O|C_S.C_I.W_{C_S}) = 1$ (1st inference)

b. Cette opération **a fini par tuer** le chien.
this operation has finished by kill the dog
'The operation ultimately killed the dog.'

Secondly and relatedly, such lexical causative statements imply that c_S is not a sufficient ab-initio cause for o, cf. (23). Statements of this type are compatible with situations where c_S is either an ab-initio probability decreaser for o (cf. e.g. the default interpretation of (22b)), or an ab-initio probability increaser for o (although to a degree strictly inferior to 1), or neither of the two (i.e. when $P(O|C_S.W_{C_S}) = P(O|\neg C_S.W_{C_S})$).

(23) $P(O|C_S.W_{C_S}) < 1$ (2d inference)

Given their contributions (22a) and (23), markers of delayed causation are infelicitous when the action of the subject's referent is clearly a sufficient ab-initio cause for the outcome o, see (24).[24]

(24) a. The executioner beheaded the prisoner. He (#ultimately/#eventually) **killed** him!
b. John pressed the button on the automatic door. He (#ultimately/#eventually) **opened** it!

Markers of delayed causation are not the only way to neutralize the inference of causal directness, however. This inference, which is problematic for the indirect reading, is not triggered in the first place in a context where the causal role of intermediate events is already presupposed. Remember for instance the example (11) repeated below.

(11) We made a couple of front pages on Mahomet in fourty years of Charlie's history, and this is what has been put to the fore by the media, and this is what **killed** our friends.

In the context of the lexical causative statement (11) (taken from an interview with the caricaturist of *Charlie Hebdo*), the attack of January 7 2015 is taken for granted, as well as all other putative causes of the killing of Charlie Hebdo's team, and the killing event itself *via* the clefting of the subject. It is therefore from the beginning clear that the front page is not a sufficient ab-initio cause of o. Similarly, compare (20b) with its variant (25) below:

(25) C'est vrai, il a écrit un bon livre et le jury lui était très favorable.
it is true he has written a good book and the committee him was very in favour
Mais en fin de compte, c'est la *presse* qui lui **a donné** le prix Nobel.
but at the end of the day it is the press that him has given the prize Nobel
'True, he wrote a good book and the committee was very in his favour. But at the end of the day, it is the *press coverage* that **gave** him the Nobel Prize.'

killed the dog ultimately), a position where the adverbial conveys an information which is central to the point made by the utterance. I leave open the question of how the inference of joint sufficiency should be analysed in such lexical causative statements.

[24]On that respect, markers of delayed causation share striking similarities with *manage to P* as described by Baglini and Francez (2016), as reflected by the oddity of *manage to open* in the same contexts (see their ex. (27)).

The example (25) is much more acceptable than (20b) because in the context of the lexical causative statement of (25), it is *presupposed* that the press coverage is *not* a sufficient cause for o. Again, the problematic inference of directness is neutralized. More generally, the clefting of the subject systematically facilitates the indirect reading because it presupposes the occurrence of the outcome o, and suggests that other causes of o have been identified by making alternatives salient in discourse. This indicates that the causal relation is considered from a bird's eye view, with the intermediate history between c_S and o unrolled, rather than from an *ab-initio* point of view.

Finally, when the subject of the lexical causative refers to an event, the event description within the subject may also contribute to defeat the inference of directness. For instance in (3b), the event description '*the gunsmith's negligence*' suggests by itself that all what happens between the gunsmith's repair and the sheriff's death is known in the context of the causative statement. It is therefore again clear from the start that c_S is not an ab-initio cause for o. Therefore, the inference of directness is cancelled (or not triggered in the first place).[25]

4. The constraint on separate adverbial modification

Let us now turn to the questions of when and why separate adverbial modification is possible. I argue that we have to empirically distinguish between two different cases, namely, (i) separate modification of an event e involving the subject's referent (e.g. a shooting) and an event e' causing a result state of the type encoded by the predicate (e.g. a killing event in the case of *kill*), such that e causes e', and (ii) separate modification of a causing event e' (e.g. a killing event) and the ensuing caused state s (e.g. a state of being dead).

4.1. Separate modification of shooting events and killing events

I take the sentences in (6) repeated below to illustrate that separate modification of the first subtype is possible with eventuality-denoting subjects, but not with entity-denoting subjects.

(6) a. Fred accidentally shot$_i$ his dog on December 23! #He eventually **killed**$_i$ him on Dec. 25.
b. Fred accidentally shot his dog on December 23! This gunshot eventually **killed** him on December 25.

The eventuality predicate *kill Fido* is analysed as the bi-eventive predicate (26a), following, e.g., Schäfer (2008). We do not want to account for the unacceptability of (6a) by assuming that the causal relation between the shooting and the killing can only have temporally adjacent eventualities as relata, since we just argued at length in previous sections that cause can relate temporally distant eventualities. Rather, the problem of (6a) is a direct consequence of the fact that the adverbial *must*

[25] Note that with individual-denoting subjects too, the ex-post-facto perspective can be adopted through another element of the context, such as a *by*-phrase (cf. e.g. (13b)). Therefore, although event-denoting subjects in principle help to make the indirect reading felicitous, they are not necessary for this reading to obtain.

scope on the causing event introduced by the lexical causative verb. The (standard) denotation of the adverbial *on December 25* in (6) given in (26b) ensures this, see (26c), which gives the result of the composition of (26b) with (26a).[26]

(26) a. kill Fido $\rightsquigarrow \lambda e.\exists s(\mathsf{cause}(e,s) \wedge \mathsf{dead}(s) \wedge \mathsf{theme}(s,\mathsf{fido}))$
b. on December 25 $\rightsquigarrow \lambda P\lambda e.P(e) \wedge \tau(e) \subseteq \mathsf{dec.\ 25}$
c. on December 25[kill Fido] $\rightsquigarrow [\lambda P\lambda e.P(e) \wedge \tau(e) \subseteq \mathsf{dec.\ 25}]$
$(\lambda e.\exists s(\mathsf{cause}(e,s) \wedge \mathsf{dead}(s) \wedge \mathsf{theme}(s,\mathsf{fido})) =$
$\lambda e.\exists s(\mathsf{cause}(e,s) \wedge \mathsf{dead}(s) \wedge \mathsf{theme}(s,\mathsf{fido}) \wedge \tau(e) \subseteq \mathsf{dec.\ 25})$

With an entity-denoting subject, the verbal predicate (26c) is combined with a Voice head (Kratzer 1996) that introduces an external argument x of an event e, and such that x is the agent of e, see (27a). (And note that x may either act intentionally, or be an accidental agent, as in (9)). Applying (27a) to (26c), we obtain the verbal predicate (27b).

(27) a. $\text{Voice}_{ag} \rightsquigarrow \lambda P\lambda x\lambda e.\mathsf{agent}(e,x) \wedge P(e)$
b. Voice_{ag} [on December 25[kill Fido]] $\rightsquigarrow$
$[\lambda P\lambda x\lambda e.\mathsf{agent}(e,x) \wedge P(e)]$
$(\lambda e.\exists s(\mathsf{cause}(e,s) \wedge \mathsf{dead}(s) \wedge \mathsf{theme}(s,\mathsf{fido}) \wedge \tau(e) \subseteq \mathsf{dec.\ 25}) =$
$\lambda x\lambda e.\exists s(\mathsf{agent}(e,x) \wedge \mathsf{cause}(e,s) \wedge \mathsf{dead}(s) \wedge \mathsf{theme}(s,\mathsf{fido}) \wedge \tau(e) \subseteq \mathsf{dec.\ 25})$

This obviously accounts for why sentence (6a) is contradictory: given that (27b) requires x to perform on December 25 an event causing a state of being dead, there is no room left to identify this causing event with a previous action of x taking place on December 23.

But then, what happens in (6b)? Pylkkänen (2008) assumes that event-denoting subjects are introduced by another Voice head, that identifies the event introduced by the subject e (e.g., the gunshot in (6b)) and the causing event introduced by the verb (e.g., the killing event in (6b)). If such a head was involved in the semantic composition of (6b), this sentence should be contradictory, given that the gunshot would have to take place both on December 23 and December 25. We therefore need another functional element than Pylkkänen's (2008) Voice. This head, that I will call Cause, is in charge of introducing an external argument v that is an event or a state,[27] and a causing relation between v and the causing event e introduced by the verbal predicate the head combines with, see (28a). Applying (28a) to (26c), we obtain the verbal predicate (28b), involving *three* different eventualities (and *two* causal relations).

(28) a. Cause $\rightsquigarrow \lambda P\lambda v\lambda e.\mathsf{event}(v) \vee \mathsf{state}(v) \wedge \mathsf{cause}(v,e) \wedge P(e)$
b. Cause[on December 25[kill Fido]] $\rightsquigarrow$
$[\lambda P\lambda v\lambda e.\mathsf{event}(v) \vee \mathsf{state}(v) \wedge \mathsf{cause}(v,e) \wedge P(e)]$

[26] I assume that the adverbial *on December 25* provides the Reichenbachian reference time, and that the bare accomplishment infinitive carries a perfective feature, responsible for the inclusion relation in (26b).

[27] In some cases as (3a), it seems that the causing eventuality denoted by the subject may be a state, which justifies the decision to leave the nature of the eventuality introduced by the subject unspecified.

$(\lambda e.\exists s(\mathsf{cause}(e,s) \wedge \mathsf{dead}(s) \wedge \mathsf{theme}(s,\mathsf{fido}) \wedge \tau(e) \subseteq \mathsf{dec.\ 25}) =$
$\lambda v \lambda e.\exists s(\mathsf{event}(v) \vee \mathsf{state}(v) \wedge \mathsf{cause}(v,e) \wedge$
$\mathsf{cause}(e,s) \wedge \mathsf{dead}(s) \wedge \mathsf{theme}(s,\mathsf{fido}) \wedge \tau(e) \subseteq \mathsf{dec.\ 25}$

Let us now apply the predicate in (28b) to the definite event description $\iota v.\mathsf{gunshot}(v)$, and derive the predicate in (29a), where the alternative that v is a state is eliminated:

(29) a. The gunshot[Cause[On December 25[kill Fido]]] $\rightsquigarrow$
$\lambda e.\exists s(\mathsf{cause}(\iota v.\mathsf{gunshot}(v),e) \wedge \mathsf{event}(v) \vee \cancel{\mathsf{state}(v)} \wedge \mathsf{cause}(e,s) \wedge$
$\mathsf{dead}(s) \wedge \mathsf{theme}(s,\mathsf{fido}) \wedge \tau(e) \subseteq \mathsf{dec.\ 25})$

b.

Le	coup de poignard	d'hier	a	fini	par	le	tuer	ce	matin.
the	stabbing	of yesterday	has	finished	by	him	kill	this	morning

'Yesterday's stabbing eventually killed him this morning.'

We can now understand why sentence (6b) is acceptable. Given that the eventuality v denoted by the subject *causes* the killing event e denoted by the verb (rather than being identified with it), v may, of course, take place before the event e that must take place on December 25, e.g. on December 23. And observe that it is possible to add a temporal modifier within the subject DP that refers to a time different from the modifier applying to the VP, see (29b).

4.2. Separate modification of killing events and caused states of being dead

So far, we thus have accounted for the contrast between (6a) and (6b). The careful reader, however, will have noted that our representation of *kill Fido on December 25* in (26c) leaves open the possibility that the caused state of being dead s occurs *after* the time interval defined by the adverbial *on December 25*. For s is not in the scope of this adverbial, and by assumption, cause can relate temporally distant events. Therefore, (26c) predicts that a causative lexical statement such as *Fred killed Fido on December 25* can be true in situations where Fido dies after December 25. At this point, I am unsure whether this result is unwelcome or not. The oddity of the example (30a), which slightly modifies (4), suggests that it is. But (30b) is accepted by some speakers I consulted, which points to the possibility that the oddity of (30a) is not of a semantic nature. Also, one finds natural examples such as (30c), locating a killing event in the past, and death in the future.

(30) a. Fred **killed** Masha **on Sunday**. #She (ultimately) **died on Monday**.
b. Lee Oswald **killed** President Kennedy **on November 22 1963 at 12.30**. He shot him as Kennedy rode in a motorcade through Dealey Plaza in downtown Dallas. Kennedy **died at 13.00** at Parkland Memorial Hospital, where he was rushed after the shooting.
c. Already **killed**, but not **dead** yet.

If the examples in (30) turn out to be semantically acceptable despite some pragmatic anomalies for (30a), we can stick with (26c). Now, if examples in (30) turn out to be semantically anomalous because they violate the requirement that the causing event *and* the result state be in the scope of the temporal adverbial, we have to revise our semantics for *kill* in order to capture this requirement. One possibility suggested to me by C. Piñón (p.c.) is to include the caused state of being dead in the denotation of *kill*, and analyze *kill Fido (on December 25)* as in (31a-c).[28]

(31) a. kill Fido $\rightsquigarrow \lambda v.\exists e \exists s(v = (e \oplus s) \wedge \textsf{cause}(e,s) \wedge \textsf{dead}(s) \wedge \textsf{theme}(s,\textsf{fido}))$
b. on December 25 $\rightsquigarrow \lambda P \lambda v.P(v) \wedge \tau(v) \subseteq \textsf{dec. 25}$
c. on December 25[kill Fido] $\rightsquigarrow [\lambda P \lambda v.P(v) \wedge \tau(v) \subseteq \textsf{dec. 25}]$
$(\lambda v.\exists e \exists s(v = (e \oplus s) \wedge \textsf{cause}(e,s) \wedge \textsf{dead}(s) \wedge \textsf{theme}(s,\textsf{fido})) =$
$\lambda v.\exists e \exists s(v = (e \oplus s) \wedge \textsf{cause}(e,s) \wedge \textsf{dead}(s) \wedge \textsf{theme}(s,\textsf{fido}) \wedge \tau(v) \subseteq \textsf{dec.25})$

This predicts examples such as (30) to be contradictory (and we can still account for (6a) vs. (6b) as before, *via* the Voice alternation). The price is that the sum $(e \oplus s)$ is not an eventuality in the usual sense. However, (31) captures the intuition that *kill Fido* denotes events *and* states.

4.3. A final note on causative psych-verbs

An intriguing property of causative *psych*-verbs is that they differ from non-psych verbs in that they allow for separate adverbial modification *even with entity-denoting subjects*, see (6a) vs. (32).

(32) Masha$_i$'s speech$_j$ on Monk's music on December 23 was quite something. And today **she**$_i$/**it**$_j$ gave me the idea I needed for my term paper on phonotactic patterns! (uttered on Dec 25)

What is remarkable about (32) is that it is possible to identify Masha's speech on December 23 as the single one of her actions causing me to get the idea I needed for my paper (on December 25), and this even in presence of an individual-denoting subject. I claim that this specificity of psych-verbs is due to the fact that their individual-denoting subjects may be reinterpreted as covert event descriptions. Technically, this translates in the view that *with these verbs*, subjects like *Masha* may either be introduced by the Voice head (27a), or by the Cause head (28a).

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[28]See Rothstein 2004: 35 for an analysis of another subclass of accomplishments in terms of event sums (Rothstein, however, does not address standard causative predicates such as *kill*). A second possibility would be to analyze *kill Fido* in the general spirit of Piñón (2011), i.e. as predicates of *event pairs* $\langle e,s \rangle$ (i.e. analyse *kill Fido* as follows: $\lambda \langle e,s \rangle.\textsf{cause}(e,s) \wedge \textsf{dead}(s) \wedge \textsf{theme}(s,\textsf{fido})$).

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On competing degree morphemes in verbs of change in Southern Aymara[1]

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Abstract. In this paper, I address verbal predicates of change in Southern Aymara, an understudied Andean language. I concentrate on verbs that are derived with the suffix *-cha*. This suffix derives degree achievements and creation predicates. I propose that they should be analyzed uniformly as degree achievements. The main empirical point of this paper is that there are two degree morphemes that combine with verbs with *-cha*, namely, a covert positive morpheme *v*.POS and an overt suffix *-su*. The latter is a degree morpheme that restricts the standard of comparison to lexical or contextual maximal degrees. I propose an analysis in terms of Maximize Presupposition: *v*.POS and *-su* constitute lexical alternatives where the latter is preferred over the former when maximal values are reached. *v*.POS is thus felicitous when no maximum is reached. The discussion bears on how telicity is achieved cross-linguistically when degree achievements are considered, thus enriching our typologies on the topic.

Keywords: degree achievement, creation predicate, telicity, Maximize Presupposition, Aymara.

1. Introduction

This paper addresses the compositional semantics of morphologically derived verbs of change in Southern Aymara (henceforth, Aymara). Aymara is an understudied Andean language spoken in southern Peru, Bolivia and northern Chile. Typologically, Aymara is a suffixal and to some extent agglutinative language whose sentences have an SOV order. In particular, I concentrate on the the Peruvian variety of the town of Pomata (province of Chicuito, department of Puno) that is spoken by 13,637 people (Instituto Nacional de Estadística e Informática, 2010).

In particular, I concentrate on verbal predicates of change that are derived by means of the suffix *-cha*. This suffix derives two kinds of predicates, i.e., degree achievements and creation predicates, as shown in the examples in (1) and (2) respectively:[2,3,4]

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[2]Abbreviations: 3 = third person, ABL = ablative, ACC = accusative, EVI = evidential, S = subject, TOP = topic.

[3]I put elided vowels in parentheses.

[4]I translate the examples in the past, as this is the default way native speakers understand the sentences I discuss (Aymara does not distinguish present and past). In addition, in Aymara, there are no determiners, so bare nouns could be understood as definite or indefinite. In what follows, all the arguments (subjects and objects) should be understood as singular and definite (for this reason, I glossed them with the definite determiner). I leave aside the contribution of the so-called evidential *-wa*.

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(1) a. Mariya ñik’ut(a)-∅ llusk’a-**ch(a)**-i-wa.
Mariya hair-ACC straight-**cha**-3S-EVI
‘Mary straightened the hair.’
b. Mariya mis(a)-∅ q’añu-**ch(a)**-i-wa.
Mary table-ACC dirty-**cha**-3S-EVI
‘Mary dirtied the table.’

(2) Jaqi uka thak(i)-∅ thaki-**ch(a)**-i-wa.
person that path-ACC path-**cha**-3S-EVI
‘The people built that path.’

The sentences in (1) illustrate degree achievements with *-cha* with the verbs *llusk’a-**cha**-ña* ‘to straighten’ and *qañu-**cha**-ña* ‘to dirty’ (the suffix *-ña* is the infinitival marker). Both sentences are similar to their English counterparts in the glosses in that they mean that the theme increases in their degree along the scale associated with the base predicates, i.e., the scale of straightness and dirtiness in the examples. In addition, *-cha* derives verbs creation predicates like *thaki-**cha**-ña* ‘to build (path-like things)’ in (2). This sentence means that an object, here a path, comes into existence. In this paper, I provide evidence that suggests that these two different kinds of verbal predicates should be analyzed in the same way in the Aymara case under discussion. Specifically, I argue that they should be analyzed as degree achievements in the sense of Kennedy and Levin (2008), i.e., in terms of an increase along a scale.

The main contribution of this paper regards how telicity contrasts are achieved in expressions including verbs with *-cha*. For instance, the English translation in (1a) and (2) have a default telic reading. (1a) has a default absolute reading in which a culmination is reached, i.e., the theme is straightened to its maximum (= a maximal degree of straightness is reached), so telic adverbials are preferred over atelic ones. The same can be said with regard to (2): this sentence has a default reading in which the building of the theme reaches a point in which it is fully built, so the distribution of adverbials is the same as for (1a). (1b), on the other hand, shows a different behavior: since the scale of dirtiness does not have a lexical maximum, culmination is not implied, which further means that atelic adverbials are preferred over telic ones.

Aymara is different in this regard. The sentences in (1) and (2) behave identically in that they are all understood in terms of the lack of a culmination, so atelic adverbials are preferred over telic ones. For a culmination to be reached, another suffix needs to be attached. This suffix is *-su*. The sentences in (1) and (2) are repeated below including *-su* now. In this case, then, telic adverbials are acceptable, but atelic ones are not. In other words, telicity contrasts in Aymara verbs derived with *-cha* depend on the presence or absence of *-su*.

(3) a. Mariya ñik’ut(a)-∅ llusk’a-**ch(a)**-<u>su</u>-(i)-wa.
Mariya hair-ACC straight-**cha**-<u>su</u>-3S-EVI
‘Mary straightened the hair (to a lexical maximal degree).’
b. Mariya mis(a) q’añu-**ch(a)**-<u>su</u>-(i)-wa.
Mary table-ACC dirty-**cha**-<u>su</u>-3S-EVI
‘Mary dirtied the table (to a contextual maximal degree).’

(4) Jaqi uka ut(a)-∅ uta-**ch(a)**-<u>su</u>-(i)-wa.
person that house-ACC house-**cha**-<u>su</u>-3S-EVI
'The people built that house (and finished it).'

I propose an analysis in terms of Maximize Presupposition Heim (1991): assuming Kennedy and Levin's (2008) account of degree achievements, I argue that Aymara has two degree morphemes, a covert verbal positive morpheme *v*.POS and *-su*, which are lexical alternatives. *-su* restricts the standard to maximal values; *v*.POS shows no restrictions in this regard. Since *-su* has a restricted domain, it is preferred over *v*.POS whenever a maximum is reached. This derives the contrast in telicity between Aymara and English, which in turn enriches our typologies regarding how telicity is achieved cross-linguistically. I thus provide evidence from Aymara for a so far unattested two degree morpheme system in connection with scalar verbs of change.

The data discussed in this paper are based on two sources of information: grammatical descriptions, in particular, Cerrón-Palomino (2008) and Gonzalo Segura (2011), and original fieldwork with two consultants. The methodology used for the latter involved the presentation of contextual scenarios using Spanish as an auxiliary language, which was followed by a request for a felicity judgment on a particular grammatical sentence given that contextual scenario. I refer the reader to Bochnak and Matthewson (2015), Davis et al. (2014), Matthewson (2004) for discussion regarding the soundness and validity of the aforementioned methodological choices.

The paper is organized as follows; in section 2, I discuss verbs with *-cha*, including what base predicates it takes, and why degree achievements and creation predicates should be analyzed in the same way in this case. In section 3, I add *-su* into the discussion, addressing the telicity contrasts it gives rise to. In section 4, I provide an account of the facts discussed and address the predictions of the analysis. In section 5, I summarize the main points of the discussion.

2. Verbs with *-cha*

In this section, I address derived verbs with *-cha*. In subsection 2.1, I discuss the meanings verbs with *-cha* can have and argue that they should be analyzed uniformly. In subsection 2.2, I discuss what base predicates *-cha* takes.

2.1. Degree achievements and creation predicates brought together

The suffix *-cha* derives degree achievements (5) and creation predicates (6).[5] The sentences in (5) mean that the theme *uta* 'the house' increases in the extent to which it is beautified (5a) or strengthened (literally, hardened) (5b). The sentence in (6) means that an object, *uta* 'the house' in this case, comes into existence—the verb *uta-**cha**-ña* is thus a creation predicate. This verb is used to mean that any house-like thing is built (e.g., schools, offices, buildings, etc.).

(5) a. Mariya ut(a)-∅ k'acha/t'ika-**ch(a)**-i-wa.
Mary house-ACC beautiful/ornament-**cha**-3S-EVI

[5] I set aside the contribution of the external argument.

'Mary beautified the house.'

b. Jaqi ut(a)-∅ qala-**ch(a)**-i-wa.
person house-ACC stone/hard-**cha**-3S-EVI
'The people strengthened the house.'

(6) Jaqi uka ut(a)-∅ uta-**ch(a)**-i-wa.
person that house-ACC house-**cha**-3S-EVI
'The people built that house.'

The sentences in (5) and (6) further show that *-cha* takes non-gradable and gradable bases. (5a) includes two derived verbs that mean the same, i.e., 'beautify'. Their bases are *k'acha* 'beautiful', which is gradable, and *t'ika* 'ornament', which is non-gradable. (5b) includes a derived verb whose base, *qala*, is ambiguous between a non-gradable version meaning 'stone' and a gradable version meaning 'hard'. The verb with *-cha*, however, can only mean 'to harden'. (6) includes a verb derived from the non-gradable base *uta* 'house'.

In what follows, I propose that degree achievement readings and creation predicate readings are to be analyzed uniformly when verbs with *-cha* are considered, specifically, they should be analyzed together as degree achievements (in the sense of Kennedy and Levin 2008; see section 4 for the proposal) involving gradable bases. I provide three pieces of evidence that suggest that a unified analysis should be pursued.

First, both degree achievements and, crucially, creation predicates can be modified by adverbial intensifiers, such as *sinti* 'a lot', *sinti-puni* 'too much' and *juk'aki* 'a little'. The claim is that if these modifiers are grammatical, the predicates involved are gradable, in this case, involving a degree achievement-like reading (see Kennedy 2012 for discussion). This is illustrated in (7).

(7) a. Mariya sinti / sinti-puni / juk'aki ut(a)-∅ k'acha/t'ika-**ch(a)**-i-wa.
Mary a.lot / too.much / a.little house-ACC beautiful/ornament-**cha**-3S-EVI
'Mary beautified the house a lot/too much/a little.'

b. Jaqi sinti / sinti-puni / juk'aki uka ut(a)-∅ uta-**ch(a)**-i-wa.
person a.lot / too.much / a.little that house-ACC house-**cha**-3S-EVI
'There was a lot/too much/a little of the people's building of that house.'
Lit. 'The people built that house a lot/too much/a little.'

Second, consider the pair of sentences in (5a) with the verbs *k'acha-***cha***-ña* and *t'ika-***cha***-ña* 'to beautify' with gradable *k'acha* 'beautiful' and non-gradable *t'ika* 'ornament' respectively. Interestingly, as suggested by means of the same gloss in the examples, sentences with these verbs appear to have rather similar meanings—in particular, the verb with non-gradable *t'ika* 'ornament' has the marks of property predication, just like the verb with gradable *k'acha* 'beautiful'. For instance, they are both felicitous if any improvement that beautifies *uta* 'the house' is made, e.g., by painting it or remodeling it. Note that this is not tied to actually putting ornaments in the theme, which is the literal meaning of *t'ika* 'ornament'. Another context in which these verbs can be used is shown in (8), where *Susi* is made more beautiful, e.g., by getting a new haircut or a new piece of jewelry. Of relevance here is thus the idea of making the theme (more) beautiful—i.e., the degree achievement reading.

(8) Mariya ut(a)-∅ / Sus(i)-∅ k'acha/t'ika-**ch(a)**-i-wa.
Mary house-ACC / Susi-ACC beautiful/ornament-**cha**-3S-EVI
'Mary beautified the house/Susi.'

Third, consider the sentence in (5b) with the verb *qala-**cha**-ña* 'to harden'. The base predicate is the ambiguous *qala* 'stone, hard'. Interestingly, the verb can only mean 'to harden' (not 'to turn into stones' or 'to create stones'). Thus, for instance, (5b), repeated below, is felicitous when the structures of the theme are strengthened, and, crucially, stones need not be involved—any strengthening will make (9) felicitous. In addition, targeting the non-gradable meaning is infelicitous: imagine a context in which a god turns things into stones. In this scenario, a sentence with *qala-**cha**-ña* 'to harden' is infelicitous. This suggests that only the degree achievement reading (i.e., the verb with the gradable base) is available in this case.

(9) Jaqi ut(a)-∅ qala-**ch(a)**-i-wa.
person house-ACC stone/hard-**cha**-3S-EVI
'The people strengthened the house.'

Based on these pieces of evidence, I propose that degree achievements and creation predicates in Aymara should be analyzed uniformly. In particular, in this paper I adopt the view that they should all be analyzed as degree achievements (in the sense of Kennedy and Levin 2008), being derived from a gradable base. I now turn to the distribution of the latter in verbs with *-cha*.

2.2. Base predicates

Following extensive literature on the topic (Cresswell, 1976; Kennedy and McNally, 2005; Klein, 1991; Pedersen, 2015), gradable base predicates can be characterized in terms of scales S, which are sets of linearly ordered degrees d along some dimension associated with a base predicate. A scale S is defined as follows:

(10) The scale S associated with a gradable base predicate is a pairing $\langle S, < \rangle$ or $\langle S, > \rangle$, where $<$ or $>$ is a linear order on S.

The minimal and maximal degrees in the scale S of a gradable base predicate are defined in (11)—note that if *min* or *max* exists, it is unique (since the scale is linearly ordered):

(11) a. *min*, the minimal degree $\in S$, is defined as the degree d such that no degree $d' < d$.
b. *max*, the maximal degree $\in S$, is defined as the degree d such that no degree $d < d'$.

The scale associated with a predicate could have (i) no minimal or maximal degree, i.e., open scales (12a), (ii) either a minimal or a maximal degree, i.e., partially closed scales, as in (12b), or (iii) both a minimal and a maximal degree, i.e., closed scales, as in (12c). (12) illustrates the same dimensions, i.e., beauty in (12a), cleanliness/dirtiness and curliness/straightness (12b), and emptiness/fullness in (12c) but opposite orderings, as indicated in the parentheses next to each item.

(12)	a.	*Open scales*			
		ugly	(>)	beautiful	(<)
	b.	*Partially closed scales*			
		clean	(>)	dirty	(<)
		curly	(>)	straight	(<)
	c.	*Closed scales*			
		empty	(>)	full	(<)

Turning now to verbs with *-cha*, the suffix takes gradable bases with any kind of scale, as shown in (13), i.e., open scales (13a), partially closed scales (13b)-(13c) and closed scales (13d).

(13)	a.	k'acha	'beautiful'	k'acka-**cha**-ña	'to beautify'
	b.	q'añu	'dirty'	qañu-**cha**-ña	'to dirty'
	c.	llusk'a	'straight'	llusk'a-**cha**-ña	'to straighten'
	d.	phuqa	'full'	phuqa-**cha**-ña	'to fill'

Moreover, as anticipated with regard to (5b)-(9), there is a group of bases for which there is a non-gradable and a gradable version. When the *-cha* verb is derived, only the gradable version of the base (whose scale is open) is used—as mentioned in subsection 2.1, targeting the non-gradable meaning is infelicitous; only the gradable meaning is available in the derived verb.

(14)	a.	qala	'stone, hard'	qala-**cha**-ña	'to harden'
	b.	qamaqi	'fox, witty'	qamaqi-**cha**-ña	'to become wittier'
	c.	anu	'dog, aggressive'	anu-**cha**-ña	'to become (more) aggressive'

An additional group of bases *-cha* takes is shown in (15). Here the bases are non-gradable. The verb with *-cha*, however, does not target the actual meaning of the base, but a property (i.e., a gradable) meaning of it (see Beavers 2011). I assume that the bases are turned into gradable to combine with *-cha*.[6] Thus, in (15a), the verb with *-cha* includes a property meaning 'beautiful' and, in (15b), it includes a property meaning 'cultivatedness'.

(15)	a.	t'ika	'ornament'	t'ika-**cha**-ña	'to beautify'
	b.	yapu	'sown field'	yapu-**cha**-ña	'to cultivate, to grow'

In general, the verbs with *-cha* in (13)-(15) have a degree achievement-like meaning—where a gradable base with a property scale is present.

The last group of bases *-cha* takes are the ones that derive creation predicates, i.e., they predicate of a theme that it comes into existence. As with regard to (15), here I assume that the bases are non-gradable; when they combine with *-cha*, they are turned into gradable having an extent scale associated with them (see Beavers 2011).[7] I further assume that these scales are top closed, i.e., there is a maximum corresponding to the actual presence of the entity denoted

[6] A general mechanism to turn non-gradable bases into gradable would be needed in this case. This would also be needed for (16) below. I set aside an explicit formulation of this in this paper.

[7] In this paper, extent scales are understood as scales involving that an entity comes into existence.

by the base. The theme in these cases has to be somewhat similar to what the base means. Thus, the theme (16a) has to be house-like (i.e., it must have, let us say, four walls and a roof), and the theme in (16a) has to be path-like (i.e., it must have, let us say, a gap perhaps flanked by borders where entities can go through).[8]

(16)	a.	uta	'house'	uta-**cha**-ña	'to build (house-like things)'
	b.	yapu	'path'	yapu-**cha**-ña	'to build (path-like things)'

To summarize, verbs with *-cha* derive two kinds of verbs, namely, degree achievements and creation predicates. The bases the suffix takes are both gradable and non-gradable. When taking the former, *-cha* derives degree achievements; when taking the latter, they are turned into gradable bases and *-cha* derives degree achievements or creation predicates.[9]

3. Adding *-su*: telicity contrast

In this section, I discuss how telicity contrasts are achieved in expressions including verbs with *-cha*. I first discuss telicity in connection with degree achievements in English, which I will use as a baseline in order to address how Aymara differs from it. As previous literature has pointed out with regard to English (see Dowty 1979; Abusch 1986; Winter 2006; Kennedy and Levin 2008), degree achievements like *straighten* in (17) are ambiguous between an absolute reading, where the theme reaches a maximal degree, namely, that representing a degree corresponding to fully straight—this is the default reading—, and a comparative reading where the theme ends up straighter, which is achieved when additional (e.g., contextual) cues are given:

(17) Mary straightened the hair.

With degree achievements like *dirty* in (18), on the other hand, the comparative reading is strongly preferred, since the scale associated with the verb does not include an absolute maximal degree (see Winter 2006; Kennedy and Levin 2008 for discussion):

(18) Mary dirtied the table.

This distinction has consequences when adverbial expressions targeting atelic and telic readings are considered. For sentences with verbs like *straighten*, telic adverbials like *in an hour* are preferred over atelic ones like *for an hour*, as shown in the contrast in (19), since the telic adverbial introduces a bound in the event, which is consistent with the presence of a maximal degree—as it constitutes a bound in the scale. This is not the case with atelic adverbials. This is shown in (19). For sentences with verbs like *dirty*, atelic adverbials are preferred over telic ones, since an atelic adverbial does not target a maximal degree. This is shown in (20).[10]

[8]I set aside a detailed account of what it means for a creation predicate to be analyzed as a degree achievement. See Beavers (2011), Kennedy (2012), Krifka (1998) and Piñón (2008) for relevant discussion.

[9]I leave the determination of details of the nature of the scale in (15)-(16) (i.e., whether it is open, partially closed or closed) for future research. I also set aside in what cases a non-gradable base derives a degree achievement or a creation predicate.

[10]The sentences to follow are conceived of as said out of the blue.

(19) a. Mary straightened the hair in an hour.
b. ??Mary straightened the hair for an hour.

(20) a. ?Mary dirtied the table in an hour.
b. Mary dirtied the table for an hour.

When Aymara degree achievements with *-cha* are considered, in principle, the expectation would be that they behave as their English counterparts when it comes to the adjunction of (a)telicity adverbial expressions. However, this is not the case. To test (a)telicity, I make use of the telic adverbial *mä ura-tha* 'in an hour' and the atelic adverbial *mä ura* 'for an hour'. What distinguishes the adverbials is the ablative suffix *-tha*, which is present in telic adverbials, but is absent in atelic ones.

To illustrate this, I add the (a)telicity adverbials to the examples in (1) and (2) above, as shown below. What can be readily noticed is that there is no contrast with regard to (a)telicity regardless of the presence or absence of a maximum value in the scales associated with the verbs. In the case of *llusk'a-**cha**-ña* 'to straighten' in (21), there is a maximum in the scale. In the case of *qañu-**cha**-ña* 'to dirty' in (22), on the other hand, there is no absolute value on the relevant end in the scale. Despite these differences, which make English degree achievements vary with regard to (a)telicity, as shown in (19)-(20) above, the Aymara examples are consistently marked with the telic adverbial *mä ura-tha* 'in an hour' and consistently good with the atelic adverbial *mä ura* 'for an hour'. The same holds in (23) with *thaki-**cha**-ña* 'to build (path-like things)': regardless of the presence of a maximum in the scale, telic adverbials are bad and atelic ones are good.

(21) a. ??Mariya mä ura-tha ñik'ut(a)-∅ llusk'a-**ch(a)**-i-wa.
Mariya one hour-ABL hair-ACC straight-**cha**-3S-EVI
'Mary straightened the hair in a hour.'
b. Mariya mä ura ñik'ut(a)-∅ llusk'a-**ch(a)**-i-wa.
Mariya one hour hair-ACC straight-**cha**-3S-EVI
'Mary straightened the hair for an hour.'

(22) a. ??Mariya mä ura-tha mis(a)-∅ q'añu-**ch(a)**-i-wa.
Mary one hour-ABL table-ACC dirty-**cha**-3S-EVI
'Mary dirtied the table in a hour.'
b. Mariya mä ura mis(a)-∅ q'añu-**ch(a)**-i-wa.
Mary one hour table-ACC dirty-**cha**-3S-EVI
'Mary dirtied the table in a hour.'

(23) a. ??Jaqi mä ura-tha uka thak(i)-∅ thaki-**ch(a)**-i-wa.
person one hour-ABL that path-ACC path-**cha**-3S-EVI
'The people built that path in an hour.'
b. Jaqi mä ura uka thak(i)-∅ thaki-**ch(a)**-i-wa.
person one hour that path-ACC path-**cha**-3S-EVI
'The people built that path for an hour.'

For telic adverbials to be grammatical when verbs with *-cha* are present, the suffix *-su* needs to be added, as shown in (24)-(26). In grammar descriptions of Aymara, this suffix is glossed as 'completely' (see Gonzalo Segura 2011). When it is present, the judgements in (21)-(23) are reversed: telic adverbials become grammatical and atelic ones become marginal. Note in the examples that the contrast in judgment is sharp in this case: whenever *-su* is present, atelic adverbials become marginal. Again, it is worth emphasizing that all the sentences show the same behavior in terms of (a)telicity regardless of the presence or absence of absolute endpoint values in the scales associated with the verbs under discussion. The main contrast is thus between the presence or absence of *-su*.

(24) a. Mariya mä ura-tha ñik'ut(a)-∅ llusk'a-**ch(a)**-<u>su</u>-(i)-wa.
Mariya one hour-ABL hair-ACC straight-**cha**-<u>su</u>-3S-EVI
'Mary straightened the hair in a hour.'
b. ?*Mariya mä ura ñik'ut(a)-∅ llusk'a-**ch(a)**-<u>su</u>-(i)-wa.
Mariya one hour hair-ACC straight-**cha**-<u>su</u>-3S-EVI
'Mary straightened the hair for an hour.'

(25) a. Mariya mä ura-tha mis(a)-∅ q'añu-**ch(a)**-<u>su</u>-(i)-wa.
Mary one hour-ABL table-ACC dirty-**cha**-<u>su</u>-3S-EVI
'Mary dirtied the table in a hour.'
b. ?*Mariya mä ura mis(a)-∅ q'añu-**ch(a)**-<u>su</u>-(i)-wa.
Mary one hour table-ACC dirty-**cha**-<u>su</u>-3S-EVI
'Mary dirtied the table in a hour.'

(26) a. Jaqi mä ura-tha uka thak(i)-∅ thaki-**ch(a)**-<u>su</u>-(i)-wa.
person one hour-ABL that path-ACC path-**cha**-<u>su</u>-3S-EVI
'The people built that path in an hour.'
b. ?*Jaqi mä ura uka thak(i)-∅ thaki-**ch(a)**-<u>su</u>-(i)-wa.
person one hour that path-ACC path-**cha**-<u>su</u>-3S-EVI
'The people built that path for an hour.'

This discussion begs the question of what kind of element *-su* is. The hypothesis that I pursue in the next section is that it is a degree morpheme that targets maximal degrees.

4. Proposal

In this section, I propose an analysis of verbs with *-cha* including the telicity contrasts in connection with the presence or absence of *-su*. Subsection 4.1 discusses the semantics I assume for verbs with *-cha*; subsection 4.2 argues that *-su* is a degree morpheme; subsection 4.3 is the analysis; subsection 4.4 discusses the predictions of the analysis.

4.1. The semantics of derived verbs with *-cha*

To account for the meanings of verbs with *-cha* in Aymara, my proposal is similar to Kennedy and Levin's (2008) account for English, which I briefly summarize below. The authors suggest that degree achievements denote a differential measure function that measures the amount that an entity changes along a scale associated with a base predicate as a result of participating in an event (see also Hay et al. 1999; Kennedy 2012; Pedersen 2015 for alternative formalizations).[11] The amount mentioned corresponds to the output of the differential measure function, which equals the degree that represents the positive difference between two degrees, namely, the degree to which the theme measures the function denoted by a gradable predicate at the end of an event minus the degree to which the theme measures the function denoted by a gradable predicate at the beginning of the event; this captures the idea that there is an increase in a scale. Degree achievements are always closed on the end of the scale corresponding to this degree, i.e., there is always a derived minimum. For Kennedy and Levin (2008), the differential measure function is derived from 'regular' measure functions, i.e., those denoted by gradable predicates *m*—here I assume that gradable bases denote measure functions that map an individual and an event into a degree, where the degree is held constant in the event (Morzycki, 2015). The denotations of 'regular' and derived measure functions are shown in (27a) and (27b) respectively (Kennedy and Levin's 2008:173):

(27) a. $[\![\text{m}]\!] = \lambda x \lambda e[m(x,e)]$
b. For any measure function m, $m_\Delta = \lambda x \lambda e[m^{\uparrow}_{m(x,ini(e))}(x, fin(e))]$

I adopt this semantics for verbs with *-cha*, thus giving a unified semantics to degree achievements and creation predicates. My proposal differs from Kennedy and Levin's (2008) in that I suggest that, in Aymara, *-cha* is the lexical item that derives the differential measure function—this follows Hay et al. (1999) and Pedersen (2015), who propose that an (abstract) suffix *-en* in English derives degree achievements from gradable predicates. This move seems warranted, since *-cha* systematically derives the verbs under discussion. The denotation of *-cha* appears in (28). Thus, *-cha* takes as arguments a measure function *m* (a gradable predicate), an individual *x* and an event *e* and gives a degree that results from the difference of the degree to which *x* measures *m* at the end of *e* minus the degree to which *x* measures *m* at the beginning of *e*. In what follows, I use the abbreviated version using m_Δ in (28b) (this follows Kennedy and Levin's 2008 convention in their discussion of English).

(28) a. $[\![\text{-cha}]\!] = \lambda m \lambda x \lambda e[m^{\uparrow}_{m(x,ini(e))}(x, fin(e))]$
b. $[\![\text{-cha}]\!] = \lambda m \lambda x \lambda e[m_\Delta(x,e)]$

I exemplify the proposal with the examples in (1) and (2), which are repeated in (29):

(29) a. Mariya ñik'ut(a)-∅ llusk'a-**ch(a)**-i-wa.
Mariya hair-ACC straight-**cha**-3S-EVI
'Mary straightened the hair.'

[11] Kennedy and Levin (2008:172) define the difference function as in (i)—I state it in terms of events here:

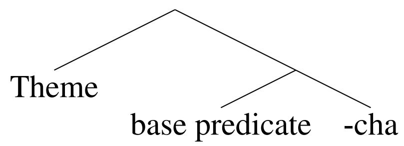
(i) For any measure function m from objects x and events e to degrees d on scale S, and for any $d \in S$, $m^{\uparrow}_d$ is a function just like m except that:
a. its range is $\{d' \in S : d \leq d'\}$, and
b. for any x, e in the domain of m, if $m(x)(e) \leq d$ then $m^{\uparrow}_d(x,e) = d$.

b. Mariya mis(a)-∅ q'añu-**ch(a)**-i-wa.
Mary table-ACC dirty-**cha**-3S-EVI
'Mary dirtied the table.'

c. Jaqi uka thak(i)-∅ thaki-**ch(a)**-i-wa.
person that path-ACC path-**cha**-3S-EVI
'The people built that path.'

Restricting to the relevant part of the VPs under discussion, I assume the LF in (30) for Aymara VPs. This representation does not include degree morphology, which will be discussed in the next subsections.

(30)



The denotations of the VPs present in (29) appear below:

(31) a. $[\![\text{-cha}]\!]([\![\text{llusk'a}]\!])([\![\text{ñikuta}]\!]) = \lambda e[\mathit{straight}_{\Delta}(\mathit{hair}, e)]$
b. $[\![\text{-cha}]\!]([\![\text{qañu}]\!])([\![\text{misa}]\!]) = \lambda e[\mathit{dirty}_{\Delta}(\mathit{table}, e)]$
c. $[\![\text{-cha}]\!]([\![\text{thaki}]\!])([\![\text{uka thaki}]\!]) = \lambda e[\mathit{path\text{-}build}_{\Delta}(\mathit{that\ path}, e)]$

The denotations in (31) make explicit that there is a differential degree. This degree corresponds to the difference of the degree to which the theme measures the function denoted by the gradable base at the end of the event minus the degree to which the theme measures such function at the beginning of the event. In the examples, it is the degree to which the theme was straightened (31a), dirtied (31b) and built (31c)—this captures the idea that there has been an increase along a scale. In the next subsection, I turn to *-su*'s status as a degree morpheme.

4.2. *-su* as a degree morpheme

In this subsection, I provide morphosyntactic evidence that suggests that *-su* is a degree morpheme. The claim is that *-su* merges very low in the structure, which is the position where degree morphemes are combined. Gonzalo Segura (2011) shows that *-su* is a suffix that combines very close to the verbal domain, in fact, it appears right next to *-cha*. It precedes all the morphemes that alter the verbal valence, such as the anticausative *-ta* and the benefactive *-rapi*. It also precedes aspectual markers. For instance, the durative *-ska*, merges after *-su*—the durative also combines in the structure after the suffixes that alter the valence of the verb are combined. This distribution is consistent with *-su* being a degree morpheme, since this kind of elements are claimed to combine in a very low position in the structure (Hay et al., 1999; Kennedy and Levin, 2008; Pedersen, 2015).

The relative position of *-su* and *-ska* is of particular interest here, since it could be argued that *-su* is some kind of perfect(ive) aspectual marker, since it is closely tied to telic readings, as discussed in section 3. If *-su* were an aspectual marker, the prediction would be that these two suffixes would not co-occur—as they would head the same projection (e.g., AspectP)—, contrary to fact (see Merchant 2015 and references therein for discussion on the relative position of AspectP in the syntactic spine). in this regard, consider the example in (32), in which *-su* and *-ska* appear in the same clause. In the example, the duration of the event of Mary dirtying the table is extended, and it ends reaching a point in which it cannot be dirtied anymore. Under the hypothesis that *-su* targets maximal values, the presence of this suffix in (32) would mean that a (contextual) maximal degree at the end of the event is reached (as the scale associated with the base *qañu* 'dirty' does not include a lexical one). The English translation using the progressive tries to make explicit that the duration of the event was extended.

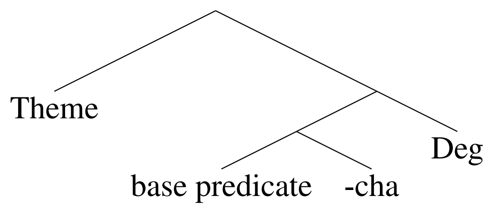
(32) Mariya mis(a)-∅ qañu-**ch(a)**-su-sk(a)-i-wa.
Mary table-ACC dirty-**cha**-su-DUR-3S-EVI
'Mary was dirtying the table (and reached a contextual maximal degree).'

The sentence when *-su* is absent is also grammatical, as shown in (33). In this case, the duration of the event is also extended. Crucially, (32) and (33) differ minimally in that a maximal degree is not reached in the latter (since *-su* is absent). Note that in both sentences the durative's contribution to the meaning of the sentence is the same: the duration of the event is extended. Crucially, this meaning does not compete with or replace the contribution of *-su*.

(33) Mariya mis(a)-∅ qañu-**cha**-sk(a)-i-wa.
Mary table-ACC dirty-**cha**-DUR-3S-EVI
'Mary was dirtying the table (and reached a non-maximal degree).'

As anticipated, the relative position of the suffixes in Aymara is consistent with the proposal that *-su* is a degree morpheme, as it combines in a very low position in the structure (Hay et al., 1999; Kennedy and Levin, 2008; Pedersen, 2015). Based on this, I revise the LF in (30) to include degree morpheme *Deg*. Note that in (34) it is made explicit that *Deg* is combined right after the verb is formed.

(34)



In the next subsection, I turn to the semantics of *-su* and discuss its relation to *v*.POS.

4.3. Semantics of *-su* and its relation to *v*.POS

Following Kennedy and Levin (2008) (see also Pedersen 2015) in their account for English, I assume that the role of degree morphology is to turn a measure of change into a property of events. In their account, degree morphology includes a standard function, which represents the minimum degree required to stand out in a given context. Degree morphology is assumed to inherit the scalar properties of the gradable base in degree achievements relative to the kind of measurement encoded by the gradable base. A degree morpheme is of type $\langle\langle e, sd\rangle, \langle e, st\rangle\rangle$ (I use s for the type of events). In English, the relevant degree morphology is a verbal positive morpheme *v*.POS, which takes a derived measure of change and turns it into a property of events. Following Kennedy and Levin's (2008) convention, I use m_Δ as an abstract representation of derived measures of change; I also use m_Δ for variables of type $\langle e, sd\rangle$, which is the type of derived measures of change. (35b) says that that application of $[\![v.\text{POS}]\!]$ to $[\![\text{m}_\Delta]\!]$ yields a function that is true of individual x and event e if and only if the degree of m_Δ (i.e., the amount to which x changes in e) exceeds the minimal value or equals the maximal value of the standard of m_Δ. To implement the assignments of values of the standard function, I propose a contextual variable assignment g that assigns a value to free variables represented with index i of type d such that $g(i)$ is in the domain of m_Δ (see Barker 2002; Heim 1994; Lewis 1979; Stanley 2000).

(35) a. $[\![v.\text{POS}_i]\!]^g = \lambda m_\Delta \lambda x \lambda e[m_\Delta(x,e) \geq g(i)]$
b. $[\![v.\text{POS}_i]\!]^g([\![\text{m}_\Delta]\!]^g) = \lambda x \lambda e[m_\Delta(x,e) \geq g(i)]$

Kennedy and Levin (2008:169) further propose that the value of the standard function is guided by the principle of Interpretive Economy, stated below (this follows Kennedy 2007; see also Pedersen 2015):

(36) Maximize the contribution of the conventional meanings of the elements of a sentence to the computation of its truth conditions.

There are two cases to consider, namely, when the degree achievement's scale has or does not have a lexical endpoint value—(37) repeats (17) and (18):

(37) a. Mary straightened the hair.
b. Mary dirtied the table.

If the verb does not include a lexical endpoint value, like with *dirty* in (37b), there is nothing to maximize, so the value of the standard equals a derived minimum (a derived zero), i.e., the output degree of the measure function applied to the individual at the beginning of the event. Exceeding this minimum accounts for the comparative reading of degree achievements—this reading is available with all the verbs. If the degree achievement's scale does include a lexical endpoint value, like with *straighten* in (37a), then conventional meanings are maximized and the standard function equals the lexical maximal value in the scale. Being equal to this standard accounts for the absolute reading of degree achievements—this reading is restricted to those verbs including lexical maximal values. Interpretive Economy in (36) thus accounts for the preference of the latter reading when a degree achievement includes a lexical maximum.

Under my implementation of the standard function in terms of variable assignment g, the assignment of minimal or maximal values is stated as follows:

(38) a. If m_Δ has a (lexical) maximal value *max*, $g(i) = max(m_\Delta)$.
b. If m_Δ does not have a (lexical) maximal value *max*, $g(i) = min(m_\Delta)$.

The denotations of (37) are as shown below. The value of $g(i)$ in (39a) follows from (38a) and the value of $g(i)$ in (39b) follows from (38b).

(39) a. $[\![(37a)]\!]^g = \lambda e[straight_\Delta(hair, e) = max(straight_\Delta)]$
b. $[\![(37b)]\!]^g = \lambda e[dirty_\Delta(the table, e) > min(dirty_\Delta)]$

I now turn to Aymara. Recall that I argued in section 4.1 that *-cha* takes a gradable base denoting a measure function and turns it into a differential differential measure one. The difference between English and Aymara lies in that in the latter there are two verbal degree morphemes, that is, in addition to verbal positive morpheme *v.*POS, there is overt *-su*. In the spirit of Heim (1991) (see also Percus 2006), the suggestion is that the two morphemes constitute lexical alternatives LEXALT in competition, as represented in (40). While *-su* restricts the value of the standard to maximal ones, *v.*POS does not show any restriction, just as the English counterpart in (35a). Under the assumption that the option with a restricted domain is preferred, *-su* blocks *v.*POS whenever a maximum is available. The denotation of *v.*POS is repeated below for Aymara in (41a) and the denotation of *-su* appears in (41b). The only difference between the two lies in the domain restriction in *-su*, where the standard equals a maximal degree. Note that this means that in Aymara Interpretive Economy need not apply in the case of the expressions under discussion, since there are additional lexical means that maximize means.

(40) LEXALT = {*v.*POS$_i$, -su$_i$}, where -su$_i$ blocks *v.*POS$_i$ if $max(m_\Delta)$ in m_Δ is reached.

(41) a. $[\![v.\text{POS}_i]\!] = \lambda m_\Delta \lambda x \lambda e[m_\Delta(x, e) \geq g(i)]$
b. $[\![\text{-su}_i]\!] = \lambda m_\Delta : g(i) = max_i(m_\Delta).\lambda x \lambda e[m_\Delta(x, e) \geq g(i)]$

In terms of what value is assigned to index *i*, in Aymara, there are three cases to consider. Two of them are similar to those that work for the English case stated in (38): if there is a lexical maximal value in the scale, it will be used (38a) and if there is no lexical maximal value in the scale, the derived minimum is used (38b), with the difference that the latter in Aymara does not show a restriction to the cases where no lexical maximal value is present—since this will be the value targeted when *v.*POS is present regardless of the presence or absence of a maximal value in the scale associated with the degree achievement. In addition to these two cases, recall that, when *-su* is present, another possibility is available: when the scale does not include a lexical maximal value, a contextual maximal value is used.[12] The three cases are stated in (42). I distinguish lexical maximal values and contextual maximal ones by means of the notation max^l and max^c respectively.

(42) a. If m_Δ has a (lexical) maximal value *max*, $g(i) = max^l(m_\Delta)$.
b. If m_Δ does not have a (lexical) maximal value *max*, $g(i) = max^c(m_\Delta)$.
c. $g(i) = min(m_\Delta)$.

[12] Note that this case is not completely out in English. It is needed when a telic reading of a degree achievement without a lexical maximal degree in the scale associated with it is targeted (see Hay et al. 1999 for discussion).

To illustrate the mechanics of the account, recall the examples in (29), to which I add *-su*:

(43) a. Mariya ñik'ut(a)-∅ llusk'a-**ch(a)**-su-(i)-wa.
Mariya hair-ACC straight-**cha**-su-3S-EVI
'Mary straightened the hair.'

b. Mariya mis(a)-∅ q'añu-**ch(a)**-su-(i)-wa.
Mary table-ACC dirty-**cha**-su-3S-EVI
'Mary dirtied the table.'

c. Jaqi uka thak(i)-∅ thaki-**ch(a)**-su-(i)-wa.
person that path-ACC path-**cha**-su-3S-EVI
'The people built that path.'

With regard to the sentences when *-su* is absent (i.e., (29)), the reasoning is as follows: they all have *v*.POS. In this case, the standard function could equal a minimal or a maximal value, since *v*.POS shows no restriction whatsoever in this regard. However, the standard will not equal a maximal degree in these cases, because there is another lexical alternative, *-su*, which is used instead to denote that a maximal degree is reached. Thus, the standard with *v*.POS will equal a minimum. With regard to the sentences when *-su* is present, the value of the standard is specified in the denotation of *-su*. Specifically, there is a domain restriction that explicitly states that for the sentences to be defined the standard must equal a maximal degree. In (43a) and (43c), the standard equals a maximal degree that is lexical, since the scales associated with the verbal predicates incorporate lexical maximal degrees. In (43b), on the other hand, the standard equals a maximal degree that is contextual, as the scale associated with the verbal predicate does not incorporate a lexical maximal degree.

The denotations of (29) and (43) appear below. The denotations of the sentences in (29) (those without *-su*, i.e., with *v*.POS) appear in (44). Here it is made explicit that the standard equals a minimum, which falls under the assignment in (42c). These correspond with the comparative readings. The denotations in (45) are the ones of the sentences with *-su* in (43). Here the standard equals maximal degrees, whether lexical, as in (45a) and (45c) (this falls under the assignment in (42a)), or contextual, as in (43b) (this falls under the assignment in (42b)). These correspond with the absolute readings.

(44) a. $[\![(29a)]\!] = \lambda e[straight_{\Delta}(hair, e) > min(straight_{\Delta})]$
b. $[\![(29a)]\!] = \lambda e[dirty_{\Delta}(table, e) > min(dirty_{\Delta})]$
c. $[\![(29c)]\!] = \lambda e[path\text{-}build_{\Delta}(that\, path, e) > min(path\text{-}build_{\Delta})]$

(45) a. $[\![(43a)]\!]$ is defined iff $g(i) = max^{l}(straight_{\Delta})$.
When defined, $[\![(43a)]\!] = \lambda e[straight_{\Delta}(hair, e) = max^{l}(straight_{\Delta})]$
b. $[\![(43b)]\!]$ is defined iff $g(i) = max^{c}(dirty_{\Delta})$.
When defined, $[\![(43b)]\!] = \lambda e[dirty_{\Delta}(table, e) = max^{c}(dirty_{\Delta})]$
c. $[\![(43c)]\!]$ is defined iff $g(i) = max^{l}(path\text{-}build_{\Delta})$.
When defined, $[\![(43c)]\!] = \lambda e[path\text{-}build_{\Delta}(that\, path, e) = max^{l}(path\text{-}build_{\Delta})]$

The proposal accounts for the telicity contrast discussed in section 3. Since *-su* targets maximal degrees only, telic adverbials are grammatical (i.e., the absolute readings targeted in the presence of *-su* correspond with telic readings), but atelic ones are ungrammatical (when *-su* is present, the comparative reading is not possible). In the case of *v*.POS, the opposite holds, since the standard equals a minimum in the scale: since the comparative reading is targeted, atelic adverbials are possible, whereas telic adverbials are not.

4.4. Predictions

The analysis predicts that it should only be possible to combine *-su* with verbs that allow degree morphology. This is borne out. Consider the examples below. The examples in (46) include a lexical degree achievement: the verb *ch'iyara-ña* 'to darken' allows *-su*. The example in (47) includes *pichawaya-ña* 'to sweep' (an activity according to its aspectual class); here *-su* is not allowed.

(46) a. Jusiya uka is(i)-∅ ch'iyar(a)-i-wa.
Joseph this dress-ACC darken-3S-EVI
'Joseph darkened the dress to a non-maximal degree.'
b. Jusiya uka is(i)-∅ ch'iyar(a)-su-(i)-wa.
Joseph this dress darken-su-3S-EVI
'Joseph darkened the dress to a maximal degree.'

(47) a. Jusiya ut(a)-∅ pichaway(a)-i-wa.
Joseph house-ACC sweep-3S-EVI
'Joseph sweeped the house.'
b. *Jusiya ut(a)-∅ pichaway(a)-su-(i)-wa.
Joseph house-ACC sweep-su-3S-EVI
'Joseph sweeped the house to a maximal degree.'

Another interesting case to test involves the suffix *-ra*, which also derives degree achievements in Aymara. The distribution of the bases this suffix takes shows that gradable bases including a lexical maximal degree are ungrammatical. It can only take gradable bases that do not include it, as illustrated below—I set aside further differences between verbs with *-cha* and *-ra*:

(48) a. *q'amu-**ra**-ña 'to clean'
b. qañu-**ra**-ña 'to dirty'

(49) a. *llusk'a-**ra**-ña 'to straighten'
b. phirqa-**ra**-ña 'to curl'

More generally, degree achievements with *-ra* cannot denote maximal degrees. Of particular interest here is that *-su* is ungrammatical with degree achievements derived with *-ra*, which is expected if *-su* targets maximal degrees.

(50) a. *qañu-**r(a)**-su-ña 'to dirty to a (contextual) maximal degree'
b. *phirqa-**r(a)**-su-ña 'to curl to a (contextual) maximal degree'

Finally, recall adverbial expressions. As discussed in subsection 2.1, verbs with *-cha* allow adverbial modification with elements like *sinti* 'a lot', *sinti-puni* 'too much' and *juk'aki* 'a little'. These elements are also possible in verbs with *-cha* taking *-su*. The expectation is that the former should be possible and the latter should be marked with sentences uttered out of the blue, since the former is compatible with high degrees, including maximal ones, whereas the latter is compatible with low (non-maximal) degrees. This prediction is borne out, as shown in (51).[13]

(51) Jaqi sinti / sinti-puni / ?*juk'aki uka ut(a)-∅ uta-**ch(a)**-i-wa.
person a.lot / too.much / a.little that house-ACC house-**cha**-3S-EVI
'There was a lot/too much/a little of the people's building of that house (to a maximal degree).'

5. Conclusion

This paper provides evidence for a two degree morpheme system combining with scalar predicates in Aymara. The suffix *-cha* derives degree achievements and creation predicates. I argued that they should be analyzed uniformly as degree achievements. I further discussed that telic readings correspond with the presence of the suffix *-su*; in its absence, atelic readings are yielded. I proposed that *-su* is a degree morpheme that is in competition with a verbal positive morpheme *v.*POS. The former restricts the standard of comparison to maximal degrees, whereas the latter remains unrestricted. For this reason, *-su* is preferred over *v.*POS whenever a maximal degree is reached. Aymara then differs from English in that in the former telicity contrasts rely on the presence or absence of lexical means (i.e., of *-su*), whereas in the latter there is a need to resource to a pragmatic principle to maximize the lexical means that are present in the base predicate included in the verb. The Aymara system thus enriches our typology regarding how telicity is achieved cross-linguistically when scalar verbs are considered.

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[13] Only when it is made explicit via contextual cues that the maximal degree is very low in the scale does *juk'aki* 'a little' become better. This suggests that reaching a maximal degree does not necessarily mean to become a member of the positive extension of the gradable base—which is a possible case under the analysis pursued here under (42b), where a contextual maximal degree is assigned.

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Extreme nouns and maximizers[1]

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Abstract. Maximizers (*completamente* 'completely', *totalmente* 'totally') are degree modifiers restricted to maximum standard adjectives. Spanish adjectives of completeness [ACs] (*completo 'complete'*, *total* 'total') display a behavior similar to that of their adverbial counterparts when they combine with nouns like *idiot*. This paper argues that ACs are maximality modifiers of *idiot*-like nouns, which are defended to be gradable and denote extreme degrees of properties. Establishing a parallelism between adverbs and adjectives of completeness allows us to explore scalarity across categories and the relevance of scale structure in the nominal domain.

Keywords: extreme nouns, maximizers, adjectives of completeness, scale structure, nominal gradability.

1. Introduction

Maximizers are degree modifiers that compose only with adjectives that use a scale with a maximum (Rotstein and Winter, 2004; Kennedy and McNally, 2005). Some of these modifiers have adjectival forms that combine with nouns. These adnominal forms are thus a valuable way of exploring gradability, and ultimately scale structure, in the nominal domain. In Spanish, the adnominal counterparts of the maximizers *completamente* 'completely' and *totalmente* 'totally' appear with nouns like *idiot* (1).

(1) Juan es un {completo idiota / total desastre}.
Juan is a complete idiot total mess
'Juan is a {complete idiot / total mess}.'

The type of modification *completo* 'complete' or *total* 'total' [henceforth, adjectives of completeness or ACs] perform in the noun seems to be degree modification. If it is so, two issues arise. First, nouns like *idiot* would be gradable. Second, ACs would be degree modifiers sensitive to scale structure. This is in conflict with the common view of nouns as non-gradable, as opposed to adjectives (see Bolinger, 1972; Matushansky, 2002; Morzycki, 2009; Constantinescu, 2011; Sassoon, 2013, a.o.).

This paper argues that ACs are maximality modifiers of *idiot*-like nouns, which are gradable and denote extreme degrees. I adopt Morzycki's (2012a) analysis of extreme adjectives for

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Spanish evaluative nouns. Nouns like *idiot* include a degree argument and a requirement that the value of this argument is above the contextually relevant scale. The degrees that are off the scale constitute a maximum for ACs, and also explain the partial maximizer behavior of these modifiers with *idiot*-like nouns. This analysis thus unifies the semantics of adverbs and adjectives of completeness and discusses the relevance of scale structure in the nominal domain.

This paper proceeds as follows. §2 introduces the data about maximizers in the adjectival domain, which is compared to the behavior of ACs when modifying *idiot*-like nouns in §3. §4 is devoted to show that nouns like *idiot* are gradable and denote extreme degrees and puts forward an analysis of these nouns as extreme predicates. It also discusses their subjectivity. The semantics of ACs is tackled in §5, which includes a discussion of previous analyses in terms of quantification over properties. Finally, §6 concludes.

2. Maximizers in the adjectival domain

The scales used by gradable adjectives differ in whether they include a maximal and/or a minimum value (Rotstein and Winter, 2004; Kennedy and McNally, 2005). These endpoints are relevant for the calculation of the standard for the predicate. Particularly, the standard of comparison of the adjective is set to the value of the upper or lower bound of the scale whenever there is one. Otherwise, the standard is computed contextually (Kennedy, 2007). From this observation, a typology of adjectives based on their scale structure can be established (2) (Rotstein and Winter, 2004; Kennedy and McNally, 2005).

(2) a. (Totally) open scale adjectives: *alto* 'tall', *ancho* 'wide', *bello* 'beautiful'
b. Lower closed scale adjectives: *sucio* 'dirty', *impuro* 'impure', *húmedo* 'wet'
c. Upper closed scale adjectives: *limpio* 'clean', *seco* 'dry', *libre* 'free'
d. (Totally) closed scale adjectives: *abierto* 'open', *lleno* 'full', *oscuro* 'dark'

Some modifiers are sensitive to the scale structure of the adjectives. For instance, maximizers such as *completamente* 'completely' or *totalmente* 'totally' only appear with upper or totally closed scale adjectives (3) (Rotstein and Winter, 2004; Kennedy and McNally, 2005).

(3) a. completamente {seco / oscuro / libre / abierto / limpio / lleno}
completely dry dark free open clean full
b. ??completamente {alta / ancho / bello / impuro / sucio}
completely tall wide beautiful impure dirty

Maximizers convey that the referent has a maximal degree of the gradable property denoted by the adjective they modify. Formally, these modifiers set the value of the degree argument of the adjective G to the maximum in its scale S_G (4) (Kennedy and McNally, 2005). The restriction on upper and totally closed scale adjectives is accounted for by the function **max**, which only yields a value if the scale has a defined maximum.

(4) $[\![completely]\!] = \lambda G \lambda x.\exists d[d = \mathbf{max}(S_G) \wedge G(d)(x)]$
(Kennedy and McNally, 2005: 369)

Maximizers share a number of properties. First, they entail that the end of the scale has been reached. Consequently, it is contradictory to assert that the referent can have a higher degree of the property (5a) (Kennedy and McNally, 2005). Second, the construction *maximizer G* is a total construct, in the sense that it has the distribution of an upper-closed scale adjective (Rotstein and Winter, 2004). This is shown by the fact that it is compatible with casi 'almost' (5b). And third, because of the universal quantification in the semantics of the max function, *maximizer G* accepts exceptive phrases (5c).

(5) a. #El avión está completamente lleno; hay un asiento libre en la primera fila.
The plane is completely full there.is a seat free in the first row
'The plane is completely full; there is an empty seat in the first row.'
b. El avión está casi completamente lleno.
the plane is almost completely full
c. El avión está completamente lleno, excepto un asiento en la primera fila.
the plane is completely full except a seat in the first row
'The plane is completely full, except for a seat in the first row.'

In short, maximizers are degree modifiers restricted to adjectives that lexicalize a scale closed (at least) in its upper end. They set the degree of the property denoted by the adjective to its maximum value. Next section is devoted to show the behavior of ACs with *idiot*-like nouns.

3. Adjectives of completeness and *idiot*-like nouns

As shown in (1), nouns like *idiot* combine with ACs. The question is whether these modifiers are acting like maximizers when appearing with nouns like *idiot*. This section compares the properties of ACs modifying these nouns to those of maximizers modifying adjectives.

First, maximizers entail that the end of the scale associated with the predicate has been reached (5a). Consequently, the referent cannot have more of the property denoted by the predicate than it already has. As expected, there is a contradiction in asserting that Juan could be more of an idiot than a complete idiot (6a). However, when Juan's complete idiocy is compared to someone else's, the examples become more acceptable, although not perfect (7a).

(6) a. #Juan es un completo idiota, pero podría serlo más.
Juan is a complete idiot but could.3SG be CL more
'Juan is a complete idiot, but he could be more of an idiot.'
b. #La clase es un absoluto desastre, pero podría serlo más.
the class is a absolute mess but could.3SG be CL more
'The class is an absolute mess, but it could be more of a mess.'

(7) a. ?Juan es un completo idiota, pero su hermano lo es más.
Juan is a complete idiot but his brother CL is more
'Juan is a complete idiot, but his brother is more of an idiot.'
b. ?La clase es un absoluto desastre, pero la de María lo es más.
the class is a absolute mess but the of María CL is more
'The class is an absolute mess, but María's is more of a mess.'

Second, although maximality modifiers are compatible with *casi* 'almost' (5b), they are ruled out with nouns like *idiot* (8a). And third, expressions including maximizers accept exceptive phrases (5c). As for *idiot*-like nouns, exceptives are acceptable, yet slightly degraded (7a).

(8) a. ??Juan es un casi completo idiota.
Juan is a almost complete idiot
'Juan is an almost complete idiot.
b. La clase es un casi absoluto desastre.
the class is a almost absolute mess
'The class is an almost absolute mess.

(9) a. Juan es un completo idiota, menos en su trabajo.
Juan is a complete idiot except in his work
'Juan is a complete idiot, except at work.'
b. La clase es un absoluto desastre, excepto el día del examen.
the class is a absolute mess except the day of the exam
'The class is an absolute mess, except for the day of the exam.'

The data shows that the modification of an *idiot*-like noun by an AC resembles modification by maximizers, but only partially. The issue is whether an analysis of ACs as maximizers can be maintained. In this paper I defend that it can. In order to show how the data in this section would be explained, the semantics of nouns like *idiot* is discussed next.

4. Extreme nouns

Evaluative nouns like *idiot* constitute a class of nouns that do not only assign a property to an individual, but also express a value judgment. Several contexts set them apart from non-evaluative nouns.[2] First, nouns like *idiot* appear in the first position in qualitative nominal constructions such as the so-called *N of an N* construction (10) (Bolinger, 1972; Doetjes and Rooryck, 2003; den Dikken, 2006; Villalba and Bartra-Kaufmann, 2010, a.o.). Non-evaluative nouns such as *doctor* only receive a possessive reading (e.g., 'Juan's doctor').

[2]The class of evaluative nouns has been referred to as *degree nouns* (Bolinger, 1972) or *scalar nouns* (Matushansky, 2002), and *quality nouns* (Milner, 1978; Ruwet, 1982). The class includes other nouns (nouns like 'matasanos' *quack* or ethnic slurs) that I set aside from the discussion (see Masià, forthcoming). For this reason, I mostly refer to the nouns under discussion as *'idiot'-like nouns*, and *extreme nouns* once the analysis is presented.

(10) el {idiota / genio / desastre / #médico} de Juan.
the idiot genius mess doctor of Juan
'that {idiot / genius / mess / #doctor} Juan.'

In addition, in Spanish *idiot*-like nouns appear in attributive construction with the indefinite articles (11a), in the so-called *'un' enfático* ('emphatic *un*') construction (Portolés, 1994; Fernández Leborans, 1999, a.o.). This contrasts with the behavior of nouns expressing a specific role in society, which appear bare (11b) (Déprez, 2005; de Swart et al., 2007, and references therein).

(11) a. Juan es *(un) {genio / desastre}.
Juan is a genius mess
'Juan is a {genius / mess}.'
b. Juan es (*un) {médico / secretario}.
Juan is a doctor secretary
'Juan is a {doctor / secretary}.'

Finally, these nouns can be used in verbless exclamatives (12a) (Vinet, 1991; Hernanz, 2001, a.o.) and independent ones (12b) (Milner, 1978; Suñer Gratacós, 1999; Hernanz, 2001, a.o.).

(12) a. ¡Un {idiota / genio / desastre / *médico}, este tío!
a idiot genius mess doctor this guy
'A(n) {idiot / genius / mess / doctor}, this guy!'
b. ¡{Idiota / Genio / Desastre / *Médico}!
idiot genius mess doctor
'{Idiot / Genius / Mess / Doctor}!'

These tests set apart the class of evaluative nouns, of which *idiot*-like nouns are a subset (for more diagnostics, see Milner, 1978; Ruwet, 1982; Suñer Gratacós, 1999, a.o.). Part of the literature considers that evaluative nouns contain some sort of affective feature that allows them to appear in the above constructions (Milner, 1978; Hernanz, 2001, a.o.; cf. Ruwet, 1982; den Dikken, 2006). Others have argued that the relevant characteristic is a degree argument (Bolinger, 1972; Matushansky, 2002; for discussion, see Constantinescu, 2011).

In this section, I argue that nouns like *idiot* denote extreme degrees of properties. In order to do so, I first give arguments in favor of a degree analysis of these nouns. Then I compare their properties to those of extreme adjectives. Afterwards, the analysis of *idiot*-like nouns is provided. Finally, the subjectivity of these nouns is addressed.

4.1. *Idiot*-like nouns are gradable

As just mentioned, some authors take the properties and distribution of evaluative nouns to be linked to the presence of a degree argument (e.g. Bolinger, 1972; Matushansky, 2002).

Certainly, if some nouns are more likely candidates than others to denote gradable properties, those are evaluative nouns, *idiot* being the quintessential example (Bolinger, 1972; Morzycki, 2009, 2012b, 2014; de Vries, 2010; cf. Constantinescu, 2011, 2013; Sassoon, 2013). This section provides arguments in favor of nouns like *idiot* containing a degree argument.

Because of their monotonicity, gradable predicates obtain degree readings when modified by downward-entailing modifiers such as *surprisingly* or *unbelievable* (de Vries, 2010, forthcoming, Nouwen, 2011). Nouns like *idiot* are interpreted in a degree sense when modified by the adnominal versions of those modifiers (13), unlike nouns like *doctor*. For instance, *un idiota increíble* 'an incredible idiot' is an idiot to a high degree.

(13) Juan es un {idiota / ?genio / desastre / #médico} increíble.
Juan is a idiot genius mess doctor incredible
'Juan is an incredible {idiot / genius / mess / doctor}.'

Degree readings are also obtained with size adjectives (Morzycki, 2009; de Vries, 2010; Sassoon, 2013). When a noun like *idiot* combines with an adjective like *enorme* 'huge', the interpretation is that the referent has a high degree of the property. Compare this to *médico enorme* 'huge doctor', where only physical size is available as an interpretation (14).

(14) Juan es un {idiota / genio / desastre / #médico} enorme.
Juan is a idiot genius mess doctor huge
'Juan is a huge {idiot / genius / mess / doctor}.'

The modification in the examples above is subject to the two properties that characterize degree uses of size adjectives (see Morzycki, 2009). First, the bigness generalization asserts that only adjectives of bigness get degree readings, adjectives of smallness do not. This is true of size adjectives modifying *idiot*-like nouns. The examples in (15a), although odd, only get a physical size interpretation. Second, the position generalization states that degree readings of size adjectives are only possible in attributive position. That is again the case with *idiot*-like nouns. Examples (15b) only present a physical size reading.

(15) a. Juan es un {#pequeño / ??diminuto / ??minúsculo} idiota.
Juan is a small tiny minuscule idiot
'Juan is a {small / tiny / minuscule} idiot.'
b. #Este idiota es {grande / enorme / gigantesco}.
this idiot is big huge gigantic

Interrogatives provide further evidence for the gradability of *idiot*-like nouns. In particular, just like gradable adjectives (16a), these nouns appear in degree interrogatives with *cómo de* in Spanish (16b). Regular nouns like *doctor* are excluded from this construction. The same happens with quantity exclamatives with *cuán* 'how' (17).

(16) a. ¿Cómo de {alto / amable} es Juan?
how of tall kind is Juan
'How {tall / kind} is Juan?'

b. ¿Cómo de {idiota / genio / ??médico} es Juan?
how of idiot genius doctor is Juan
'How much of a(n) {idiot / genius / doctor} is Juan?'

(17) ¡Cuán {alto / amable / genio / desastre / ??médico} (que) es Juan!
how tall kind genius mess doctor that is Juan
'How {tall / kind / genius / mess / doctor} Juan is!'

So far, it seems that nouns like *idiot* are gradable. At this point, it is reasonable to question what type of scale structure they use (see §2). The data in §3 already showed that ACs do not have a clear-cut behavior as maximizers when modifying *idiot*-like nouns, not completely supporting the idea that they use upper-closed scales.

Focusing on data from entailments of the comparative construction (Kennedy and McNally, 2005), nouns like *idiot* pattern with minimum-standard adjectives in triggering entailments to the unmarked form (18) (Constantinescu, 2011, de Vries, forthcoming). In other words, if someone is more of an idiot than someone else, it is entailed that the first person is an idiot.[3]

(18) a. La habitación está más sucia que la cocina. → La habitación está sucia.
the room is more dirty than the kitchen the room is dirty

b. ??Juan es más un idiota que Sofía. → Juan es un idiota.
Juan is more a idiot than Sofía Juan is a idiot

To sum up, *idiot*-like nouns are gradable and seem to have minimum standards. That is, having only a small degree of the relevant property (idiocy, messiness, etc.) is enough to qualify as an idiot, a mess, etc.[4] In the next section I argue that *idiot*-like nouns denote extreme degrees.

4.2. *Idiot*-like nouns denote extreme degrees

Adjectives such as *wonderful* or *horrible* refer to a very high or the highest degree of a property (Cruse, 1986) and, in this sense, are close to superlatives. This class of adjectives that includes extremeness in their lexical semantics are often referred to as *extreme adjectives* (Cruse, 1986; Paradis, 1997, 2001; Morzycki, 2012a). In this section, I argue that nouns like *idiot* also denote extreme degrees of properties (see also Constantinescu, 2011; Morzycki, 2012a, 2014).

[3] Although nouns like *idiot* in comparative constructions in Spanish are somewhat degraded (especially if the determiner appears), speakers find that the entailments still come through.

[4] De Vries argues that this is related to the fact that these nouns do not have a prototype that may constitute an upper bound (for details, see de Vries, 2010, forthcoming).

Intuitively, for someone to qualify as an idiot, just some degree of dumbness is not enough, the individual needs to be remarkably dumb.

To begin with, some of the contexts in §4 allow adjectives in the relevant positions. However, being gradable is not enough for adjectives to appear in these constructions. Rather, they need to denote extreme degrees. For example, non-extreme adjectives such as *tall* are excluded in the *N of a N* construction (19a) (cf. (10)) (Constantinescu, 2011). The same is true of verbless or independent exclamatives (19b) (cf. (12a)) (Vinet, 1991; Hernanz, 2001, a.o.).

(19) a. el {??alto / ??amable / horrible / magnífico} de Juan
the tall nice horrible great of Juan
'that {tall / nice / horrible / great} Juan.'
b. ¡{??Alto / ??Amable / Horrible / Magnífico}(, este chico)!
tall nice horrible great this guy
' {Tall / Nice / Horrible / Great}(, this guy)!'

In addition, extreme predicates display several specific properties. First, they have their own specialized degree modifiers. While modifiers such as *directamente* 'downright' do not appear with non-extreme adjectives, regular degree modifiers like *bastante* 'fairly' do not occur with extreme adjectives (20) (Cruse, 1986; Paradis, 1997; Hernanz, 2001; Morzycki, 2012a, a.o.). In the same way, nouns like *idiot* combine with equivalent adnominal modifiers, which are impossible in their degree reading with non-gradable nouns such as *doctor* (21).

(20) a. Juan es directamente {maravilloso / ??alto}.
Juan is downright wonderful tall
b. Juan es bastante {??maravilloso / alto}.
Juan is fairly wonderful tall

(21) a. Juan es un valiente {idiota / genio / #médico}.
Juan is a brave idiot genius doctor
'Juan is a downright {idiot / ??doctor}.'
b. La clase es una soberana {maravilla / *actividad}.
the class is a supreme wonder activity
'The class is a full-on {wonder / *activity}.'

Second, extreme predicates are somewhat unnatural in comparatives, with different degrees of acceptability among speakers, but more acceptable in equatives (22) (Cruse, 1986; Paradis, 1997; Morzycki, 2012a). *Idiot*-like nouns are also slightly more degraded in comparative than in equative structures (23).

(22) a. Juan es más {??maravilloso / ??horrible / alto} que Sofía.
Juan is more wonderful horrible tall than Sofía

b. Juan es tan {maravilloso / horrible / alto} como Sofía.
Juan is as wonderful horrible tall as Sofía

(23) a. ??Juan es más (un) genio que Sofía.
Juan is more a genius than Sofía
'Juan is more of a genius than Sofía.'
b. ?Juan es tan genio como Sofía.
Juan is as genius as Sofía
'Juan is as much of a genius as Sofía.'

Third, extreme predicates can be intensified through prosodic prominence (24a) (Cruse, 1986; Bolinger, 1972; Morzycki, 2012a). *Idiot*-like nouns behave accordingly (24b).

(24) a. Kevin Spacey is {fan*taaaa*stic / ??*gooooooooooood*}! (Morzycki, 2012a)
b. Juan es un {i*dioooo*ta / ??*méeeee*dico}.
Juan is a idiot doctor

In short, nouns like *idiot* denote extreme degrees of properties. The tests in this section showed that they behave like extreme adjectives. It can be thus concluded that these nouns encode extremeness in their lexical semantics. This idea is implemented in the next section.

4.2.1. Analysis

In order to account for the semantics of nouns like *idiot*, I adopt Morzycki's (2012a) analysis of extreme adjectives. The basic intuition is that different subsets of scales are relevant in different contexts, and extremeness consists of going off the relevant scale, to a point where no further distinctions between degrees are made (Morzycki, 2012a). For instance, in order to qualify as an idiot, someone has to be dumb to a degree above any expectation, off the relevant scale for the adjective *dumb*, in a zone of indifference between degrees of dumbness.

This idea connects with contextual domain restriction. In the same way quantifiers are contextually restricted (e.g. von Fintel, 1994), degree quantification is also subject to contextual variation in its domains (e.g. Zanuttini and Portner, 2003). Contextual domain restriction is thus introduced in the denotation of ordinary adjectives (Morzycki, 2012a). The semantics for *dumb* in (25a) includes the restriction that the degree d has to be in the salient set of degrees in the contextual scale C. In the absence of degree morphology, the null morpheme POS saturates the degree argument and establishes the requirement that the degree exceeds the standard (25b).

(25) a. $[\![dumb]\!] = \lambda d \lambda x[d \in C \wedge \mathbf{dumb}(d)(x)]$
b. $[\![\text{POS } dumb_C]\!] = \lambda x.\exists d[d \in C \wedge \mathbf{dumb}(d)(x) \wedge d \succeq \mathbf{stnd}([\![dumb_C]\!])]$
(Morzycki, 2012a)

Extreme predicates exceed the contextually-provided set of degrees. This is reflected in the condition that their degree d of the property is greater than the maximal degree in the contextual scale C (Morzycki, 2012a). Extending the analysis to nouns like *idiot*, their denotation would be as in (26).

(26) a. $[\![idiota_C]\!] = \lambda d \lambda x[d > \mathbf{max}(C) \wedge \mathbf{dumb}(d)(x)]$
b. $[\![genio_C]\!] = \lambda x \lambda d[d > \mathbf{max}(C) \wedge \mathbf{smart}(d)(x)]$

Under this analysis, like gradable adjectives in a degree-based framework, nouns like *idiot* have degree arguments and are lexically associated with scales. Just like in the case of adjectives, a degree morpheme is necessary to get to a property of individuals. If no overt degree word is present, I assume a null POS morpheme saturates the degree argument (Morzycki, 2009).[5] According to (27), an individual is an idiot if, and only if, she is dumb to a degree d that exceeds the standard for the predicate in C and that is greater than the highest salient degree of dumbness in C. In this case, the standard and the domain restriction interact: for the standard to be relevant, it must be beyond the perspective scale.

(27) a. $[\![\textsc{pos}\ idiota_C]\!] = \lambda x.\exists d[d > \mathbf{max}(C) \wedge \mathbf{dumb}(d)(x) \wedge d \succeq \mathbf{stnd}([\![idiota_C]\!])]$
b. $[\![\textsc{pos}\ genius_C]\!] = \lambda x.\exists d[d > \mathbf{max}(C) \wedge \mathbf{smart}(d)(x) \wedge d \succeq \mathbf{stnd}([\![genius_C]\!])]$

Nouns like *idiot* are fundamentally adjective-like, as manifested in their similar distribution in inversion constructions (10), (19a), exclamatives (12), (19b), and questions (16). The denotations in (27) reflect this adjectival condition of these nouns not only by providing them with gradable semantics, but also by using adjectival measure functions. Besides this, by including the measure function of the non-extreme or more neutral adjective, the denotation of extreme nouns accounts for the entailments to the non-extreme form (28). Any individual dumb enough to be an idiot must have a degree of dumbness beyond C; by monotonicity, any individual dumb to that degree is dumb to all the degrees below, including the standard for *dumb*.

(28) a. Juan es un idiota. → Juan es tonto.
Juan is a idiot Juan is dumb
b. Juan es un genio. → Juan es listo.
Juan is a genius Juan is smart

Hernanz (2001) argues that evaluative expressions have a *wh*-feature that explains their occurrence in inversion constructions, exclamatives, and other *wh*-like behavior. In the analysis of nouns like *idiot* put forward here, they include a widening in the domain of degrees. In particular, these nouns refer to degrees that exceed the maximal degree in the salient set of degrees. This connects with Zanuttini and Portner's (2003) analysis of *wh*-exclamatives, according to which exclamatives involve domain widening by the combination of a *wh*-word and a factive

[5] Looking ahead, ACs are argued to be overt degree morphemes in the next section. Morzycki (2009) actually already considers ACs to be adnominal degree morphemes, but his analysis differs from ours in that his gradable nouns do not denote extreme degrees.

operator. Thus, there seems to be a connection between *wh*-behavior and evaluativity that could be made explicit by our analysis.

One way of doing this could be to link extremeness to mirativity (DeLancey, 1997; for analyses of exclamatives as mirative constructions, see Michaelis, 2001; Castroviejo Miró, 2006), and, ultimately, to expressivity (see Martin, 2007 for extreme adjetives). More specifically, the fact that the individual has a property to an unexpectedly high degree is accompanied by an emotion (surprise, but also other emotions like annoyance) by part of the speaker. This emotional attitude arises from the truth-conditional meaning of evaluative nouns and constitutes their expressive meaning.[6] For instance, if someone is smart to so extreme a degree to qualify as a genius, it causes in the speaker an emotional attitude of surprise or admiration towards that individual.

To summarize, nouns like *idiot* have been given a denotation that involves extreme degrees, following the analysis for extreme adjectives in Morzycki (2012a). In particular, they are gradable properties of individuals, with the requirement that the degree of the property exceed the contextually salient set of degrees. Next section discusses subjectivity of extreme nouns.

4.3. Consequences of the analysis: subjectivity

Before proceeding to the analysis of ACs, let me briefly discuss one consequence of the analysis above, which helps clarify the connection between being extreme and being evaluative. Subjective predicates are predicates whose truth is relativized to the perspective of a judge (Lasersohn, 2005; Stephenson, 2007; Bylinina, 2014, a.o.). For instance, a sentence like *Roller-coasters are fun* may be true for one speaker but false for another, and both can be right at the same time.

Extreme nouns pass the tests for subjectivity. They can appear as the complement of subjective attitude verbs (29a) Sæbø, 2009 and they give rise to faultless disagreement (29b) (Lasersohn, 2005; Stephenson, 2007). Regarding the latter, speaker B's does not constitute a contradiction, because both speakers can be right.

(29) a. Juan me parece {divertido / un idiota / un genio / un desastre}.
Juan DAT.1SG find funny a idiot a genius a mess
'I find Juan {funny / an idiot / a genius / a mess}.'

b. A: Juan es {divertido / un idiota /un genio / un desastre}.
'Juan is {funny / an idiot / a genius / a mess}.'
B: No, no lo es.
'No, he's not.' FAULTLESS DISAGREEMENT

Adjectives can be subjective in two ways (Bylinina, 2014; Kennedy, 2016). They can be subjective with respect to the threshold for its application or with respect to the ordering of the

[6] In this paper, I leave the expressive component of *idiot*-like nouns aside, but see Masià (2017b) for an analysis.

individuals in their extension. For instance, *fun* is subjective regarding its standard: two speakers may disagree on whether roller-coasters are above the standard for *fun* because one places the standard higher than the other. In addition, the ordering of the set {roller-coasters, climbing, reading} for *fun* may be ⟨roller-coasters, climbing, reading⟩ for one speaker, but ⟨reading, roller-coasters, climbing⟩ for another. Since *idiot*-like nouns have been argued to use adjectival scales from evaluative adjectives in their semantics (26) and these adjectives are subjective in the two ways (Bylinina, 2014; Kennedy, 2016), extreme nouns are expected to be two-way subjective as well.

The tests in (29), using the positive form of the adjective and a positive construction for the noun, show that extreme nouns are subjective with respect to their standard. Subjectivity with respect to their ordering is detected by the acceptability of the comparative form in the diagnostics above. Since extreme nouns in the comparative form are slightly degraded, so are the examples in (30) including them. Nevertheless, they are not ruled out with subjective attitude verbs (30a) and they give rise to faultless disagreement (30b).

(30) a. Juan me parece más {divertido / ?genio / ?desastre} que Sofía.
Juan DAT.1SG find more funny genius mess than Sofía
'I find Juan {funnier / more of a genius / more of a mess} than Sofía.'
b. A: Juan es más {divertido / ?genio / ?desastre} que Sofía.
'Juan is {funnier / more of a genius / more of a mess} than Sofía.'
B: No, no lo es. 'No, he's not.' FAULTLESS DISAGREEMENT

Just like evaluative adjectives, extreme nouns seem to be subjective in two ways. I suggest that this fact can be related to the presence of adjectival measure functions in the lexical semantics of nouns like *idiot* in the analysis put forward in §4.2.1. Next section presents the analysis of ACs as adnominal maximizers.

5. Back to adjectives of completeness

5.1. Adjectives of completeness are maximizers

Since *idiot*-like nouns denote gradable properties, an analysis of ACs as degree modifiers is sustained. However, there are some difficulties. Maximizers are sensitive to scale maximums, but the nouns under discussion seem to use scales with no upper-bound (§4.1). Therefore, either the maximum for ACs must be provided by something other than a bound in a lexical scale, or, alternatively, ACs need to be analyzed as non-maximizers. In this section I argue for the first option, showing that the special behavior of ACs with nouns like *idiot* can be derived from the particularities of the extremeness the latter include in their lexical meaning.

Paradis (1997) observes that extreme adjectives have an inherent superlativity, and, in this sense, they represent the ultimate point of a scale. She argues that maximizers combine with adjectives such as *wonderful* to reinforce their extremeness. In the approach to extremeness adopted in the previous section (Morzycki, 2012a), the contextually provided scale contributes a sort of maximum: the degrees above it. Since these degrees are undifferentiated, they can be thought of as a single one. For instance, for a noun like *idiot*, it is not the case that there is a ceiling of idiocy, but rather that, above certain degree, we do not introduce any distinction between the degrees of idiocy of the individuals. In a sense, that set of indistinct degrees acts as a maximum (see Morzycki, 2012a: 606).

If the degrees above the salient scale form a kind of boundary, this may constitute an appropriate maximum for maximizers. I argue that it is in fact a degree that can be returned by the **max** function in the semantics of maximality modifiers. ACs can thus be analyzed as maximizers (31) (see also Morzycki, 2009).

(31) $[\![AC]\!] = \lambda G_{\langle d,\langle e,t\rangle\rangle} \lambda x.\exists d[d = \mathbf{max}(S_G) \wedge G(d)(x)]$

The composition of an AC with an extreme noun is then as in (32a). The AC saturates the degree argument of the noun and sets its value to the maximum of the scale. Two restrictions apply on the degree d. It must be above the relevant set of degrees in C and it must be the maximum (of the degrees off the scale lexicalized by *dumb*).[7] According to this semantics, Juan is a complete idiot if, and only if, he has a degree of dumbness above the salient set of degrees in the context (32b).

(32) a. $[\![\textit{completo}]\!]([\![\textit{idiota}_C]\!]) = \lambda x.\exists d[d = \mathbf{max}(S_{idiot_C}) \wedge [\![\textit{idiota}_C]\!](d)(x)] =$
$= \lambda x.\exists d[d = \mathbf{max}(S_{idiot_C}) \wedge d > \mathbf{max}(C) \wedge \mathbf{dumb}(d)(x)]$

b. $[\![\textit{Juan es un completo idiota}]\!] =$
$= \exists d[d = \mathbf{max}(S_{idiot_C}) \wedge d > \mathbf{max}(C) \wedge \mathbf{dumb}(d)(\text{Juan})]$

The fact that no distinction is made among the degrees above the relevant set of degrees in C has the consequence of blurring the difference between the unmodified and the modified extreme noun. Put differently, there is not a sharp distinction between being an idiot and being a complete idiot. This does not mean that ACs have no effect. By means of the maximality function, the degree of idiocy of *complete idiot* is always higher than that of *idiot*. But due to the fact that these degrees do not have exact, determinate values, the contrast is fuzzy. This may explain the oddness of the sentences in (33).

(33) a. ??Juan es un idiota, pero no un completo idiota.
Juan is a idiot but NEG a complete idiot
'Juan is an idiot, but not a complete idiot.'

[7] This analysis of ACs is different from considering them extreme degree modifiers in Morzycki's (2012a)'s terms. Under his analysis, modifiers such as *downright* widen the domain of degrees to accommodate a new standard for the predicate. Roughly, the standard for *downright gigantic* is situated above the already expanded domain for *big* in the semantics of *gigantic*. In my analysis, ACs target the widened set of degrees used by extreme nouns, but do not have a widening effect themselves. This analysis is compatible with other degree uses of ACs (see §2; see also Masià, 2017a, 2018).

b. ??La clase es un desastre, pero no un absoluto desastre.
the class is a mess but NEG a absolute mess
'the class is a mess, but not an absolute mess.'

5.2. Explaining the data

We can now explain the nonmaximizer behavior of ACs described in §3. Regarding the entailment that the end of the scale has been reached, recall that sentences with ACs and extreme nouns result in a contradiction when the degree of the property of the same individual is being compared (6a), but not when the comparison is drawn between the degrees of two different individuals (7a). For instance, saying that Juan is a complete idiot, but he could be more of an idiot is as contradictory as saying that a plane is completely full, but could be fuller (5a). By contrast, there is not so strong a conflict when asserting that Juan is a complete idiot, but someone else exceeds his degree of idiocy.

If Juan is a complete idiot, he has a maximal amount of idiocy, although the particular corresponding degree cannot be pinpointed, due to the fact that that degree is beyond the salient scale. It feels unnatural to recalculate that maximum when considering the same individual (unless some new facts are learned about Juan) because the speaker is contradicting her own property assignment. However, given that the maximum is undetermined, the speaker can situate it at a higher value than she originally did if the context changes (for instance, she meets Juan's brother). In fact, note that the sentences improve if *todavía* 'even' is added (34).

(34) Juan es un completo idiota, pero su hermano lo es todavía más.
Juan is a complete idiot but his brother CL is even more
'Juan is a complete idiot, but his brother is even more of an idiot than him.'

As for the incompatibility with *casi* 'almost' (8a), I suggest that it has to do with this expression presupposing an identifiable maximum. *Almost* targets a value that is close to the maximum, but has not reached it. If the maximum for, say, being an idiot cannot be singled out, the expression *un casi completo idiota* 'an almost complete idiot' would not return a concrete value either, and the difference between being a complete idiot and being an almost complete idiot would be trivial (see also Paradis, 1997: §3.3.3).

Exceptive phrases were fairly acceptable with ACs and extreme nouns (9a), as expected from a total construct. The presence of an AC usually has the side effect of decreasing the amount of imprecision allowed in the context. As a consequence, the number of exceptions is reduced, making exceptives slightly less felicitous than in the sentences without the maximizer.

Coming back to the scale structure of extreme nouns, the data in (18) pointed to them having a minimum standard. Although that still holds, their combination with ACs and the maximality interpretation that the latter receive provides evidence for them having a maximum as well. As mentioned above, this is not a conventional maximum, but one made of degrees off the relevant contextual scale.

In short, ACs are maximizers of extreme nouns. They set the degree of the property denoted by these nouns to its maximum value. However, since those degrees exceed the contextually provided scale and no distinctions are made among them, the combination of ACs and extreme nouns presents a mixed behavior with respect to maximality. In the next section, I discuss a couple of alternative analyses.

5.3. Alternative analyses

Previous analyses of ACs take them to universally quantify over dimensions associated with the noun. This section reviews a non-degree and a degree proposal along these lines and shows that they are not sufficient to capture the distribution of ACs with extreme nouns.

Constantinescu (2011) argues that ACs in their intensifying use with *idiot*-like nouns signal the extent to which the property denoted by the noun holds of the object in question. She puts forward that ACs apply to the characteristic function included in the meaning of the noun (e.g. Bouchard, 2002; Demonte, 2008) and assert that the properties displayed by the individual match those associated with the noun, in the speaker's opinion. However, the noun's defining criteria does not have to be exhaustively satisfied, as shown by the nonmaximal behavior of ACs in these uses (see §3), it is enough if the relevant properties are clearly manifested in a salient way. For instance, for a workshop to be a complete failure, it may be enough if it is a failure in an aspect especially relevant to the speaker (e.g., quality of the talks), even if it is not in other less salient respects (e.g., quality of the coffee).

The idea that ACs indicate that the referent fully matches the definition of the noun is problematic. All nouns have a set of criteria an individual must satisfy to qualify as them. However, this reading of ACs is only available for extreme nouns. If the role of ACs were to assert that the noun is right for the individual, they would be expected to have this function with all nouns. For instance, the examples in (35) would be predicted to convey that those particular instances deserved to be referred to as *a novel* and *a conference*, respectively, but that is not the case.

(35) ?Esta es una completa {novela / conferencia}.
this is a complete novel workshop
'This is a comprehensive {novel / workshop}.'

The intuition that ACs indicate that the referent is an N in all the relevant dimensions associated with the noun can be recast in a degree-based framework. Sassoon (2013, 2017) argues that nouns like *idiot* are similar to adjectives in their occurrence with *with respect to* phrases (36).

(36) Dan is an idiot {with respect to money / in every respect}. (Sassoon, 2013)

Relatedly, de Vries (2010, forthcoming) claims that *idiot*-like nouns are gradable and use open scales (see also Morzycki, 2009). ACs are analyzed as modifiers that assert that the individual has every dimension associated with the noun. For instance, a *total nerd* would be someone who is nerdy with respect to his looks, social skills, intelligence, hobbies, etc. This predicts that nouns modified by ACs do not accept *with respect to*-phrases, but this is not borne out (37). Someone can be a total idiot or a complete mess only with respect to one dimension.

(37) a. Era un idiota total en cuanto a calorías, alimentos y cosas de esas.[8]
was a idiot total with regard to calories food and things of those
'I was a total idiot regarding calories, food, and things like that.'
b. Soy un completo desastre con respecto a las lanas y los proyectos.[9]
am a complete mess with respect to the yarns and the projects
'I'm a complete mess with respect to yarn and (DIY) projects.'

This said, it is not completely clear to me that all the *with respect to* phrases in (36), (37) target actual dimensions of the noun. What properties make someone an idiot? Someone may consider that not knowing how to manage money makes you an idiot, but that is certainly neither a necessary nor a sufficient condition to qualify as one. Rather, it seems one of the many ways in which someone can be an idiot. Consider a noun like *smoker* instead, which has clear(er) dimensions (Morzycki, 2012b). A smoker is someone who smokes a certain amount of cigarettes with a specific frequency. Some degree in both dimensions is necessary for someone to qualify as a smoker. A complete smoker would be someone who has a high degree in both dimensions. However, ACs are not felicitous with this noun (38).

(38) ??Juan es un completo fumador.
Juan is a complete smoker

Morzycki (2012b) argues that nouns like *idiot* are only associated with one dimension (e.g., idiocy). ACs are analyzed as modifiers that assert that the measurement of the individual along the dimension associated with the noun is large (39). For instance, Clyde is an utter idiot if, and only if, his measure along the unique dimension associated with idiot, idiocy, is large. ACs include the requirement that the noun have only one dimension (represented by the iota operator), accounting thus for their distribution.

(39) $[\![\mathit{utter}]\!]^c = \lambda f_{\langle e,t \rangle} \lambda x.\mathbf{large}_c(\mu(\iota D[D \in \mathbf{dimensions}(f)])(x))$

The analysis put forward here resembles Morzycki's (2012b) in that it assumes that the only dimension of measurement relevant for extreme nouns is the one provided by the measure function of their related adjectives. However, we have considered nouns like *idiot* to be gradable (extreme, in particular) (cf. Morzycki, 2009), and have argued that ACs can be analyzed as maximality modifiers, unifying them to the analysis of their adverbial counterparts.

[8] http://1medbio.blogspot.com.es/2012/09/medicina-biologica-dr-german-duque_22.html
[9] http://www.waselwasel.com/crisis-tejeril/

In short, an analysis of ACs as quantifying over the characteristics or dimensions associated with the noun does not fully cover the data. For this reason, ACs are better understood in terms of maximality modifiers of extreme nouns.

6. Conclusion

This paper has argued that ACs are maximality modifiers of nouns like *idiot*. The latter have been analyzed as extreme predicates. That is, *idiot*-like nouns are gradable and denote extreme degrees. This means that their degree arguments have values above the relevant scale in the context. ACs modifying extreme nouns behave only partially as maximizers because of the type of maximum those nouns provide. In particular, the set of degrees off the relevant scale constitute a sort of maximum, but the degrees in that interval are undifferentiated to one another.

Providing an analysis of ACs as maximizers has reinforced the parallelism between adverbial and adjectival modification and unraveled the ways in which nouns can be gradable and the significance of scale structure in their semantics. Nevertheless, gradability in the nominal domain is still a controversial issue and its connection to evaluativity and subjectivity is not fully understood. Exploring other instances of evaluative nouns, such as expressive variants (*quack* as the variant of *doctor*), ethnic slurs or nouns formed by an affective suffix (e.g., Spanish *politicastro* 'politician.PEJ'), their contribution to the expressive dimension of meaning (Potts, 2005; Gutzmann, 2013), and their combination with adnominal degree modifiers may shed light in that direction.

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Some kind of relative clause[1]

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Abstract. Amount Relatives (ARs) differ from restrictive relative clauses in that they do not refer to a particular object denoted by the head of the relative clause, but to an amount of such objects (Carlson, 1977a; Heim, 1987). Traditionally, ARs have been regarded as degree expressions. In this paper I argue against this view and propose instead that amount interpretations of relative clauses are in fact a special case of kind interpretation.

Keywords: kind reference, amounts, relative clauses.

1. Introduction

This is paper is concerned with Amount Relatives in English, relative clauses that receive quantity-oriented interpretations (Carlson, 1977a; Heim, 1987; Grosu and Landman, 1998, 2017; Herdan, 2008; McNally, 2008; Meier, 2015). Consider the following example, minimally adapted from Heim (1987: 38).

(1) It would take us years to drink the champagne they spilled that evening.

The sentence in (1) is ambiguous. On its ordinary interpretation, the relative clause picks out the particular champagne that was spilled that evening, and the sentence on the whole is about the time it will take to drink that spilled champagne. This is the meaning we arrive at when, following the traditional analysis (Quine, 1960; Partee, 1973), we interpret the relative clause by intersecting the predicate denoted by the head noun with the extension of the *that*-clause. But this is not the most accessible interpretation of the sentence. On its most salient reading, (1) refers to the task of drinking the *amount* of champagne that was spilled that evening. In this case, the particular champagne that was spilled is not the object of the drinking; rather any champagne *in the same amount* will suffice. The examples below provide similar cases. Under the relevant interpretation, they all make a claim about an amount, not about an object.

(2) a. Mary saw the birds in thirty minutes that John saw in a day. (Meier, 2015)
⇝*Mary saw the number of birds that John saw*
b. We lost the battle because we lacked the soldiers our enemy had. (McNally, 2008)
⇝*We lacked the amount of soldiers that our enemy had*
c. The money it cost could have fed many people. (Grosu and Landman, 2017)
⇝*The amount of money it cost*

Because of their semantic ability to refer to amounts, these relative clauses were named "Amount Relatives" by Carlson (1977a); I will refer to them as ARs henceforth.

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Historically, analyses of ARs have assumed that degree semantics should be invoked, in some form or other, in order to derive their amount interpretations. Picking up on Carlson's idea that the work of extracting an amount should be done at the CP level, the received view has it that in ARs the embedded CP is a degree expression, denoting either a set of degrees or a maximalized degree (Heim, 1987; von Fintel, 1999; Grosu and Landman, 1998, 2017; Herdan, 2008; Meier, 2015). That is, the amount interpretation is the result of some "amount construction", according to which the CP in (3) should be treated as a degree predicate–involving degree abstraction at the CP level. For instance:

(3) It would take us years to drink the champagne [$_{\text{CP}}$ they spilled that evening]
$[\![\text{CP}]\!] = \lambda d$. they spilled d-MUCH champagne that evening

The CP being degree denoting, these analyses come with the consequence that ARs should show all the properties of other bona fide degree constructions, such as comparatives, equatives, degree questions, etc.

In this paper I provide a radically different approach to ARs. First, I show that there are a number of parallelisms between ARs and relative clauses with *kind* interpretations, which are unexpected on a degree-based account of ARs. Then, I bring a series of arguments against a degree-based analysis of ARs: contrary to what is expected, ARs do not show any of the hallmark features of well-established degree constructions. From these two sets of facts I conclude in favor of a uniform analysis of kind and amount relatives and against a degree-based approach to their semantics. In the proposal I will advance, amount interpretations *are* a form of kind interpretation. Consequently, whenever a relative clause admits an amount interpretation, it also necessarily allows a kind interpretation. This is captured by the following generalization:

(4) The AMOUNT $\subseteq$ KIND generalization:
Amount interpretations of relative clauses are a form of kind interpretation.

2. Amount Relatives in perspective

2.1. Main properties of ARs

There are three main semantic properties of amount interpretations that set them apart from ordinary object-referring (intersective) interpretations. The first and most obvious is that they refer to amounts, not objects. This poses a general challenge: in spite of being DPs of the form *the NP*s, amount interpretations do not refer to that NP. The flip-side of this property is that the NPs heading the relative clause in (1) and (2) cannot be interpreted as definites, but as indefinites, in spite of the presence of the definite article. For instance, in (1) there is no single individual object-level champagne that would take us long to drink; in fact, any champagne in the relevant amount suffices. The last distinguishing property of amount interpretations is that they always involve a comparison of two amounts of the same stuff. To appreciate this requirement better, consider first a classifier relative clause with an overt noun *amount*.

(5) It would take us years to drink the amount of champagne that you drank of wine.

What (5) shows is that relative clauses headed by the noun *amount* allow the comparison of two different instances of stuff; in (5) the comparison is between amounts champagne and wine. The same, however, is not possible with ARs.

(6) *It would take us years to drink the champagne that you drank wine.

To ensure that this restriction is not syntactic, we can use sentences that are grammatical but lack an amount interpretation in the relevant environments. Consider (7):

(7) [*Context*: I drank two liters of champagne in 3 hours, and you drank two liters of wine in 30 minutes.]
It took me 3 hours to drink the champagne that you drank in 30 minutes.

Despite its grammaticality and the supportive context, (7) would be deemed false in this situation. This points out that, unlike for (5), comparing amounts of different stuff is not possible for relative clauses like (1) and (7).

Summing up, any theory that aims at accounting for amount interpretations of relative clauses should capture these three empirical facts, summarized in (8) and paraphrased in (9) for clarity:

(8) a. *Definiteness*:
Amount interpretations refer to a definite amount, not a definite individual.
b. *Indefiniteness*:
The head of the relative clause is interpreted as an indefinite.
c. *Identity*:
Amount interpretations require a comparison of two amounts of the same stuff.

(9) ⟦It would take us years to drink the champagne they spilled that evening⟧ [=(1)]
⇝ It would take us years to drink champagne in that amount
[where *that amount = the amount of champagne that they spilled that evening*]

2.2. A notable parallelism

The properties of amount interpretations discussed above have been known since Carlson (1977a, b). Carlson also noted that relative clauses allowing for amount interpretations can be kind-referring as well. Consider a minimal variant of (1):

(10) It will take us the rest of our lives to find the champagne they spilled that evening.

On its most salient interpretation, (10) receives a form of *kind* interpretation–biased by the change of verb from *drink* to *find*. For instance, it could be that the champagne is difficult to find because it is very rare. This is only one of many possible reasons; it could also be that there is a high demand of that particular kind of champagne, that it is not usually imported to our country, etc.[2] All these interpretations have the same properties of amount interpretations described in (8). For one, the sentence does not refer to a particular champagne, despite being overtly of the form *the champagne that....* This is precisely the condition on *indefiniteness* of the head of the relative clause described in (8). Similarly, the sentence refers to a definite kind of champagne, the precise kind of champagne that they spilled that evening. This is, again, fully parallel to the condition on *definiteness* described in (8). Finally, notice that we are not at liberty to choose what is the thing that would take us the rest of our lives to find; it must be champagne. This is the same *identity* restriction that we observed in (8) for amount interpretations. To appreciate the parallelism between kind and amount interpretations in full, consider the following equivalent of the paraphrase in (9).

(11) ⟦It would take us years to drink the champagne that they spilled that evening⟧
⇜⇝It would take us years to drink champagne of that kind
[where *that kind* = *the kind of champagne that they spilled that evening*]

The conclusion is clear: the facts in (8) are not exclusive of amount interpretations alone.

2.3. Further similarities

There a number of further parallelisms between kind and amount interpretations of relative clauses, suggesting that the connection between the two is not spurious. First, both kind and amount interpretations seem to be a particularity of the definite article.

(12) It would take us years to {find/drink} {the / *a / *some / *few / *two} champagne that they spilled that evening.

Second, the two interpretations are generally incompatible with the complementizer *which*:

(13) It would take us years to {find/drink} the champagne {that / ∅ / *which} they spilled that evening.

Third, amount interpretations of relative clauses do not obligatorily rely on the presence of a relative clause, and with sufficient contextual support, it may be dropped altogether. Thus, both amount and kind interpretations are possible with nouns modified by PPs.

(14) a. We lost the battle because we didn't have the soldiers of the Imperial Army.
b. We used to organize a soccer team, but we don't have the students in the department anymore.

[2]This type of interpretation is sometimes referred to as an "extent" reading, which goes beyond what we usually think of taxonomic kinds. I will continue to call it simply a "kind" interpretation for consistency, but it should be clear that this interpretation is in fact richer than a well-established kind.

For instance, the sentence (14a) might refer to the fact that the reason for losing the battle was that we did not have as many soldiers as the Imperial Army did. This is the amount interpretation. Alternatively, it could be that despite having more soldiers than the Imperial Army, ours are poorly trained, lack motivation, etc. This is the kind interpretation (see fn.2). Similar interpretations are available with bare DPs as well.

(15) a. We lost the battle because we didn't have the soldiers.
b. We used to organize a soccer team, but don't have the students anymore.

Thus, in all three cases we observe that the relationship between the availability of the two interpretations is preserved. More importantly, the presence of amount interpretations in (14) and (15) is puzzling from a perspective where they require a degree variable originating in a subordinate position, as is usually assumed with ARs.

The upshot of this discussion is that we have two types of interpretation, kind and amount, showing the same signature effects, and similar syntactic constraints, distribution and availability. These parallelisms and the fact that kind-reference typically does not involve degrees raise the question: Are we justified in appealing to degree semantics to account for amount interpretations? Minimally, in doing so we would miss a generalization, namely, that amount and kind interpretations of relative clauses share the key semantic properties that make ARs stand out and behave unlike intersective relative clauses. In what follows, I show that not only does appealing to degrees miss a generalization, it also makes the wrong empirical predictions.

3. Doing without degrees

This section examines whether so-called ARs behave as bona fide degree constructions. The results of this examination have already been foreshadowed before: if we take comparatives, equatives, etc. as the quintessential degree constructions involving a relative clause and degree abstraction at the CP level, amount interpretations of relative clauses do not behave alike.

3.1. Sub-deletion

The process known as sub-deletion is considered a hallmark of degree abstraction (Kennedy, 1999; Lechner, 2001). For instance, comparatives and equatives all allow sub-deletion.

(16) a. I brought more bananas than you brought apples.
b. I brought as many bananas as you brought apples.

Classifier Relatives also allow sub-deletion. In contrast, relative clauses with amount interpretations never allow sub-deletion.

(17) a. I brought the { amount / quantity } of bananas that you brought of apples.
b. *It will take us years to drink the champagne that they spilled wine that evening.

The lack of sub-deletion properties of (17b) points towards a fundamental difference in how the amount interpretations arise in (16)/(17a) and (1)/(2). Thus, we fail to find the expected parallelism between canonical degree constructions and ARs.

3.2. Islands

The second argument is the lack of island effects with relative clauses that permit an amount interpretation. There is a subset of syntactic islands, the so-called weak or sensitive islands, which only allow extraction of certain grammatical expressions: expressions ranging over individual entities are good extractees, as opposed to expressions ranging over other domains, like degrees, times, manners, etc., which often incur in so-called island violations. If relative clauses require degree abstraction to obtain amount interpretations, they should pattern together with other constructions that involve the same operation in showing weak-island sensitivity, much like comparatives, equatives and *how many* questions. By the same token, relative clauses with an amount interpretation should contrast with individual *who* questions, which involve abstraction over individuals, and are able to be extracted from weak islands.

Below, I examine the behavior of *e*-denoting *vs.* *d*-denoting *wh*-words in negative islands as a baseline, and compare this with the behavior of comparatives, equatives and relative clauses.[3] The interaction between degree operators and negative and other downward entailing operators was noted early on the works that pioneered degree semantics for the study of comparative constructions (see von Stechow, 1984). An influential view popularized by Rullmann (1995) attributes the ill-formedness of the (18) examples below to the impossibility of maximalizing a set of degrees that contains a negative operator in its scope.

(18) a. *How many soldiers doesn't the Imperial Army have?
b. *We have more soldiers than the Imperial Army doesn't have.
c. *We have as many soldiers as the Imperial Army doesn't have.

The ungrammaticality of the previous examples contrasts with the grammaticality of cases where the extractee lives in the domain of individuals, such as *which* and *what*.

(19) Which soldiers doesn't the Imperial Army have?

If we look at relative clauses with amount interpretations, we observe that they pattern like (19) and unlike the examples in (18) above. Many speakers readily admit an amount reading of (20): it amounts to saying that our soldiers exceeded in number those of the Imperial Army.[4] (As expected, out of the blue, the kind interpretation of (20) is also available.)

[3] Due to space limitations, I only discuss the case of negative islands, but the same observations hold of others, such as tenseless *wh*-islands, a variety of factive constructions, etc.

[4] Some speakers may need some more contextual support. Suppose that our school is competing against others to get some fellowship. In order to get the fellowship there are certain stringent constraints on how many students schools may have, such that having a certain number of students may maximize your chances of obtaining the fellowship. In this case, a sentence like *our school got the fellowship because we had the students that yours didn't have* expresses that we had an amount of students such that your school did not have as many students.

(20) We won the battle because we had the soldiers that the Imperial Army didn't have.

3.3. Interim conclusion

In the last two sections, I demonstrated both that (i) there is an undeniably similarity between amount relatives and kind-referring relatives and (ii) unexpected differences between amount relatives and other degree constructions. These facts suggest that a unified treatment of kind and amount relatives is not just defensible, but desirable. Therefore, I propose the generalization in (4), where amount readings are ultimately derived from kind readings.

(4) The AMOUNT ⊆ KIND generalization:
Amount interpretations of relative clauses are a form of kind interpretation.

4. What kinds and amounts have in common

The goal of this section is to spell out a formal account of the generalization in (4). The general intuition that I will pursue, in a nutshell, the following. The relative clauses we have discussed so far make reference to subkinds. The head noun of the relative clause provides the name of a kind that we can then reference and attribute properties to. The kind interpretations prompted by relative clauses in (1) and (2) highlight some relevant property that holds of the referent of the relative clause. This property is used to attribute to the kind-referring term the sufficiently regular behavior that it requires to be understood as kind-referring. Paraphrasing:

(21) a. It would take us years to drink the champagne that they spilled last night.
$\rightsquigarrow$ It would take us years to drink champagne with some relevant property of the champagne we spilled last night

b. $[_{\text{DP}}$ the champagne that we spilled last night $]$ $\leftrightsquigarrow$ champagne with property $\mathcal{P}$
[where "the champagne that we spilled last night" is a realization of $\mathcal{P}$]

Since the relevant property $\mathcal{P}$ that serves to single out the referred kind is unspecified, it could be anything that is supported by the current circumstances, and so it may well be a gradable property like *be* d-*dry*, and *be* d-*much*, as well a non-gradable property, like *be produced in Alsace*, or a more common taxonomic property of champagne-kinds, like *be a prestige cuvée*. In this way it is possible to capture amount interpretations of relative clauses like (1)/(2) by the same means required to account for kind reference. It is in this sense that amount interpretations can be taken to be a form of kind interpretation and that a unified account is possible. As a consequence, whenever a relative clause admits an amount interpretation it also necessarily allows a kind interpretation. This way of looking at sentences like (1)/(2) captures their overall vagueness–i.e. the champagne that was spilled could have any number of properties bearing on the time it would take us to drink an equivalent champagne. The key unifying factor, however, is that the property $\mathcal{P}$ contributes a way of narrowing down the space of possibilities for the subkind in question.

4.1. On kinds and subkinds

Although definite DPs cannot typically be used to form generic statements in English, there are specific environments where the definite article can be used to make reference to a kind. Consider (22), where a kind-referring term is further restricted by the use of an anaphoric demonstrative or a relative clause. In these examples, the head noun "kind" is optional, suggesting that the definite article is not altogether ruled out from kind-referring terms.

(22) a. This (kind of) lion is widespread.
b. This (kind of) whale is extinct.
c. The (kind of) lion that eats people is widespread.
d. The (kind of) whale that had horns is extinct.

Crucially, the sentences in (22) refer to subkinds of lions and whales, as opposed to the natural kinds on the whole. Moreover, subkind-referring expressions like those in (22) need not be natural or well-established; they can be *ad-hoc*. This is easily seen in (22c): the lions that eat people, for instance, do not form a natural class; in fact, they may comprise of individual lions in several subspecies of lion and exclude others in the same subspecies.

Chierchia (1998) thought of kinds as regularities that occur in nature, whose only property is that "we can impute to them a sufficiently regular behavior". *Ad hoc* subkinds allow us to do something similar in real time, that is, impute a regular behavior to some subset of a kind without prior agreement as to whether the behavior in question actually qualifies as sufficiently regular. This is a very useful mechanism if, with Chierchia, we believe that what counts as kind is not set by the grammar, but amounts instead to conventional (shared) knowledge of a community of speakers. It allows us to talk and ask questions about very specific kinds. These examples help to pinpoint what we need to form an *ad hoc* subkind: (i) a semantic sortal–something to be a kind of–, and (ii) some means to identify what the relevant subkind is. (i) is provided by a kind-referring noun. Anaphoric demonstratives, relative clauses (and sometimes PPs and other modifiers like adjectives) can accomplish (ii). The analysis I defend here capitalizes on the possibility of constructing *ad hoc* subkinds and the grammaticality of the definite article when making reference to such subkinds.

4.2. *Ad hoc* subkinds as partitions

Referencing subkinds, *ad hoc* or not, is not completely free. Carlson (1977a) noted that when referring to different subkinds, the subkinds must be disjoint, they cannot share realizations. A sentence like (23) cannot be verified by a situation where only Fido is sitting in the next room, even though Fido in fact belongs to more than one kind of dog (e.g. if he is a watch dog and a border collie in the real world, he effectively belongs to two different subkinds of dog).

(23) Two kinds of dogs are sitting in the next room.

Carlson (1977b: 213) spelled out the constraint as follows (slightly adapted here):

(24) **Disjointness Condition**: A kind-referring expression can only refer to a contextually defined subset of all the possible subkinds that the noun is true of, such that:
a. the subkinds in this subset are disjoint and share no realizations,
b. the subkinds collectively cover all the space of realizations of the kind.

In order to make the connection between *ad hoc* subkinds and amount interpretations maximally salient, I will recast Carlson's (1977b) disjointness condition in terms of partitions. I suggest that reference to subkinds must be mediated by an equivalence relation that induces a partition on the denotation of its relevant superkind. How this equivalence relation is determined is context dependent; as a consequence, part of the task when interpreting an *ad hoc* subkind referring expression involves retrieving this equivalence relation from the context.

Following Cresswell (1976), Klein (1980) and many others, degrees can be understood as equivalence classes of ordinary objects. That is, the degree of my height can be defined by the set things that are the same height as me, an amount of champagne as the set of portions of liquid of equal volume, etc. Because interpreting *ad hoc* subkinds involves figuring out what the equivalence relations are, and because some equivalence relations can serve to define degrees, there is no reason why *ad hoc* subkinds should not make reference to portions of equal amounts, just like they can refer to sets of entities (*qua* kinds). Coming back to the example in (21) above, we could say that the equivalence relation *be the same kind as* would give us a partition of champagne individuals according to their kind (e.g. *blanc de noirs*, *blanc de blancs*, *rosé champagne*...). The equivalence relation *be as sweet as* would partition the domain of champagne in terms of the sweetness of its instances (*extra brut*, *brut*, *extra dry*...), whereas an equivalence relation *be as much as* would partition the denotation of champagne in different amounts (*1L*, *2L*, *3L*... or perhaps *1 bottle*, *2 bottles*, *3 bottles*...).

Let us look first into partitions. A partition is a way of dividing some set into disjoint subsets. More interestingly for us, the partitioning of a set can be carried out by an equivalence relation, which is a reflexive, symmetric and transitive relation. If R is an equivalence relation, $[x]_R$ represents the equivalence class containing x. An equivalence class simply collects in a set all the elements that are equal with respect to some equivalence relation. Thus, if y is also a member of $[x]_R$, then $[x]_R = [y]_R$. Each subset that is a member of some partition is called a *cell*. An equivalence relation R is able to induce a partition on a set A, because any two members x and y can only be in the same cell if (and only if) they are related by R.

(25) a. *Partition*: Let A be a non-empty set. A partition is a collection of subsets of A iff (i) for any two subsets X and Y, $X \cap Y = \varnothing$ and (ii) the union of all subsets of A equals A.
b. *Equivalence Relation:* Let R be an equivalence relation. Then:
$a \simeq_R b$ iff $\forall x[(R(a,x) \leftrightarrow R(b,x)) \wedge (R(x,a) \leftrightarrow R(x,b))]$
c. *Equivalence Class:* Let $[\ ]_R$ be a function from a domain D to $POW(D)$ such that: $\forall x \in D[[x]_R = \{y : y \in D \wedge x \simeq_R y\}]$

Let us return to Fido in (23). Given the equivalence relation *be the same breed as*, Fido is a member of the cell containing border collies, the equivalence class $[F]_{breed}$. By the same token, if the equivalence relation were *have the same role as*, Fido would be in the cell containing watch dogs, $[F]_{role}$. Given the properties of partitions, Fido cannot live in two cells at the same time, and so we have to chose one or the other equivalence relation,. Hence the ill-formedness of (23).

We can now look into how to extend the partition talk to degrees. I follow Cresswell (1976) in assuming that degrees can be viewed as equivalence classes of individuals (see Klein, 1980; Rullmann, 1995). I illustrate the main idea with an adjective A. Associated with any gradable predicate (an adjective, adverb, verb, etc.) there is a two-place relation $\geq_A$, and a set D_A. The set D_A is a subset of the universe of discourse containing all and only those objects of which the adjective can be sensibly predicated. This is just a lexical requirement to make sure that a set like D_{tall} contains people, mountains, etc., but not ideas or colors, since the latter cannot be sensibly attributed a height. The relation $\geq_A$ is reflective of our conceptual ability to determine, from any two individuals, which has more of a certain quality than another. Cresswell (1976) suggested to define $\geq_A$ as follows:

(26) $\langle D_{tall}, \{\langle x,y\rangle : x,y \in D_{tall}$ and x is as tall as $y\}\rangle$

From here the relation $\geq_A$ may induce a totally-ordered relation $\geq_A$ on the members of DEG_A such that $deg_A(x) \geq_A deg_A(y)$ *iff* $x \geq_A y \wedge y \ngeq_A x$. In this case, we can easily define an equivalence relation from $\geq_A$, and partition a domain according to the resulting equivalence relation, where the degree of A-ness of an object x, say $deg_A(x)$ is defined as the set of all objects that stand in the $\simeq_A$ relation to x:

(27) a. $x \simeq_A y \leftrightarrow x \geq_A y \wedge y \geq_A x$
b. $deg_A(x) = \{y \in D_A : x \simeq_A y\}$

As a consequence, the degree to which Liz is tall, $deg_{tall}(Liz)$ can now be identified with the set of all objects that are exactly as tall as Liz. In this view, each degree d corresponds to one of the cells in the partition DEG_A induced on the set D_A. For instance, in the case of DEG_{tall} (and a very reduced domain) we may have:[5]

(28)

$d_{5.8f}$: John, Sue Liz	$d_{5.9f}$: Mary, Al	d_{6f}: Mike, Helen	$d_{6.1f}$: Hilary

Establishing partitions from pluralities works exactly the same. We only have to be careful to avoid overlapping individuals. That is, we must avoid that a plurality of two individuals $a \oplus b$, living in the cell corresponding to those pluralities of cardinality 2, be also members of some other cell in the partition. For instance, one could expect that if $a \oplus b$ teams up with individual c to form the plurality $a \oplus b \oplus c$, then individuals a and b would simultaneously be in the cell corresponding to pluralities of cardinality 3 as well. The solution is to adopt a Link (1983) style approach to pluralities, where plural entities are just *sums* of individuals (and not sets), as concrete as the individuals that serve to define them and of the same logical

[5]Notice that the thresholds of the degrees should be overtly determined, so that there is no vagueness whatsoever as to where exactly every individual belongs in the partition. In the example above the cut-off point was the nearest inch, so the actual equivalence relation should read *be as tall as, to the nearest inch*.

type, creating a non-monotone domain of individuals. If a mapping exists between degrees and sets of individuals, as discussed above, each level in a Linkian structure can be seen as an equivalence class. Assuming that cardinalities are simply degrees, as it is common practice, we can create a partition DEG_{card} on D by the equivalence relation $\simeq_{card}$.

(29) a. $x \simeq_{card} y \leftrightarrow x \succeq_{card} y \wedge y \succeq_{card} x$ [where $\succeq_{card}$ = *a cardinality as big as*]
b. $deg_{card}(x) = \{y \in {}^{*}D : x \simeq_{A} y\}$

The result is a partition of the domain of plural individuals according to their cardinality. For instance, the equivalence class $[a \oplus b]_{card}$ corresponds to all plural individuals of cardinality 2 in the domain, such that $[a \oplus b]_{card} = [a \oplus c]_{card} = [b \oplus c]_{card}$, etc. Because plural individuals are individuals with full rights, we need not look into their composing parts. That is, that a and b belong to one cell and $a \oplus b$ to a different cell is inconsequential in this respect.

4.3. Connecting the dots

In order to make the connection between *ad hoc* subkinds and amount interpretations of relative clauses explicit, we have to look a bit further into *ad hoc* subkinds. *Ad hoc* subkinds are inherently vague referring expressions. Although they refer to subkinds, they do not do so in a direct way. Compare:

(30) a. The blue whale is becoming extinct.
b. The whales that you like so much are becoming extinct.

One can refer to a subkind by directly mentioning its name. In this case, *blue whale* stands for a (taxonomic) subkind of whale. But very few subkinds have names. For all we know, the kind of *whales that you like so much* could be *blue whales*, but it could as well be almost any collection of whales that you fancy. That is, the subkind *whales that you like so much* are a subkind just by virtue of your liking them so much. In this case, then, the only "sufficiently regular behavior" that we may impute them is precisely that you like them so much.

I suggest that the sole role of the relative clause in *ad hoc* subkind reference constructions is to provide information that helps determine what the relevant sufficiently regular behavior is. How exactly does the relative clause fulfill this role? It does so by restricting, in more or less the usual way, the denotation of the kind-denoting NP, e.g. *whale* in (30b), to a subset of whales. Crucially, this subset must be a member of one cell in a partition of whale subkinds. Given the nature of partitions, information about one cell can help us fill in the rest of the cells; for instance, by lumping together in one cell the individual whales that you like, and all the ones that do not belong in this cell occupying the sole other cell of the partition. The more information we might have about your preferences, the richer the partition could be. Under this view, a critical part of resolving *ad hoc* subkind reference is being able to determine an equivalence relation that puts all the whales that you like in a single cell.

This is not always as straightforward as it may seem and, oftentimes, vagueness is rampant. In (1), *the champagne that we spilled last night* is referring to an *ad hoc* subkind of champagne. If we go with the taxonomic interpretation of the sentence, we partition the domain of champagne into its different subkinds, and we assume that the particular champagne that the spilled last night lives in one of the cells. For instance, if they spilled a very rare kind of *prestige cuvée*, we would require a partition based on taxonomic kinds.

(31)

Prest. cuvée	Blanc de noirs	Blanc de blancs	Rosé

Each one of the cells above contains the individual instances of champagne that correspond to each kind.[6] Carlson's (1977a) disjointness condition is met by resorting to an equivalence relation like *be the same kind as*. Now, it could be that the reason why it would take us so long to find the champagne that we spilled last night is because it was much sweater than usual. In that case, we can generate the relevant partition by sweetness–gr. of sugar per liter–from an equivalence relation like *be as sweet as*.

(32)

$d < 6$	$12.1 < d < 17$	$17.1 < d < 32$	$32.1 < d < 50$	$\ldots < d < \ldots$

To reiterate: subkind reference must be mediated by a partition to ensure that the domain is covered by non-overlapping sets. This partitioning is carried out by an equivalence relation that is only contextually determined. As long as this is observed, any equivalence relation might do. Thus, the only difference between (31) and (32) above is that different equivalence relations are picked in different contexts. At this point, it is straightforward to extend the same reasoning to the classical AR examples and amount interpretations. Since we know that cardinalities can be defined in terms of equivalence classes, there is no reason why the required equivalence relation cannot be of the form *be as much as*. Thus, for the classical *champagne* example in (1), we could envision a partition by volume, as in (33).

(33)

$0\text{L} \leq d < 1\text{L}$	$1.1\text{L} < d < 2\text{L}$	$2.1\text{L} < d < 3\text{L}$	$3.1\text{L} < d < 4\text{L}$	$4.1\text{L} < d < 5\text{L}$	$\ldots < d < \ldots$

If this rationale is correct, amount interpretations of relative clauses are simply a case of *ad hoc* subkind reference. Thus, the only analysis we need is one that derives *ad hoc* subkind reference, and no appeal to degree semantics is necessary.

To sum up, making reference to subkinds requires structuring the domain in a certain way. I argued that one way of capturing this requirement is by partitioning the relevant domain. Once this step is taken, a parsimonious account of amount interpretations of relative clauses is made available. Because degrees are definable in terms of equivalence classes, we can exploit the independently-needed mechanisms of *ad hoc* kind reference and induce a partition that gives us equivalence classes of quantities or amounts. Given the evidence in sections §2 through §3, this account offers a number of advantages: (*i*) it accounts for the pervasive similarities between kind and amount referring relative clauses in terms of their the syntactic/semantic properties, (*ii*) it accounts for the lack of evidence for degree abstraction, and (*iii*) it relies on mechanisms

[6] In this respect, the table above is just a shortcut to the actual partition, whose members are always individuals, not kinds.

that are independently needed for the interpretation of subkind-referring expressions, as well as extant analyses of degrees as equivalence classes.

5. Compositional implementation

In laying out my assumptions about kind reference I am following Chierchia (1998) for the most part. Kinds are individuals whose spatiotemporal manifestations are discontinuous. In this sense, the kind DOG can be identified as the sum of all individual dogs, which can then be modeled as the largest member of the plural individual comprising all dogs. For the majority of properties, like the property of being a dog, there is a corresponding kind, the dog-kind. Conversely, natural kinds have a corresponding property (the property of belonging to that kind). Properties may be systematically mapped to their individual correlates via a nominalization function, the "down" operator $^{\cap}$. Likewise, individual kinds may be mapped to their corresponding properties via the inverse of $^{\cap}$, the "up" operator $^{\cup}$.

(34) a. **Predicativization**: Let d be a kind. Then for any world/situation s, $^{\cup}d = \lambda x. \leq d_s$, if d is defined, false otherwise (where d_s is the plural individual that comprises all of the atomic members of the kind).

b. **Nominalization**: For any property P and world/situation s, $^{\cap}P = \lambda s.\iota P_s$ if $\lambda s.\iota P_s$ is in K; else undefined (where P_s is the extension of P in s and K is the set of kinds).

Kinds are individuals with their own rights, and so they belong to their own domain D_k, a subset of D.[7] Thus, we can talk about the domain of object-individuals D_o, to the exclusion of the domain of kind individuals, D_k. Kinds have the possibility to combine both with kind-level and with object-level predicates. In the first case, kinds are attributed some property directly by the main predicate, (35a). In the second case, most commonly with episodic sentences, we encounter a mismatch between a kind denoting argument and a predicate that lexically selects for non-kind predicates, (35b).

(35) a. Dogs are {widespread/extinct/common}.

b. Dogs are barking outside my window.

Example (35a) is a case of direct-kind reference: to derive this interpretation, we simply apply the kind denoting term to the predicate, e.g. $extinct(\textsc{dog})$. The example in (35b) is different in that the dog-kind now serves as an argument to an individual-selecting predicate. In this case, the predicate does not attribute properties to the dog-kind, but to object-level instances of the dog-kind; (35b) asserts the existence of some individual dog that is barking. To achieve this result, Chierchia (1998) proposes a new rule of composition, Derived Kind Predication (DKP henceforth), that solves two problems: it provides a means to solve the sortal mismatch and introduces existential quantification over instances of a kind.

[7] In order to represent kinds and object variables, I follow the convention of using the subscripts k for kind-level and o for object-level variables.

(36) a. Derived Kind Predication (DKP):
If P applies to objects and k denotes a kind, then $P(k) = \exists x[{}^{\cup}k(x) \wedge P(x)]$

b. $[\![(35b)]\!] = \exists x[{}^{\cup}({}^{\cap}\lambda x.{}^{*}dog(x) \wedge barking\text{-}outside\text{-}my\text{-}window(x))]$
$= \exists x[x \leq \textsc{dog} \wedge barking\text{-}outside\text{-}my\text{-}window(x)]$

The next step in arriving at the desired *ad hoc* subkind interpretations involves a mapping from kinds to subkinds.[8] In accordance with the discussion above, however, we need a mapping that will partition kinds, not just any subkind extracting operation. The partition function below meets these two criteria (cf. Gillon, 1987; Schwarzschild, 1996): a partition of a kind K is a set of subsets of ${}^{\cup}K$ that covers ${}^{\cup}K$ and whose members do not share any instantiating individuals.

(37) **Partition function**: A partition function $\prod$ is a $\langle k, kt\rangle$ function such that for any kind K, $\prod(K)$ meets two conditions:

a. *Cover*: $\forall x_o[x_o \leq K \rightarrow \exists y_k \in \prod(K)[x_o \leq y_k]]$

b. *No overlap*: $\forall x_o[\exists y_k \in \prod(K)[x_o \leq y_k] \rightarrow \neg\exists z_k \in \prod(K)[y_k \neq z_k \wedge x_o \leq z_k]]$

As an illustration, consider the case of $K = \textsc{dog}$, where we partition the dog-kind taxonomically (i.e. $\prod(\textsc{dog}) = \{\textsc{collie}, \textsc{pug}, \textsc{greyhound}, \textsc{beagle}, \ldots\}$). Then condition (a) states that if x_o is an instance of the kind DOG, there is some subkind y_k in the set of subkinds $\prod(\textsc{dog})$ that x_o is also an instance of. This condition makes sure that all particular dogs belong to some subkind, to some breed in this case. In turn, condition (b) states that if x_o is an instance of the subkind y_k, there will be no additional subkind z_k in $\prod(\textsc{dog})$ such that x_o also realizes. This is reflective of the fact that, if Fido is a beagle, he cannot be any other breed. More generally, the function ensures that if we partition the dog-kinds by breed, all border-collies will be in the same cell of the partition, and, say watch-dog border-collies will not be able to occupy their own–despite being a subkind of dogs as well in the actual world.

We can now use the partition function in (37) to provide a compositional account of *ad hoc* kind-referring terms. First, a kind must be partitioned into a set of individual correlates of its subkinds. We can do this by defining a kind-to-subkind operator that employs the partition function (cf. Zamparelli, 1998). Call this operator κ.

(38) $[\![\kappa]\!] = \lambda x_k.\lambda y_k.\prod(x_k)(y_k)$

From a semantic standpoint, we can think of κ as doing covertly the task that the noun *kind* does overtly. It targets a kind x_k and returns a set of kind-individuals that partitions x_k. The function returns the set of (individual correlates of) subkinds that are in the partition.

(39) $[\![\kappa]\!]([\![\textsc{dog}]\!]) = \lambda y_k.\prod(\textsc{dog})(y_k) = \{\textsc{greyhound}, \textsc{border collie}, \textsc{beagle}, \ldots\}$

In this case, we have partitioned the domain of DOG subkinds according to their taxonomy, making sure on the way that no one dog belongs to two separate kinds. So far we have suc-

[8]There are a number of mappings in the literature between kinds and subkinds (e.g. Krifka et al., 1995; Wilkinson, 1995; Zamparelli, 1998), usually carried out by an operator, whose meaning is generally taken to be very similar to the noun *kind* in expressions like *kind of dog*.

cessfully reproduced Carlson's (1977a) results, but we have not quite achieved our goal of accounting for *ad hoc* kind reference. As I suggested earlier, two pieces of information are required in order to form an *ad hoc* kind in real time: (i) a semantic sortal–something to be a kind of–, and (ii) some means to identify what the relevant subkind is, i.e. to identify its sufficiently regular behavior. This is shown by the contrast between the two sentences in (40):

(40) a. That kind of dog is dangerous.
b. *The kind of dog is dangerous.

In the two cases in (40) the semantic sortal is provided by the kind-referring noun *dog*, but only (40a) provides a means to identify the relevant properties of the dogs that are to be recognized as dog-subkinds; in this case it does so by anaphorically referring to it. The variant in (40b) lacks this second piece of information and reference to a kind fails.

A similar state of affairs holds in the absence of the noun *kind*. When no natural kind nor an antecedent for the intended subkind is available, we can use *the NP Rel Clause* constructions to refer to *ad hoc* kinds. This is because the relative clause itself can express a regularity that characterizes the kind in question, thus aiding in kind reference resolution. With kind-referring terms involving the noun *kind*, the role of the relative clause is obvious. But given our analysis of the κ-operator, the role of the relative clause in *ad hoc* kind reference without the noun *kind* should follow analogously.

In order to capture this difference formally we can think of the relative clause as a means to further narrow the kind-referring potential of kind-referring NPs. It is in this respect that appealing to partitions becomes specially useful. We can easily modify κ so that it makes reference to an additional argument, a predicate P, and states a new condition whereby objects in the intersection of P and the property correlate of the kind K all live in the same cell of some partition of K. This can be done as follows. Consider first a revised version of κ, κ+.

(41) $[\![\kappa+]\!] = \lambda x_k.\lambda P_{\langle et\rangle}.\lambda y_k.\prod(x_y)(y_k) \wedge \forall z_o[z_o \leq x_k \wedge P(z_o) \rightarrow z_o \leq y_k]$

After applying to an individual kind x_k and a property P of individuals, κ+ returns the subkinds that include objects whose realizations are both instances of x_k and members of P. The task of P, the relative clause, is to provide information about the regular behavior that we must impute to the subkind in question. This is achieved by letting the relative clause do its usual job and interpreting it intersectively.

Let us work out a concrete example, *the lions that eat people*, from (22c). The term *lions that eat people* refers to a kind, but not to a natural or well-established one, so this is a task for κ+. For concreteness, assume a syntactic structure along the lines in (42). By the time κ+ gets to enter into the derivation, the NP already denotes a kind.[9]

[9]There a number of ways of doing this (see e.g. Carlson, 1977b; Zamparelli, 1998; Dayal, 2004; Kratzer, 2005). Bear in mind however that different options entail different views of how nouns come to denote kinds. At any rate, this is a simplifying assumption, and nothing about how *ad hoc* kind-referring terms are derived hinges on this decision.

(42) $[_{\text{DP}}\ [_{\text{D}}\ \text{the}\ ]\ [_{\text{NP1}}\ [_{\text{NP2}}\ \kappa\text{+}\ [_{\text{NP3}}\ \text{lion}\ ]_i\ ]\ [_{\text{CP}}\ \text{that}\ t_i\ \text{eat people}\ ]]]$

(43) a. $[\![\text{NP2}]\!] = [\![\kappa\text{+}]\!]([\![\textsc{lion}]\!])$
$= \lambda P_{\langle et \rangle}.\lambda y_k. \prod(\textsc{lion})(y_k) \wedge \forall z_o[z_o \leq \textsc{lion} \wedge P(z_o) \rightarrow z_o \leq y_k]$
b. $[\![\text{NP1}]\!] = \lambda y_k. \prod(\textsc{lion})(y_k) \wedge \forall z_o[z_o \leq \textsc{lion} \wedge \textit{eat-people}(z_o) \rightarrow z_o \leq y_k]$

The last line above returns a set of subkinds of the lion-kind that partitions the domain of lions and where the all the object-level lions of which *P* holds constitute an instance of one such kind. This is still too weak a meaning. But now the definite article can simply contribute an ι-operator: $[\![\textit{the P}]\!]$ = the contextually salient largest member of *P*, if there is one, else undefined. The article applies to the set of subkinds of lions denoted by NP1 and returns the single salient subkind of which all the people-eating lions are an instance, i.e. the individual correlate of the property *be a people-eating lion*.

(44) $\iota y_k. \prod(\textsc{lion})(y_k) \wedge \forall z_o[z_o \leq \textsc{lion} \wedge \textit{eat-people}(z_o) \rightarrow z_o \leq y_k]$
$= {}^{\cap}(\lambda z.{}^{*}lion(z) \wedge eat\ people(z))$

As a consequence, non-people-eating lions and lions that eat other things besides people will have to live in other cells of the partition.[10] It follows, then, that the cells in the partition cannot contain taxonomic subkinds anymore, since no partition of lions in terms of their subspecies will contain the *ad hoc* subkind of lions that eat people in one its cells. Thus, as desired, this method of referencing *ad hoc* subkinds overrides any other natural ways of picking the relevant subkinds (e.g. taxonomic properties, etc.). The most likely way to complete the rest of the partition is to find a suitable equivalence relation that groups all people-eating lions in the same cell. An equivalence relation *eat the same as* might do. With this equivalence relation we may obtain a partition of the lion-kind like the following.

(45) $\{\textsc{lions that eat people}, \textsc{lions that eat zebras}, \textsc{lions that eat carrion}\ldots\}$

What matters most is that the modifier, the relative clause in this case, is informing us about what one of the subkinds must look like. The resulting DP can serve as an argument to kind-level predicates in the usual way. Alternatively, it can serve as non-kind-selecting predicates via Derived Kind Predication (see (36a) above): a sentence like (46a) asserts the existence of an instantiation of the *ad hoc* eating-people-lion-kind, and that you like (some of) those instantiations.

(46) a. You like the lions that eat people.
b. $[\![(46\text{a})]\!] = \exists y[{}^{\cup}({}^{\cap}\lambda z.{}^{*}lion(z) \wedge \textit{eat-people}(z))(y) \wedge like(y)(you)]$
$= \exists y[y \leq \textsc{lion} \wedge \textit{eat-people}(y) \wedge like(you, y)]$

Notice that, practically speaking, (46a) may be interpreted in a number of ways. This is because the semantics of κ+ only forces us to find a partition of lions where the lions that eat people live in one cell, but it does not force us to talk about the fact that these lions eat people. As

[10] As mentioned above, in order to build the partition properly the relevant description should be explicit enough to avoid overlap. Thus, we should have $\{\textsc{lions that eat only people}, \textsc{lions that eat only zebras}, \ldots\}$.

with ordinary kind predication, there might be a number of reasons to refer to a kind. Thus, the traits of the lions that you like in (46a) need not be determined by the relative clause. For instance, it could be that lions that eat people have a number of associated characteristics (e.g. they are faster, smarter, etc.) that you like, despite the fact that you are not fond of their habit to eat people. In such case, (46a) is true and felicitous, as captured by (46b).

6. Conclusions

The merits of looking at English so-called ARs as a species of kind-referring relative clauses are various. All the properties of amount interpretations of relative clauses discussed in sections §2 through §3 follow without additional stipulations, namely, (i) it accounts for the AMOUNT $\subseteq$ KIND generalization in (4) above, which states that amount interpretations of relative clauses are parasitic on kind interpretations and (ii) it explains why amount interpretations are not subject to the typical restrictions that we observe with constructions that involve degree-abstraction and degree-operators. Thus, if the results reported here are on the right track, the relative clauses discussed in this paper are not "Amount Relatives", literally speaking, but *ad hoc* kind-referring expressions.

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Underspecified changes: a dynamic, probabilistic frame theory for verbs[1]

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Abstract. The verb 'rise' can be used both with property-denoting nouns like 'temperature' but also with NPs like 'a Titan' or 'China'. Whereas in the former case the change triggered by a rising event is directly related to the subject (its current value increases), this does not hold for 'a titan' or 'China'. In this case it is a property of these objects, say their height or their political power, which increases in value. Furthermore, 'rise' does not target a particular property as the examples above show. This data has led Cooper (2010) to the conclusion that it is presumably not possible (i) "to extract a single general meaning of words which covers all the particular meanings of the word in context", and (ii) "to determine once and for all the set of particular contextually determined meanings of a word". In this article we present a solution to the two problems raised by 'rise' in a frame theory. 'Rise' is analyzed as a scalar verb which does not lexicalize a complete scale in its meaning. Rather, it shows underspecification relative to the dimension (property) parameter of a scale. The set of admissible properties is determined by a constraint on the value ranges of properties. If the property is not uniquely determined by the subject, the comprehender uses probabilistic reasoning based on world knowledge and discourse information to defeasibly infer the most likely candidates from this set (2nd problem). The first problem is solved not by simply introducing objects into the representation of a discourse but instead by pairs consisting of an object and an associated frame component which collects the object information contributed by the discourse. Changes triggered by events like the one denoted by 'rise' are modelled as update operations on the frame component while the object component is left unchanged.

Keywords: lexical semantics, scalar changes, frame theory, probabilities.

1. Two puzzles about 'rise'

According to Cooper (2010), the question 'What is the meaning of an item?' is divided into the following two subquestions: (i) "is it possible to extract a single general meaning of words which covers all the particular meanings of the word in context?", and (ii) "is it possible to determine once and for all the set of particular contextually determined meanings?" For Cooper, data like that in (1) shows that the answer to both questions is most likely 'no'. (Examples (1c) - (1e) taken from Cooper 2010.)

(1) a. The temperature (of the liquid) is rising.
    b. The price (of the commodity) is rising.
    c. As they get to deck, they see the Inquisitor, calling out to a Titan in the seas. **The giant Titan rises through the waves**, shrieking at the Inquisitor.
    d. Mastercard rises.
    e. China rises.

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In order to arrive at a single general meaning for 'rise', it is necessary to characterize the contribution of the subject argument in a unique way. However, the data in (1) shows most likely that this cannot be done. In (1a) and (1b) the change expressed by 'rise' is directly related to the denotation of the subject argument. It is the value of the temperature/price that increases. This does not hold for the remaining three examples. The referent of 'titan', 'Mastercard' and 'China' must be held constant. What changes, rather, is the value of a property of the subject referent. For example, in (1c) it is the height of the titan that increases. Hence, there are conflicting constraints imposed by the subjects in (1a) and (1b) on the one hand and the other three examples on the other hand. Even if one focuses on the property that gets changed, there is no uniformity because different properties such as temperature, price and height are involved in these examples. Cooper concludes: 'This makes it difficult to see how we could give a single type which is general enough to include both varieties and still be specific enough to characterize the meaning of rise' (Cooper, 2010).

The 'Mastercard' and 'China' examples are taken by Cooper as evidence that the second question has to be answered in the negative too. Cooper comments: "While speakers of English can get an idea of the content of the examples in (1d) and (1e) when stripped from their context, they can only guess at what the exact content might be. It feels like a pretty creative process" (Cooper, 2010). The problem stems from the fact that given an object like 'China' or 'Mastercard' there are in general many properties that can be targeted by 'rise'. What is required, therefore, is an explicit context like the one given by Cooper for 'China rises' in which particular properties are singled out:

(2) "The rise of China will undoubtedly be one of the great dramas of the twenty-first century. China's extraordinary economic growth and active diplomacy are already transforming East Asia, and future decades will see even greater increases in Chinese power and influence. But exactly how this drama will play out is an open question. Will China overthrow the existing order or become a part of it? And what, if anything, can the United States do to maintain its position as China rises?"

Cooper's argument can be summarized in the following way: (i) 'rise' semantically targets a property whose value is increased by an event of this sort; (ii) this property is not uniquely determined; (iii) there seems to be no principled way to characterize or define the set of admissible properties once and for all so that for any given context one element of this set is selected by 'rise' (second problem); and (iv) the subject argument of 'rise' either denotes the targeted property or an entity which has this property. In the latter but not in the former case, the denotation of the subject argument is held constant (first problem).

In this article we will propose a solution to these two puzzles in a frame theory. In contrast to Cooper's variant of such a theory which is based on records we apply a variant of frame theory outlined in (Petersen, 2007) and elaborated on for dynamic frames in Naumann (2013) and Gamerschlag et al. (2014). We incorporate insights from two research traditions: (i) 'temperature' and 'price' are (basically) functional nouns, i.e. they semantically relate a property with an object that has this property and a value of this property. This semantic representation closely resembles the frame representation of nouns in general in terms of typed attribute value structures. Hence, in our frame theory, all nouns are represented in terms of frames. Furthermore, discourse objects are pairs consisting of an object and an associated frame component. Changes, and more generally updates, are always executed on the frame component while the object component is held constant. This is the key to the solution of the first puzzle. (ii) The key observation for a solution of the second puzzle comes from the notion of a scale. Each admissible attribute is associated with a particular scale which specifies a dimension, a set of values, and an ordering relation on them. 'Rise' shows attribute-underspecification: no particular dimension is specified. Rather, it imposes a constraint on the ordering relation defined for the attribute values. Only those properties (dimensions) are admissible which satisfy this constraint.

Before presenting our analysis of 'rise', we will first introduce some theoretical prerequisites in the following sections which deal with functional concepts, scalar changes and their relation to frames.

2. Inherently functional nouns with particular value ranges

One way of analyzing nouns like 'temperature' and 'price' is as being basically inherently functional, i.e. as denoting a functional concept, cf. Löbner (2011).[2] For example, the temperature is always the temperature of something else. Possible objects are persons (Bill's temperature), bodies (the temperature of the sphere) and three-dimensional spatial regions (the ambient temperature). Similar observations apply to 'price'. The two objects targeted by such nouns are linked in a particular way. The object denoted by 'the N' in an identity statement like 'The temperature is 90 degrees Celsius' or 'The price is 30 Euro' is the value of a property of the object left implicit in those statements. Making the relation explicit yields for example 'The ambient temperature is 90 degrees Celsius'. Here, the noun denotes the property itself, e.g. 'temperature'. Let us call the value of the property the 'dependent object' and the object the value is related to by the property the 'independent object'. For example for 'The temperature of the liquid is 90 degrees Celsius', one gets: temperature $\doteq$ property, 90 $\doteq$ dependent value and the liquid $\doteq$ independent object. Two properties of functional nouns like 'temperature' and 'price' are (i) they are time-dependent and (ii) for a given independent object and time point there is a unique value, i.e. dependent value. Examples of inherently functional nouns that are also time-dependent and (almost) functional are 'president' and 'husband'. The difference between 'temperature' and 'price' on the one hand and 'president' and 'husband' on the other lies in properties of the set of (dependent) values. Whereas for the former this set is linearly ordered (100 degrees Celsius is greater than 50 degrees Celsius) there is no ordering on the set of possible presidents or the set of possible husbands. This difference shows up in the admissibility of 'rise'.

(3) a. The temperature is rising/changing.
    b. The president is *rising/changing.

The distinction between dependent and independent objects is directly related to one of the

[2] 'Basically' means that there are other uses as well. For example, 'temperature' can be used as a sortal noun, see Löbner (2011) for details.

problems discussed in the first section. The subject of 'rise' denotes either a property of an object the value of which is changed by an event of rising or the object the value of a property of which is changed by a rising event. Hence, if the subject does not denote a property, it denotes an entity a property of which is targeted by 'rise'. The task, therefore, is to find a representation of nouns in which they are not simply interpreted as sets of objects or as sets of pairs of objects but in which also their properties become available.

3. Scalar changes and scalar underspecification

Rappaport Hovav and Levin (2010) make a basic distinction in the verbal domain between result verbs and manner verbs. Examples of both types of verbs are given in (4).

(4) result verbs: clean, cover, empty, fill, freeze, kill, melt, open, arrive, die, enter, ...
manner verbs: nibble, rub, scribble, sweep, flutter, laugh, run, swim, ...

These two classes of verbs differ with regard to what they lexically encode as part of their meaning. Result verbs encode scalar changes whereas manner verbs encode non-scalar changes. According to Rappaport Hovav and Levin (2010: p.8), a scalar change in an entity involves a change in value of a particular dimension for this entity in a particular direction along the scale, with the direction specified by the ordering relation. Hence, scalar changes are changes in the value of a single property or attribute of an entity. By contrast, non-scalar changes cannot be characterized in terms of an ordered set of values of a single attribute (Rappaport Hovav and Levin, 2010: p.12). Rather, they involve complex changes—that is, a combination of multiple changes—and this complexity means that there is no single, privileged scale of change (Rappaport Hovav and Levin, 2010: p.12). Scalar changes are based on the notion of a scale, "where a scale is a set of degrees—points or intervals indicating measurement values—on a particular dimension (e.g., height, temperature, cost), with an associated ordering relation" and "verbs denoting events of scalar change lexically specify a scale", (Rappaport Hovav and Levin, 2010: p.8). According to Kennedy and McNally (2005), a possible definition of this notion is: a scale is a triple $\langle S, \Delta, R \rangle$ s.t. S is a set of degrees, Δ is the dimension of measurement and R is an ordering on S. Thus, following Rappaport Hovav and Levin (2010) different scalar verbs encode different scales, some of them only differing by the order of degree-points. By way of example, consider the two verbs 'cool' and 'warm', which lexicalize a *property scale*. For both verbs, the dimension of measurement is that of the temperature of an entity and the values are therefore temperature degrees. They differ w.r.t. to the direction along the temperature scale. Whereas for 'warm' there is a change from a smaller to a greater temperature degree (increase in temperature) for 'cool', this direction is reversed: the temperature decreases.

Rappaport Hovav and Levin (2010) argue that change of state verbs always lexicalize a complete scale in the sense that all three parameters are specified in the lexicon. If a verb does not lexicalize a complete scale, it does not encode a scalar change according to the authors. For example, Rappaport Hovav and Levin (2010) do not classify 'cross' and 'traverse' as verbs encoding a scalar change. Though these verbs lexically specify a dimension of measurement (a path) and, therefore, a set of values (position on the path), the direction of motion along this path is not lexically specified and, hence, they do not impose an ordering on the points of the path. The view that scalar changes require a complete scale as part of their lexical meaning has been challenged in Fleischhauer and Gamerschlag (2014), who show that change of state verbs coming with a property scale do not necessarily encode a complete scale but can also exhibit scalar underspecification. For instance, none of the verbs in (5) specifies any particular dimension in its lexical meaning that is targeted and depends upon the functional noun realized in subject position to introduce a dimension such as temperature, price and pressure. The verbs 'rise' and 'fall' in the first two examples operate on the scale provided by the subject and express the 'direction of change', i.e. whether the change results in an increase or decrease of values. The verb 'change' in the third example is even less specific since it refers to a change along the dimension expressed by the subject without encoding a fixed direction of change.

(5) a. The temperature/price/pressure is rising. $\rightarrow$ increase in temperature/price/pressure ($>$)
b. The temperature/price/pressure is falling. $\rightarrow$ decrease in temperature/price/pressure ($<$)
c. The temperature/price/pressure is changing. $\rightarrow$ increase or decrease in temperature/price/pressure ($> \cup <$)

In spite of being incomplete in regard to the dimension, all of the three verbs in the example above can be characterized as change of state verbs since they already address some aspect of change,namely its direction or the fact that a change takes place at all. As will be shown in the next section, this kind of scalar underspecification is the key to our solution of the second puzzle, i.e, the question how the context determines the meaning of a lexical item.

4. (Scalar) changes in a frame theory

Frame theory is based on the notion of an attribute. Attributes are interpreted as functional binary relations. In addition to being functional they are typed (or sorted). For each attribute, there is a source sort and a target sort. For example the attribute COLOR has the source sort **physical object** and the target sort **color**. For TEMPERATURE, the source sort is **physical object** too but the target sort is **temperature**. A sort s is interpreted as a subset D_s of the global domain D. If s is the target sort of an attribute, D_s will be called the *value range* of this attribute. One way of classifying attributes is in terms of instances (or subtypes) of more general relations. Löbner (2014) distinguishes four classes: (i) mereological attributes (HEAD, HANDLE), (ii) role/correlate attributes (PRESIDENT, SPOUSE), (iii) property attributes (WEIGHT, TASTE) and (iv) event-related/affordance attributes (PURPOSE). The value ranges of attributes can be classified according to their ordering properties. A basic distinction is that between 'unordered', denoted by $\perp$, and 'ordered', $<$. If the set is ordered, relevant properties are 'linear' ($<_{linear}$), 'existence of a minimal element' ($<_{min}$) and 'existence of a maximal element' ($<_{max}$). An attribute dimension is a triple $\langle \Delta_{\text{ATTR}}, D_s, ord \rangle$ s.t. Δ_{ATTR} is the interpretation of ATTR, D_s is the value range of ATTR and *ord* is the ordering defined on this value range. In the present context *ord* is always at least linear. However, particular verbs can impose stronger conditions, e.g. that the linear order has a minimal but no maximal element. As will be shown below in section 6 this is the case for 'rise'. Non-stative (or dynamic) verbs operate on the set of attribute dimensions in the frame components of their arguments. They (possibly) im-

verb	**unique attribute specified**	**linear order required**	**direction of change**
cool, widen	+	+	+
rise	-	+	+
cross	+	+	-
rename	+	-	-
change	-	-	-
??	-	+	-
non existent	-	-	+
non existent	+	-	+

Table 1: Classification of change of state verbs

pose constraints on the following three parameters: (i) a particular attribute is specified (yes: + / no: -); (ii) 'ord' is required to be (at least) linear (yes: + / no: -) and (iii) a direction of change is specified or not (yes: + / no:-). Table 1 shows the eight possible combinations of these three parameters. The direction of change $\vec{R}$ is defined in terms of *ord*: if $ord = \bot$, $\vec{R} = \bot$ and if $ord = <_{linear}$, $\vec{R} \in \{<_{linear}, >_{linear}, ><_{linear}\}$. Here, we use the following notation: (i) $\leq := < \cup id$; (ii) $> := \leq^c$ and (iii) $>< := > \cup <$.

A verb expresses a scalar change if the value range is required to be linearly ordered and the direction of change $\vec{R}$ is either increasing or decreasing. In contrast to Rappaport Hovav and Levin (2010), we neither claim that a verb specifying a scalar change necessarily determines the attribute dimension nor that the direction of change is always fixed; thus our approach is in line with the definition of a scalar change in Fleischhauer and Gamerschlag (2014). If a verb does not require D_s to be ordered though it is compatible with such an ordering, we set $\vec{R}$ to '-'. Hence, if $ord = <_{linear}$, a '-' amounts to $\vec{R} = ><_{linear}$. This explains the compatibility of 'change' both with ordered and unordered value ranges, witness the examples in (6).

(6) a. The temperature is changing. ($\vec{R} = ><_{linear}$)
b. The colour of the leaf is changing. ($\vec{R} = \bot$)
c. The president is changing. ($\vec{R} = \bot$)

Table 1 excludes combinations requiring no linear order on the value range while at the same time entailing a direction of change because the direction of change $\vec{R}$ is defined in terms of the ordering on the value range. Note that the combination 'unique attribute specified= -','linear order required= +' and 'direction of change= -' is marked by question marks in the table above since we leave it as an open question whether this particular combination is attested for a verb or not. Possible candidates might be 'level off' and 'reach' as in 'Inflation leveled off' and 'The temperature reached 30 degrees Celsius'.

5. Attribute-underspecification

From the three constraints on parameters in Table 1, the first two are directly related to properties of an argument that is targeted by a verb. It is only the constraint on the direction of change that is partly independent of properties of the target argument.[3] Furthermore, if a verb lexically specifies a particular property attribute, the ordering relation is determined too because it is a property of the attribute's value range which is given by the target sort of the attribute. By contrast, imposing a constraint on the ordering does not uniquely determine a particular property attribute because different such attributes can have ordering relations on the value range with the same properties. This yields *attribute-underspecification*. Therefore there is an asymmetry depending on whether a unique attribute is determined or whether the properties of the ordering on the value range are specified. In the first case no further underspecification results whereas in the second case one gets attribute underspecification. However, attribute underspecification does not mean that the set of admissible (property) attributes cannot be determined once and for all. It is the set of all property attributes satisfying the constraint imposed by the ordering that are defined for the frame component of the argument targeted by the verb. If the attribute is not specified in the lexicon, it can be (uniquely) determined by the sort of the argument which is targeted by the verb. For example for 'rise', the attribute-underspecification is eliminated if the subject argument denotes an attribute whose value range is linearly ordered. This holds for 'temperature' and 'price'. If the subject argument is not an attribute-denoting noun, the underspecification is in general not eliminated because the object denoted by the subject will in general have more than one (property) attribute which satisfies the condition on its value range.[4]

The relation between scalar changes in our frame theory and the notion of a scale defined above in section 3 is the following. The measurement dimension Δ corresponds to a single attribute (e.g., SIZE, PRIZE, TEMPERATURE). The set S is the value range of the attribute D_s, if it is specified in the lexicon. Since the parameter $\vec{R}$ is determined by the verb, there is no difference w.r.t. this parameter. The notion of an attribute is, however, more general than that of a dimension in a scale. Attributes can be used to represent arbitrary properties of objects, witness the examples above of various classes of attributes. Attributes that correspond to dimensions are property attributes with a value range that is at least linearly ordered.

6. The constraint on the value range imposed by 'rise'

In our frame theory verbs can impose constraints both on an attribute and the value ranges of attributes.[5] 'Rise' is an example of a verb which imposes a constraint on the value range but does not specify any particular attribute in the lexicon. Hence, attribute-underspecification applies to it. The constraint on the value range is given below in (7).

(7) a. The ordering $<$ is linear.
  b. $<$ has a minimal element: $\exists\delta.\forall\delta' : \delta \leq \delta'$.
  c. $<$ has no maximal element: $\forall\delta.\exists\delta' : \delta < \delta'$:

Hence, the ordering is bounded to the left but unbounded to the right. The third constraint is

[3]Remember the dependency between the parameters 'direction of change' and 'linear order required': if 'direction of change = +', then 'linear order required = +'.

[4]If the value range of an attribute is scalar, then it is a property attribute. However, it does not hold that if an attribute is a property attribute, then its value range is scalar, witness the example of TASTE.

[5]In addition, verbs can impose a constraint on the source sort or target sort of an attribute.

due to the empirical observation that 'rise' by itself does not impose a bound on the change. Rather, a (culminating) value can be arbitrarily fixed by a measure phrase, e.g. 'rise (by) 30m'. Examples of (property) attributes which satisfy this constraint include TEMPERATURE, PRICE, ECONOMIC_POWER and POLITICAL_POWER. Which attributes satisfy this constraint for objects of a given sort depends on the set of attributes defined for the frames of that sort. For example, of the above four examples only ECONOMIC_POWER and POLITICAL_POWER are defined for frames of sort **country**.[6] We are now ready to define the lexical constraint imposed by 'rise'.

(8) 'rise' lexically imposes the following two constraints: (i) the subject argument has at least one attribute which satisfies the constraint on the value range given in (7) and (ii) for at least one of those attributes there is an increase relative to the value of this attribute triggered by the rising.

Though 'rise' does not single out a unique attribute, a unique set of attributes is determined, namely all those attributes whose value ranges satisfy (7). Hence, instead of specifying a set of admissible attributes in terms of *one* property that is common to all of them, the set of admissible attributes is determined by *one* property of their value ranges. This is our answer to the second puzzle of how the context determines word meaning. Before turning to our answer to the first puzzle of how to arrive at a generalized meaning representation of a lexical item, we need to introduce some more details of our frame theory.

7. Modelling world knowledge and discourse information

7.1. Modelling world knowledge

Our frame theory is based on models $\mathscr{M} = \langle W, D_o, D_f, D_t, P, R, I\rangle$ s.t. (i) W is a finite set of worlds which are used to represent epistemic uncertainty; (ii) the domain $D_o = \bigcup_{\sigma\in\Sigma} D_\sigma$ is the union of finite domains D_σ based on a partially ordered sort hierarchy $\langle\Sigma, \sqsubseteq_\Sigma\rangle$ with basic sorts like 'event' (e) or 'individual' (d); (iii) D_f is the domain of frames. Each frame is of a sort σ and is related to a particular world w by a function IN: $IN(f)$ is the world relative to which f contains information about its root (details below); (iv) D_t is a linearly ordered set of time points; (v) P is a probability distribution on subsets of W. One has $P(\{w\}) > 0$ for all $w \in W$; (vi) R is an accessibility relation on W which is assumed to be the universal relation, i.e. $R = W \times W$; and (vii) I is an interpretation function.

In our frame theory a distinction is made between objects, i.e. individuals and events, on the one side and frames on the other side. Both are atomic entities that are elements of two separate domains D_o and D_f, respectively. Relative to a possible world and a time point each object is assigned a set of frames which is partially ordered based on the information contained in a frame belonging to this set. In a discourse, an object is associated with a frame that collects sortal and relational information about it got in the discourse (see below for details). Objects

[6]Note that we are aware of the fact that the exclusion of TEMPERATURE in the frame of 'China' is an over-simplification since an attribute such as AVERAGE TEMPERATURE IN SUMMER should certainly be part of this frame. However, for the sake of simplicity we exclude TEMPERATURE as an attribute interpreted as the temperature of simple physical objects.

are related to frames by a function *root*, which maps a frame to the object which is the referent of the frame in the sense that the information contained in this frame is about this object. Each frame is of a particular sort, say **person** or **temperature**. Frames with the same root are ordered by a (partial) information ordering. This ordering is defined in terms of a function θ, which assigns to each frame the set of relations (chains of attributes) plus the corresponding sortal information defined for it. A frame f about an object o (i.e. $root(f) = o$) contains more information than a frame f' with the same root if $\theta(f') \subseteq \theta(f)$ and $\forall o'.[\![\pi]\!](f')(o)(o') \rightarrow [\![\pi]\!](f)(o)(o')$ for π a chain of attributes in $\theta(f')$, i.e. f contains all information about o that f' contains and possibly some more information. Note that, (chains of) attributes are not interpreted as binary relations on D_o, but their interpretation is relativized in two respects. The first is directly linked to the fact that information about an object is always related to a particular frame. This dependency is achieved by interpreting (chains of) attributes as ternary relations on $D_f \times D_o \times D_o$.[7] For example, $[\![\text{ATTR}]\!]$ assigns to a frame f a binary relation on D_o s.t. $[\![\text{ATTR}]\!](f)(o)(o')$ is true if o and o' are related by ATTR in f. This way of relativizing the interpretation of expressions is similar to the way information is made world-dependent in two-sorted type theory. However, this move does not account for the fact that information in frames is in general time-dependent. The values of attributes in a frame can be changed by an event (of the appropriate sort) resulting in another frame which reflects this change of value. There are various ways of how this time-dependency can be modelled. Let D_t be a domain of time points that is linearly ordered by $<_t$. One way is to use a special constant $Hold$ on $D_f \times D_t$ s.t. $Hold(f,t)$ is true if the information contained in f is true at t. An alternative is to relativize the interpretations of relational expressions a second time. Instead of having relations on $D_f \times D_o \times D_o$, one has relations on $D_t \times D_f \times D_o \times D_o$. For example $[\![\text{ATTR}]\!](t)$ assigns to a frame f a binary relation on D_o at time point t. The disadvantage of the second alternative is that it makes it more difficult to compare the information contained in two frames with the same root since this information is always time-dependent.

7.2. Possibilities, information states and discourse objects

Besides world knowledge, discourse information has to be modelled as well. A possibility p is a pair $\langle c, w \rangle$. The first component of a possibility is a stack c, i.e. a function from a finite initial segment of $\mathbb{N}$ to discourse objects, see below and e.g. van Eijck (2007) and Naumann and Petersen (2017) for details. The second component of a possibility is a possible world w. The stack c is called the *discourse component* and w the *world component* of the possibility. An information state is a set of possibilities together with a probability distribution Pr that is derived from P (see below for details). Modelling information states as sets of possibilities in the way defined above accounts for epistemic uncertainty. Attribute-underspecification gives rise to such uncertainty if no particular attribute is specified, as in the case of 'China rises'. Each possibility models a possible resolution in the sense that there is (at least) one attribute which satisfies the condition on the value range in (7). For example, for China there is a possibility in which its political power increases and a possibility in which its economic power increases.

[7]In the context of our argument, the sort hierarchy plays a minor role. Thus, in the current paper, we mainly ignore the sortal restrictions expressed by frames. However, in parallel to the relational information expressed by attributes, the sortal restrictions expressed by sorts are interpreted not as unary relations on D_o but as binary relations on $D_f \times D_o$.

In standard semantic theories, a domain extension operation (associated with the meaning of indefinites, or more generally, quantified NPs and verbs) introduces a new object, an individual or an event, into the discourse. In our frame theory a domain extension operation is more complex. Instead of an object a pair consisting of an object and an associated frame is introduced. The frame contains the information gathered about the object plus (possibly) information based on world knowledge of a comprehender. Such pairs are called *discourse objects*. The first projection (component) is called the *object component* and the second projection the *frame component* of the discourse object. Getting more information triggers an update operation on the frame component of a discourse object while keeping the object component constant. Two kinds of updating operations have to be distinguished: (i) getting more 'static' information about an object, e.g. sortal and/or relational information that is not time-dependent (getting information about a static world), and (ii) getting information that is dynamic in nature, e.g. information about a property the value of which has been changed due to the object having been involved in an event (information about an evolving, changing world). Though this modelling of discourse objects works fine for non-relational nouns like 'person' or 'China', it is insufficient for functional nouns like 'temperature' 'price' or 'president'. Consider e.g. a basic frame for 'temperature'.

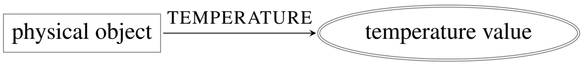

Figure 1: 'temperature' frame

In the 'temperature' frame the central node is not the root of the frame graph. Rather it has an incoming arc labeled TEMPERATURE indicating that the referent of the central node is functionally dependent on the referent of the open argument node. If this argument is filled with something of type **physical object**, the actual referent of the concept is determined (each physical object has a unique temperature). Thus, the central node is closed because it is determined by the open argument node.[8]

In order to adequately integrate functional nouns in our discourse model, we propose to model the frame component of functional nouns as a pair of frames, one frame representing the dependent object and the other frame for the independent object.[9] For non-relational nouns like 'person' or 'China', the dependent and the independent frame component are the same. For functional nouns, the value of the function θ contains at least one element of the form $\otimes$ATTR, i.e. the converse of ATTR. For example, in the case of 'temperature' one has $\theta(f) = \{\otimes\text{TEMPERATURE}\}$. By contrast, for non-relational (sortal) nouns no such elements exist.[10] As a result, a discourse object is a pair $\langle o, \langle f_d, f_i \rangle \rangle$ consisting of the object component o and the frame component $\langle f_d, f_i \rangle$, which in turn consists of the dependent frame f_d and the independent frame f_i.

[8]In our frame graphs, the central node is marked by a double line; argument nodes are open nodes and denoted as rectangles while closed nodes are marked by ellipses. For more information on frame graphs see Petersen (2007) and Petersen and Osswald (2014).

[9]Non-functional nouns like 'sister' do not fall into the scope of the present paper; in principle, they are handled similar to functional nouns.

[10]For the sake of simplicity, we claim that frame graphs do not contain circles.

8. Representing changes

Since discourse objects are pairs $\langle o, \langle f_d, f_i \rangle \rangle$, a dynamic verb can operate on all three components, at least theoretically. In our frame theory, a verb always operates on the frame component while the object component is held constant. With respect to the frame component, it is important to distinguish between constraints on a frame component and the actual change effected relative to a frame component. If the verb imposes a constraint, e.g. on the ordering of the value range of an attribute, this constraint has to be satisfied for a sort in the dependent frame and not in the independent frame. This becomes evident if one considers a functional noun like 'temperature'. If it is the temperature of a person, the person frame will in general have several property attributes whose value ranges satisfy the constraint imposed by 'rise'. However, this is not what is required. Rather, it is the value range of the temperature attribute that has to satisfy the constraint. By contrast, the change itself is modelled as an update operation on the independent frame component. This becomes again evident if one looks at an example involving 'temperature', like 'John's temperature is rising'. The dependent object is a (temperature) value (or degree). This values does *not* change, witness Partee's famous puzzle: 'The temperature is rising. The temperature is 90. ♯ 90 is rising'. What is changing (evolution of the world, ontic change) is John's temperature. Its value is higher at the end of the rising compared to its value at the beginning of the event. Hence, the relation between the components of a discourse object and the change expressed by a dynamic verb is as follows.

(9)
- The object component, e.g. a temperature value or China, remains constant.
- Any constraints must be satisfied in the dependent frame component.
- The change is defined as an update operation on the independent frame component.

Since for non-relational nouns like 'China' the two frame components are the same, the constraints and the change are both related to this frame. We are now ready to formulate our solution to the first puzzle: (i) changes are uniformly represented at the level of frames, and (ii) the objects themselves are held constant. (i) and (ii) apply to all arguments, in particular to relational (functional) and non-relational nouns, alike.

9. Static and dynamic frames

A basic frame for 'rise' has a single attribute THEME. At this level the rising event, i.e. the value of $root(f_{rise})$, is taken as an atom. By a zooming operation Z in the sense of Blackburn and deRijke (1997) this atomic event is decomposed into single step subevents. This level is called the 'event decomposition' level (ED). It represents the temporal structure of the event and links it to the level of the described situation, the participating objects, and their roles in the event. Each temporally extended event e on the ED level is bounded by two boundary events $\alpha(e)$ (left boundary) and $\beta(e)$ (right boundary) whose runtimes are singletons (cf. Pinon, 1997). Non-boundary events are linked to global properties of the event, termed 'static event frames' (SEF) in Naumann (2013). The basic frame for 'rise' described above is of this sort. Boundary events are linked to situation frames (SF) which are built up from the frames for the objects involved. The SFs specify the relevant information about the attribute involved in the change, e.g. HEIGHT or TEMPERATURE. Let us illustrate this with 'The balloon rises by 30m'.

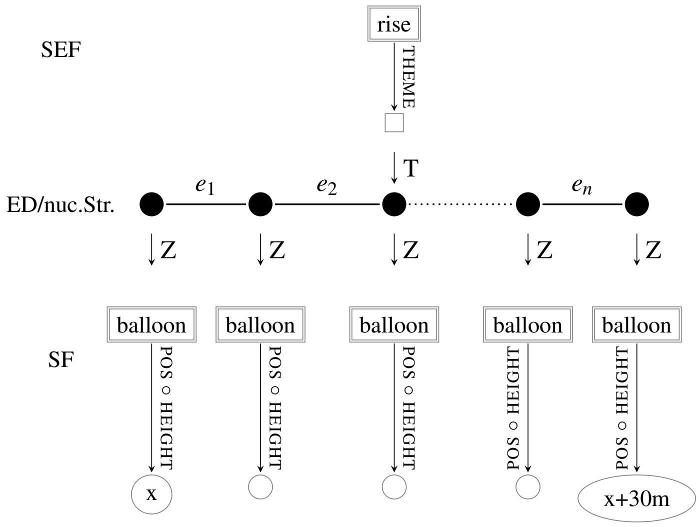

Figure 2: dynamic frame for ‘The balloon rises by 30 meters’

At the top the basic SEF for ‘rise’ with the single THEME-attribute is shown. The ED-level is shown below. Formally, it is achieved by a zooming operation of type ‘temporalization’ (T). At this level the rising event is decomposed into a sequence $e_1 \cdots e_n$ of atomic rising events whose sum is just the rising event which is the root of the rising frame. Each e_i is bounded by two boundary events, represented by the black bullets. As said above, each boundary event is related to a particular time point. The SF at the timepoint of each boundary event gives the information about the attribute whose value gets changed. In this case it is the value of the chain POSITION ○ HEIGHT in the frame of the balloon. The SF level in the figure provides snapshots of the balloon’s height at different time points of the event. A condensed representation in a single frame is given below. Note that ‘trace’ and ‘change’ are “dynamic attributes” which are projected into this frame from the event decomposition frame introduced above. Attributes of this type have the function to record the value change of attributes such as POSITION and HEIGHT over the course of the event (for details see Gamerschlag et al., 2014).

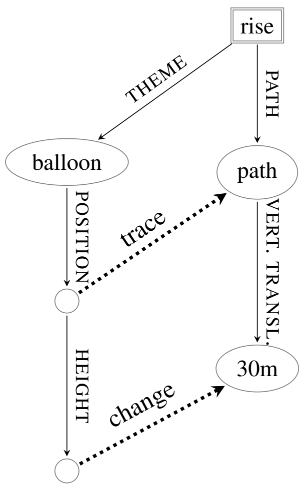

Figure 3: condensed dynamic frame for ‘The balloon rises by 30 meters’

10. The dynamic meaning of 'rise'

The interpretation of 'rise' triggers both a domain extension operation and an update operation. First, an event of rising is introduced into the discourse. Second, the domain object related to the theme argument, e.g. 'China', is updated. This update operation is related to the change triggered by a rising event. For scalar verbs in general, the change is effected relative to an attribute of some argument (as discussed in section 4). If the verb shows attribute-underspecification, no particular attribute is singled out. In this case the current information state must be updated for each attribute that satisfies the constraint imposed by 'rise' on the value range. This has the effect that for a possibility p_i in the input, there can be more than one successor possibility in the output. In particular, one has: for each possibility p_i in the input there are up to n successor p_o in the output, for n the number of admissible attributes. Each successor p_o models a change w.r.t. to an admissible attribute and therefore is a possible resolution of the attribute underspecification. The qualification 'up to' refers to the fact that a possibility is discarded if in its world component the rising event in the possibility does not bring about a change w.r.t. the attribute specified in the possibility. Hence, this update operation combines aspects of both a 'normal' update (information is added to the frame component of a discourse object already on the stack) and a domain expansion operation: it leads to 'branching' in the sense that a possibility in the input information state can have more than one successor. In (10) the definition of successor is given and in (11) the (simplified) interpretation of an attribute and two domain extension operations are supplied.

(10) a. A stack c' is a successor of a stack c, $c \preceq c'$, iff $c' = c^\frown\alpha$, for some discourse object α.

b. A possibility $p' = \langle c', w' \rangle$ is an object-successor of possibility $p = \langle c, w \rangle$, $p \preceq_o p'$, iff $c' \preceq c$ and $w = w'$.

c. A possibility $p' = \langle c', w' \rangle$ is a frame-successor of possibility $p = \langle c, w \rangle$ w.r.t. position v_i and value range restriction vr, $p \preceq_{v_i,vr} p'$, iff $w = w'$, $|c| = |c'|$, $\exists o\, f_o\, f'_o\, \text{ATTR}.\ c[i] = \langle o, f_o \rangle \wedge c'[i] = \langle o, f'_o \rangle$, $f_o \sqsubseteq f'_o$, $\theta(f'_o) = \theta(f_o) \cup \{\text{ATTR}\}$, $[\![vr]\!](range(\text{ATTR}))$ and $\forall j.(0 \leq j < |c| \wedge j \neq i \rightarrow c[j] = c'[j])$.

(11) a. $s[\text{ATTR}(f)] = \{p \in s \mid \exists i, j \in \mathbf{N} : p = \langle c, w \rangle\ ,\ \pi^2(c[i]) = f,\ IN(\pi^2(c[i])) = w,$ $\langle \pi^2(c[i]), \pi^1(c[i]), \pi^1(c[j]) \rangle \in [\![\text{ATTR}]\!]\}$.

b. $s[\exists] = \{p' \mid p \in s \wedge p \preceq_o p'\}$.

c. $s[update(v_i, vr)] = \{p' \mid p \preceq_{v_i,vr} p' \wedge p \in s\}$.

In (10a), stack c' is a successor of c ($c \preceq c'$) if it extends c by a discourse object. In (10b), a possibility p' is an object-successor of p if its stack component is a successor of that of p and the world components are the same. In (10c), a frame-successor p' of a possibility p has the same world component as p and its discourse component (stack) extends the frame component of the discourse object at position v_i by an attribute ATTR that satisfies the value range restriction vr while leaving all other discourse objects the same. (11) specifies an information state s after update with some information ϕ. Here, $s[\phi]$ stands for the updated information state. In (11a) π^k is the k-th projection function. $\pi^1(c[i])$ is the object stored at position i and $\pi^2(c[i])$ its associated frame, i.e. $\pi^1(c[i])$ is the root of $\pi^2(c[i])$. The interpretation of an attribute tests whether the attribute holds between the frame stored at position i, the object stored at the same position i, and the object stored at position j. This operation eliminates possibilities from the information state that do not pass the attribute test. In (11b), $\exists$ non-deterministically extends each possibility in the input by a discourse object. This operation is used, whenever a new indefinite discourse object is introduced. In (11c), $update(v_i, vr)$ expands an information state by adding to the frame component at position i of the discourse component (non-deterministically) an admissible attribute whose value range satisfies the constraint vr.

11. Probabilities: a worked-out example

The set of attributes satisfying the constraint on the value range in (7) imposed by 'rise' can be quite large. There are two kinds of information by which this set can be constrained: (i) world knowledge of a comprehender and (ii) the preceding or ensuing linguistic context. For example, a comprehender may have knowledge about China's rising economic power so that he expects the sentence 'China rises' to be about this rising economic power. Context adds extra information to frames in form of an update operation on an input frame. For example, the context below, adapted from Cooper (2010), adds the new information to the 'China'-frame that the value of the attribute DIPLOMATIC_ACTIVITY is 'high'. This information can be taken as an indication that 'China rises' is about its political power and not about its economic power.

(12) China's rising will undoubtedly be one of the great dramas of the twenty-first century. China's extraordinary active diplomacy is already transforming East Asia.

In contrast to attributes like TEMPERATURE and PRICE which are excluded for 'China', the above two kinds of information do in general not exclude all other choices. For example, even if a comprehender knows that China's economic power rises and he therefore expects the sentence to be about that attribute, encountering later on the information about the high diplomatic activity may well have the effect that he revises his decision to interpret the sentence as being about China's political power. The information a comprehender has about attributes like TEMPERATURE and PRICE, namely that they are excluded for objects of sort **country**, is 'hard' information, whereas the kind of information used about the other two attributes above is 'soft' information because it can be revised. We will model soft information in terms of probabilities.[11]

In the rest of this section we will provide a worked-out example which shows how the choice of an attribute can be constrained using a probability distribution which is based on the knowledge of a comprehender who is processing the text in (12).

We begin by defining the probability distribution Pr_s on an information state s. Four cases have to be distinguished: (a) an information state with no discourse information (base case), (b) eliminative update, (c) domain extension and (d) expansive update. For cases (b), (c) and (d), Pr_s needs to be updated. The definitions are given in (13), see also Djalali and Kaufmann (2009) by whom these definitions are inspired.

[11] Hard information is then the limiting case where the probability is either 1 (bottom-up information) or 0 (information like TEMPERATURE, which is not defined for countries).

(13) a. $Pr_s(\langle\langle\rangle, w\rangle \,|\, s) := P(w)$.
b. $Pr_s(p \,|\, s[\phi]) := Pr_s(p \,|\, s)/\Sigma_{p' \in s[\phi]} Pr_s(p' \,|\, s)$, if $p \in s[\phi], 0$ otherwise.
c. $Pr_s(p' \,|\, s[\exists]) := Pr_s(p \,|\, s)/|D|$, for $p \preceq_o p', p \in s, p' \in s[\exists]$.
d. $Pr_s(p' \,|\, s[update(v_i, vr)]) := Pr_s(p \,|\, s)/|D_{vr}|$ with $p = \langle c, w\rangle$, $c[i] = \langle o, f_o\rangle$, $p \in s$, $p' \in s[update(v_i, vr)]$, $p \preceq_{v_i, vr} p'$ and $D_{vr} := \{\text{ATTR} \,|\, \exists f : f_o \sqsubseteq_f f \wedge \text{ATTR} \in \theta(f) \wedge [\![vr]\!](range(\text{ATTR}))\}$.

In an information state with no discourse information, the probabilities are those of the world components (see (13a)). For eliminative updates, the probability is shifted by conditioning, i.e. the new probability of a 'surviving' possibility from the input is got by dividing its probability in the input by the sum of prior probabilities of all surviving possibilities (see (13b)). For the domain extension operation, the probabilities of possibilities in the input are uniformly distributed over their object-successors (see (13c)), whereas in the case of $update(v_i, vr)$ they are uniformly distributed over their frame-successors (see (13d)).

For our example, let us make the following simplifying assumptions. For 'China', only the attributes POLITICAL_POWER and ECONOMIC_POWER satisfy the value range constraint imposed by 'rise'. A discourse object is of the form $\langle o, f_o\rangle$ and not $\langle o, \langle f_d, f_i\rangle\rangle$ since for China both frame components are the same. The initial information state of the comprehender has two possibilities p_1 and p_2, both containing no discourse information and with worlds w_1 and w_2, respectively. One has $P(w_1) = 0.5 = P(w_2)$. Applying (13a) yields $Pr_s(p_1 \,|\, s) = 0.5 = Pr_s(p_2 \,|\, s)$. In w_1 there is one rising event with China as theme that increases China's political power whereas in w_2 there is a corresponding rising event that increases China's economic power. Processing (12) starts with introducing China at position 0 (positions in a stack are counted beginning with 0) together with a minimal China-frame. The initial probabilities for p_1 and p_2 are not changed, because 'China' has singular reference, being a proper name. Processing 'rising' (or 'rises') introduces a rising event at position 1. Again Pr_s is not changed since it is assumed that there is one rising event in each world with China as theme.[12] In addition, for each rising event the China-frame at position 0 in the corresponding possibility is updated with either the attribute POLITICAL_POWER or ECONOMIC_POWER. Hence, each of the two possibilities has two frame-successors p_{i1} and p_{i2}, yielding an information state s' with four possibilities. Applying clause (13d), one gets $Pr_{s'}(p_{11} \,|\, s') = Pr_{s'}(p_{12} \,|\, s') = Pr_{s'}(p_{21} \,|\, s') = Pr_{s'}(p_{22} \,|\, s) = 0.25$. The probabilities are divided by 2 because there are two attributes satisfying the value constraint. Next it is tested whether a change is effected by the two rising events relative to the two attributes. In w_1 ECONOMIC_POWER and in w_2 POLITICAL_POWER fail this test. The corresponding possibilities are discarded. For $Pr_{s'}$ clause (13b) applies, shifting the probabilities of the two remaining possibilities p_{11} and p_{22} to 0.5. This is summarized in the table below where we focus on the relevant attributes.

world	attribute	Pr_s
p_{11}	POLITICAL_POWER	0.5
p_{22}	ECONOMIC_POWER	0.5

Table 2: Distribution after update with 'China' and 'rising'

[12] If there are n objects in the universe, clause (13c) applies first, applying clause (13b) twice, first for the sortal information 'rise' and then to the information that China is the theme, yields the same result as stated in the text.

The discourse information the comprehender has about China in this information state is contained in the frame below.

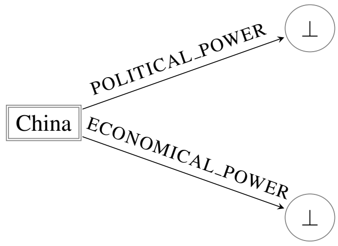

Figure 4: Frame for 'China'

⊥ indicates that the comprehender does not know whether a change occurred relative to POLITICAL_POWER or ECONOMIC_POWER. Hence, without further information a comprehender cannot distinguish between the two links marked by '?' in the 'China's rising'-frame below, again representing the frame corresponding to all discourse information in the information state.

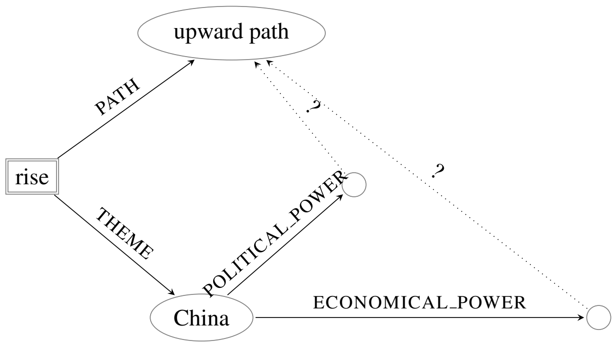

Figure 5: 'China rises'-frame with equal probabilities

In order to account for the contextual information about the attribute DIPLOMATIC_ACTIVITY we have to take the comprehender's expectation about this attribute into account. The (revised) initial distribution is shown below.

	attribute	DIPL._ACTIVITY	P(w)
w_{11}	POL._POWER	low	0.02
w_{12}	POL._POWER	high	0.48
w_{21}	ECO._POWER	low	0.25
w_{22}	ECO._POWER	high	0.25

Table 3: Initial distribution with DIPLOMATIC_ACTIVITY $=$ *high* included

Processing 'China's extraordinary active diplomacy' in (12) updates the (global) 'China'-frame containing the discourse information to that below.

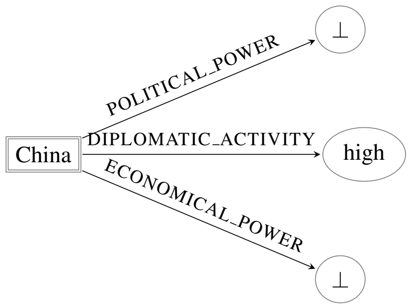

Figure 6: Frame for 'China' extended by contextual knowledge

Updating with this 'hard' information triggers an update in Pr_s using clause (13b). The new distribution is shown below.

	attribute	DIPL._ACITIVITY	Pr_s
p_{11}	POL._POWER	high	0.6575
p_{22}	ECO._POWER	high	0.3425

Table 4: 'China rises': distribution **after** update with DIPLOMATIC_ACTIVITY $=$ *high*

Hence, using the 'hard' information that China's diplomatic activity is high and the comprehender's expectations about the relation between this kind of activity and the two different powers, results in a probability distribution in which the two attributes no longer have the same probability. Rather, the comprehender has for POLITICAL_POWER a probability of 65.75%. Next, he can apply a decision rule. One of the most simplest ones is 'Choose that possibility with the highest probability'. Applying this rule leads a comprehender to expect that the rise of China in (12) is most likely to be about an increase in its political power. Even if this rule is applied, a change in economic power is still an option. The 'rise'-frame resulting after application of the decision rule is shown below.

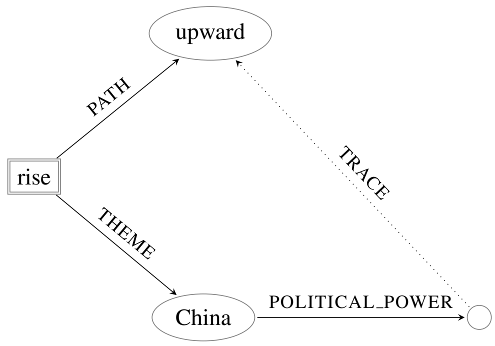

Figure 7: Resolved 'China rises'-frame using probabilities and a decision rule

Thus, if no further information is provided, the comprehender expects that 'China rises' in the context of high diplomatic activity means that the polical power of China is rising.

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Coreference and disjoint reference in the semantics of narrative dance[1]

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Abstract. This paper presents an exploratory production study of Bharatanatyam, a figurative (narrative) dance. We investigate the encoding of coreference vs. disjoint reference in this dance and argue that a formal semantics of narrative dance can be modeled in line with Abusch's (2013, 2014, 2015) semantics of visual narrative (drawing also on Schlenker's, 2017a, approach to music semantics). A main finding of our investigation is that larger-level group-boundaries (Charnavel, 2016) can be seen as triggers for discontinuity inferences (possibly involving the dynamic shift from one salient entity to another).

Keywords: co-reference, disjoint reference, dance semantics, iconic semantics, picture semantics.

1. Background and motivation

In this paper, we aim to contribute to new lines of research that look at different cognitive systems (in the cognitive science/neuroscience sense; cf. Rebuschat et al., 2011) and how they relate to each other. Our research builds on recent pioneering investigations that explicitly connect language and linguistics to other fields such as music cognition (Schlenker, 2017a) and dance (Charnavel, 2016). A well-known predecessor of such approaches is the work of Lerdahl and Jackendoff (1983), who proposed a generative theory of music. In this paper, the question of interest is whether dance has something akin to a (compositional or non-compositional) "semantics", which we can describe by means of linguistic tools. We thus adopt the methodological approach of Lerdahl and Jackendoff, applying linguistic methodology to other cognitive systems in order to investigate underlying commonalities.

In exploring the semantics of dance, we directly build on Charnavel's (2016) question of whether dance has hierarchical structure (which derives from *grouping*; see also Lerdahl and Jackendoff, 1983). On the semantics side, we proceed to ask what kind of meaning may be encoded in dance. This type of research being foundational, we start by carrying out a production study to establish the range of possible factors that we can investigate. A long-term goal of this investigation is to establish the common semantic properties of (non-) linguistic cognitive systems.

[1] We thank the Kala Saadhana Arts & Dance Institute (and, in particular, its founder and artistic director Kavitha Laxmi) for collaborating with us on the dance study. For assistance in preparing the experimental stimuli, carrying out the recordings and post-processing of the motion-capture recordings, we thank Tonje Andersen, Jeanette Birtles, David Buverud, and Sigurd Hanserud. We are grateful to Philippe Schlenker for comments on a draft version of this paper. For useful feedback and discussion, we thank the audiences at the *fourMs Forum* (Department of Musicology, University of Oslo), the *Language and Cognition* group (Harvard University), the workshop in honor of David Pesetsky's 60th birthday (MIT), the *CASTL colloquium* (University of Tromsø), and at *Sinn und Bedeutung 22*. The dance study obtained ethical approval from the Norwegian Centre for Research Data (NSD).

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1.1. Co-reference and disjoint reference in dance?

Given the broad range of different musical genres and dance forms, linguistic investigations that venture into music or dance can adopt one of the following approaches. They can either try to make generalizations across genres (e.g., Charnavel, 2016; Schlenker, 2017a) or focus on a case study (see Katz and Pesetsky, 2011, who zoom in on Western art music as instantiated by the works of Mozart and Bach). In our study, we choose the second route, focusing on *Bharatanatyam*,[2] a narrative dance form (outlined in section 1.2 of this paper). This allows us to draw on the insights of Abusch (2013, 2014, 2015) with regards to visual narrative. Naturally, a long-term goal of exploring the semantics of dance should include an in-depth investigation of abstract iconic meaning atoms as posited by Schlenker (2017a) for music; these may be manifested in dance through different types of spatiotemporal movement descriptors, e.g. the *quality* of a given movement may be described as "smooth" vs. "jagged" (see for example Guest, 2004, and Napoli and Kraus, 2015, for overviews on the parameters of dance and movement).

Our strategy to approach dance semantics was to single out a phenomenon that we could investigate by means of a production study, namely coreference vs. disjoint reference. The encoding of coreference and disjoint reference between noun phrases is illustrated (very coarsely) in (1) and (2), respectively. Note that we do not aim to contribute to the large body of literature on how exactly such sentences should be analyzed (e.g., Heim, 1982), i.e. we gloss over the difference between truth-conditional and presuppositional content in (1) and (2), and we take (1a) to roughly have the truth conditions in (1b), whereas (2a) roughly has the truth conditions in (2b). The difference between (1) and (2) that is at the center of our exploration is that (1) introduces a single discourse referent whereas (2) introduces two separate discourse referents (see also Kamp and Reyle, 1993).

(1) *coreference*
  a. *A man* came into the room and *that man* closed the window.
  b. true iff $\exists$x[x is a man & x came into the room & x closed the window]

(2) *disjoint reference*
  a. *A man* came into the room and *another man* closed the window.
  b. true iff $\exists$x[x is a man & x came into the room
      & $\exists$y[y is a man & y closed the window & y $\neq$ x]]

As linguists, we are interested both in the meanings of natural language expressions, such as the sentences in (1a) and (2a), and in how they are compositionally derived from their parts. Another relevant question in formal semantics concerns the difference between types of content (i.e., using the terminology of Potts, 2015, the difference between truth-conditional *at-issue* content and *non-at-issue* content, which encompasses presuppositions, conventional implicatures, and conversational implicatures). We will return to this second question later.

Focusing on the coreference/disjoint reference distinction, Abusch (2013) investigates comics without words (French *sourds*), i.e. purely visual narratives. She focuses on mangas such as

[2] We follow the convention in the literature and capitalize the first letter of *Bharatanatyam*.

Masashi Tanaka's *Gon*, which tell the story of Gon, a small dinosaur that interacts with real life animals. The question that Abusch raises is as follows: in a comic (Episode 4) that contains a number of eaglets, a reader can establish coreference across panels, i.e. if we see an eaglet depicted in panels 32, 33, 34, and 36, we generally infer that this is the same eaglet (as opposed to one of the others that have been introduced earlier). The central question for Abusch is how coreference across panels is established in such comics, i.e. what is the cognitive mechanism behind such identity inferences. In the absence of words and pointing gestures, Abusch takes this to be a non-trivial question. In line with Discourse Representation Theory (Kamp and Reyle, 1993), she proposes that the referents in comic panels are existentially quantified, (3a-c), and coreference arises from post-semantic identification of discourse referents in the pragmatics (which is a type of pragmatic enrichment), (3d). Such existential quantification is plausible in visual narratives, as there are no definite descriptions comparable to *the eaglet* in natural language.

(3) *coreference in comics without words (Abusch 2013)*
 a. panel 34: "[*an eaglet*]$_1$ bounced down a cliff face"
 b. panel 35: "[*a bobcat*]$_2$ looked and opened its mouth"
 c. panel 36: "[*a bobcat*]$_3$ jumped toward [*an eaglet*]$_4$ that was bouncing down"
 d. *pragmatic enrichment*
  → "[*the bobcat*]$_{3=2}$ jumped toward [*the eaglet*]$_{4=1}$ that was bouncing down"

Crucially, the questions and insights that Abusch (2013) addresses for comics without words should carry over to any type of silent visual narratives, including narrative dance and pantomime. This motivates our case study of Bharatanatyam as presented in the remainder of this paper.

When we investigate the semantics of dance, we naturally aim to look for any phenomena that may reflect properties similar to those found in natural language semantics. Coreference vs. disjoint reference is a very basic and fundamental distinction in natural language semantics. As a consequence, if we find that it can be encoded in dance, this can be taken to lend initial support to a view that a semantics of dance may be conceivable.

1.2. Enter Bharatanatyam

Bharatanatyam is a classical South Indian dance that originates in Tamil Nadu (see Puri, 1986, 2004; Williams, 2003; Ramesh, 2013, 2014); it is a type of figurative (narrative) dance that typically serves to tell a story. As a figurative dance, it is more similar to language (and silent visual narrative) than other dance forms (such as ballet, contemporary or street dance), yet more conventionalized than pantomime (which can be viewed as an extreme form of figurative dance; see Charnavel, 2016). We thus expect it to share properties of silent visual narratives. Note that, while Bharatanatyam is typically accompanied by music or spoken word (e.g., singing of the narrative), it is not necessarily accompanied by music, and we recorded our stimuli (described in section 2) without music.

Traditionally, Bharatanatyam is used to tell religious narratives, but it also allows for secular and modern stories in contemporary dance productions. As outlined by Puri (1986), the dance has a rich inventory of conventionalized gestures, including around 31 types of single hand gestures (*hasta mudras*) and 27 types of double hand gestures, which have received some attention in the semiotic literature (see Puri, 1986:271-276; see also Ikegami, 1971). The double hand gestures are combinations of two single hand gestures. Gesture inventories and their sizes vary, depending on the source material, since this is a 2000-year-old danceform. Hand gestures are semantically underspecified; for instance, the *patāka* ('flag') gesture, which involves a flat hand with fingers touching (similar to the hand position when 'high-fiving') can be interpreted as one of the entities from the following set (Ikegami, 1971:373):

(4) *possible meanings associated with the patāka ('flag') mudra* (Ikegami, 1971:373)
'clouds, a forest, things, bosom, might, peace, a river, heaven, prowess, moonlight, strong, sunlight, wave, entering, silence, an oath, the sea, sword, a palmyra leaf'

This underspecification is resolved by the context, i.e. the eventual meaning of a *patāka* mudra depends on factors such as the position of the arm, the accompanying movement, and so forth.

In addition to hand gestures, Bharatanatyam makes gestural use of the entire body; Puri (1986:251) identifies whole body gestures as "larger action sign units", which subsume a dancer's eyes, face, neck, torso, limbs and feet. We can thus differentiate between "local" gestures such as hand-and-arm combinations, and "global" full-body gestures. In our study, we focused on such "global gestures", since we take hand gestures to have symbolic meanings, which are conventional in the sense that they may be rote learned (requiring a trained audience to correctly interpret them). Global gestures are a phenomenon that we may also expect to find in non-conventionalized spontaneous dance, which is relevant for future studies that build on our findings.[3]

To move away from low-level symbols such as hand gestures (which may simply have a sign-based semantics), our strategy was to look at more abstract and global types of meaning such as the coreference/disjoint reference distinction. We now proceed with describing the setup of our explanatory production study.

2. Experimental design

In our investigation of Bharatanatyam, we are working with Kavitha Laxmi, who is the artistic director of the Kala Saadhana dance institute in Oslo and a professional Bharatanatyam dancer.[4] For our exploratory production study, we recorded dance sequences based on a set of items that we constructed in order to probe for coreference vs. disjoint reference. We designed our stimuli as short narrative texts. The items were designed in a way that aims to utilize conventional meanings such as the ones associated with hand gestures, illustrated in (4) above (including objects such as 'palmyra leaf', cf. (7)). The context for all items is given in (5); this context (an artist having designed a statue for a temple) was based on recent dance productions at the Kala Saadhana dance institute with the aim of limiting artificial components in the narrative that are solely due to the experimental design. What is

[3] Note that facial expressions are also used as part of the Bharatanatyam sign system; given the nature of our study, our dancer aimed to minimize the use of facial expressions and compensate for it with other gestures.
[4] For illustration, a dance sequence can be found at https://www.youtube.com/watch?v=O-LpIysAKE4

crucial for our setup is the idea that there are several possible referents in the context (here: 'the room is full of people'); this allows us to freely introduce discourse referents.

(5) *Context:* An artist has designed a statue for a temple. She is at the temple, watching how people interact with the statue; the room is full of people.

We recorded 6 mini-narratives in 2 conditions (coreference vs. disjoint reference), i.e. 12 dance sequences in total. Two sample narratives are given in (6) and (7). This setup allows us to elicit minimal pairs in our production study. In each item, both dance sequences start the same, e.g. in (6a-b), the artist sees a strong man sitting on the ground. Then they differ in terms of whether the same individual is involved in another action, or a different individual. The embedding in perception contexts ('the artist sees…') aims at fixing a perspectival center for the narrative; in follow-up studies, we included unembedded variants (e.g. 'A woman is sitting on the ground. […]'). The resulting dance sequences do not reflect this difference.

(6) *Item 1*
a. The artist sees a strong man sitting on the ground.
Then she sees that *the same man* is holding a spear. (coreference)
b. The artist sees a strong man sitting on the ground.
Then she sees that *another man* is holding a spear. (disjoint reference)

(7) *Item 2*
a. The artist sees a woman waving a palmyra leaf in the sunlight.
Afterwards *that woman* is pointing at the clouds in the sky. (coreference)
b. The artist sees a woman waving a palmyra leaf in the sunlight.
Afterwards *another woman* is pointing at the clouds in the sky. (disj. ref.)

In terms of possible manipulations, Bharatanatyam is relatively flexible. It is typically accompanied by music and chanting, but it can also be danced without them. We recorded our stimuli without music.

The dance sequences were recorded in the Music and Motion Lab of the Department of Musicology, University of Oslo. The professional Bharatanatyam dancer was recorded by one video camera and eight motion capture cameras, using an infrared, marker-based Qualisys motion capture system with eight wall-mounted Oqus 300 cameras, capturing at 200 Hz. A total of 45 reflective markers ("dots" to be tracked by the cameras) were placed on the body of the dancer. The advantages of such a production study is that we can compare minimal pairs and see how intended meanings can be encoded. After recording the 12 dance sequences without any accompaniment, we recorded the same 12 dance sequences while slowly reading out the text; this allowed us to map the recorded movements (and related gestures) to intended meanings in case of uncertainty. The dancer did not choreograph the dance sequences in advance, but read the dance sequences before beginning the dance sequence. While the production thus involves a certain amount of planning (and is not fully spontaneous), it still retains a certain amount of spontaneity.

For the analysis, the recordings were post-processed in the Qualisys Track Manager software (QTM 2.16). This software generates a 3-dimensional (3D) rendering based on the multicamera recording of the reflective markers, as illustrated for four dance positions in Figure 1. In the remainder of this paper, we use the 3D renderings in order to focus on the "global" (full-body) gesture aspects of the dance sequence that are relevant for us (glossing over details that may be present in the live video recording yet lost in the 3D rendering).

While we limit the discussion in this paper to a qualitative analysis, the methodology (motion capture) lends itself to quantitative follow-up analyses using numerical methods (see Kelkar and Jensenius, 2018, for an example).

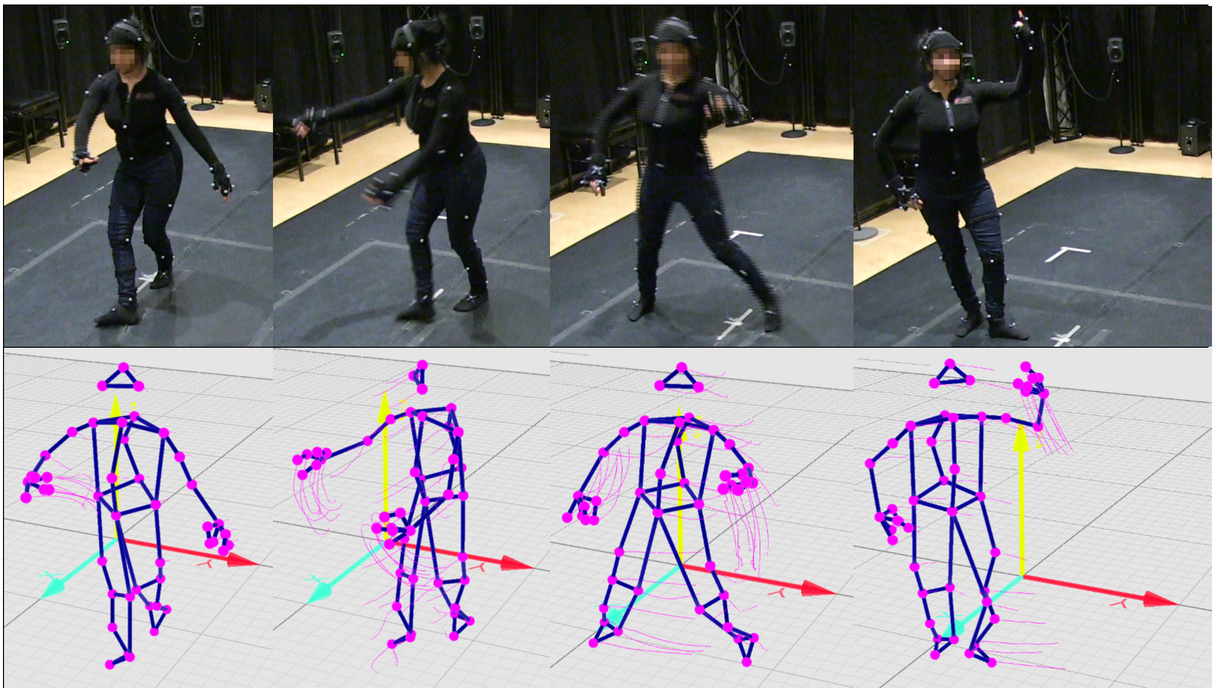


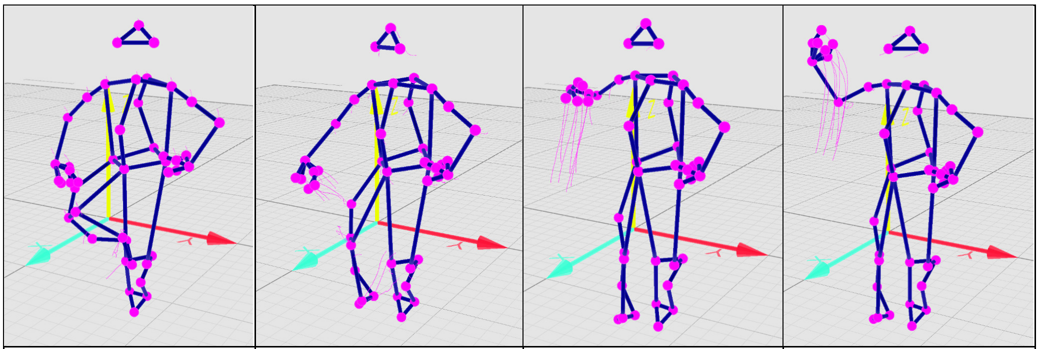
Figure 1: sequence of four dance positions (stills from the video recording and 3D motion capture rendering, with motion history trajectories)

In the next section, we proceed with a qualitative analysis of the results.

3. Qualitative analysis of the results

We start by analyzing the coreference sequence, (6a), adapted in (8); as shown in Figure 2, we can zoom in on the movement and study different parts. In Figure 2, each label [P_n] represents a dance position; these positions are stipulated at arbitrary cut-off points, since a dance performance is by its very nature non-discrete. As indicated in (8), we can identify the dance position [P_{11}] with an activity of *sitting on the ground*, whereas the dance position [P_{14}] represents an activity of *holding a spear*. Intermediate stages (such as [P_{12}] and [P_{13}]) cannot be as easily connected to parts of the written narrative.

(8) The artist sees a strong man [$_{P11}$ sitting on the ground].
Then she sees that *the same man* [$_{P14}$ is holding a spear].

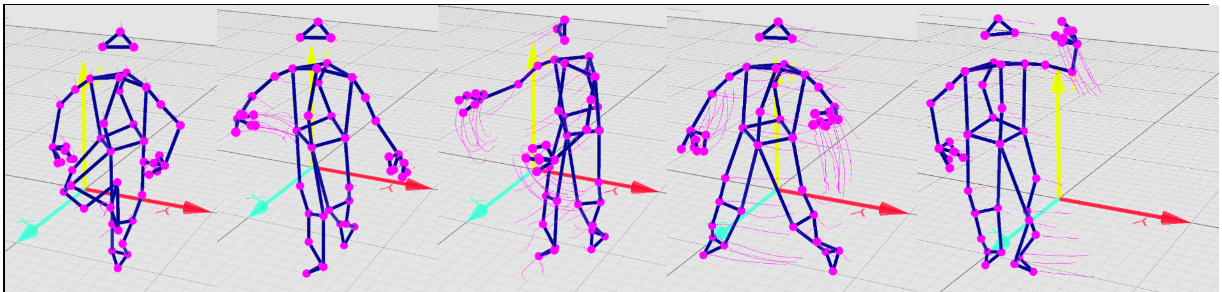


[P11]	[P12]	[P13]	[P14]

Figure 2: coreference condition

What Figure 2 shows is that the coreference condition simply involves a fluid motion from displaying a sitting position to displaying a spear-holding position. It does not seem to be necessary (in the given context) to separately mark coreference between the "sitter" and the "spear holder". By contrast, the disjoint reference condition, repeated in (9) from (6b), has additional complexity, as illustrated in Figure 3. Once again, we can identify a dance position that symbolizes a *sitting on the ground* activity, [P21]; an attentive reader will notice a remarkable consistency between [P11] in Figure 2 and [P21] in Figure 3, which are taken from two separate recordings. We can also identify a dance position that symbolizes a *spear holding* activity, [P25]. Most interestingly, for our purposes, the marking of disjoint reference can be broken down into three different dance positions that are assumed between [P21] and [P25]. Step by step, we notice that after giving up the sitting position [P21], the dancer first uses a *mudra* (here: hand-and-arm gesture) that symbolizes "another/different", in [P22] (roughly: a round movement of the right hand and arm from the left to the right). She then marks a new position in the visual space, [P23], and she then assumes the new position, [P24]. Eventually, she assumes the spear-holding position in [P25], but does so in a way that mirrors the spear-holding position in the coreferent condition ([P14] in Figure 2), i.e. it is now the left arm that is raised (as opposed to the right arm) and the dancer faces towards the left (as opposed to the right).

(9) The artist sees a strong man [P21 sitting on the ground].
Then she sees that [P22+P23+P24 *another man*] [P25 is holding a spear].



[P21]	[P22]	[P23]	[P24]	[P25]

Figure 3: disjoint reference condition

The marking of a new position on stage (and thus in the visual space), [P23] is a phenomenon that is reminiscent, from a linguist's perspective, of the loci in sign language (see Schlenker, 2017c, for a recent survey article), opening new lines of inquiry for follow-up studies. Assuming the new position also appears reminiscent of phenomena such as *Action Role Shift* in sign language (see Davidson, 2015, for a recent discussion).

For present purposes, we take the sequence in [P_{22}]-[P_{24}] to be crucial for an understanding of how disjoint reference, in particular, can be encoded in dance. While we have not yet carried out perception studies on the basis of these data, we carried out an informal pilot study in which two of our research assistants (who had not yet seen the dance sequences) watched the dance sequences in random order with the task of determining for each sequence whether it described a story about a single individual or two separate individuals. Even after being informed about the 'another'-symbolizing mudra, they found this mudra difficult to track. Instead, they reported that the introduction of a new position on stage was a major cue for introducing a second individual, while the absence of such a new position implied the lack of such a second individual. We thus expect this to be a feature of the dance that may carry over into other narrative dance forms, and possibly also into non-narrative dance forms as long as the dancer pursues an intention of narrating a story. Section 4 shows how a semantics of dance could be formally implemented (drawing on Abusch, 2015) and which role *grouping* may play in a dance semantics (drawing on Charnavel, 2016). Section 5 briefly returns to the mirroring that we observed in comparing [P_{25}] in Figure 3 to [P_{14}] in Figure 2.

4. Theoretical interpretation of results

In theoretically interpreting the findings, one factor that is clearly relevant (though it has not previously been connected to semantic interpretation) is the notion of *grouping* (see Lerdahl and Jackendoff, 1983). Charnavel (2016) argues that dance shares hierarchical grouping with language and music, which may be interpreted as giving rise to a syntactic structure of dance.

Building on Lerdahl and Jackendoff (1983), Charnavel (2016:13) posits five *grouping well-formedness rules* three of which are quoted in (10).

(10) *grouping well-formedness rules (Charnavel, 2016:13)*
- a. *GWFR2:* A dance constitutes a group.
- b. *GWFR3:* A group may contain smaller groups.
- c. *GWFR5:* If a group G1 contains a smaller group G2, then G1 must be exhaustively partitioned into smaller groups.

By virtue of the grouping well-formedness rules in (10a-c), grouping serves to create hierarchical structure (in the sense of an exhaustive partitioning of a dance sequence into sub-sequences [groups], which may, in turn, be partitioned into further sub-sequences [groups]). What becomes central at this point are the *grouping preference rules* that determine the sub-sequences (or constituents) of a dance sequence. Charnavel (2016) proposes fifteen such grouping preference rules, of which the most relevant (for our purposes) are given in (11).

(11) *grouping preference rules (Charnavel, 2016:18,19,24)*
- a. *GPR1* (change of direction): Consider a sequence of positions p_1, p_2, p_3, p_4, p_5, p_6. The transition p_3-p_4 may be seen as a group boundary if the path formed by p_1-p_2-p_3 does not have the same direction as the path formed by p_4-p_5-p_6.

b. *GPR2* (change of orientation): Consider a sequence of positions p_1, p_2, p_3, p_4. The transition p_2-p_3 may be seen as a group boundary if the orientation of the body (part) in p_1-p_2 is different from the orientation of the body (part) in p_3-p_4.

c. *GPR10* (intensification): When the effects picked out by the local rules of change (GPR1-GPR8) are relatively more pronounced, a larger-level group boundary may be placed.

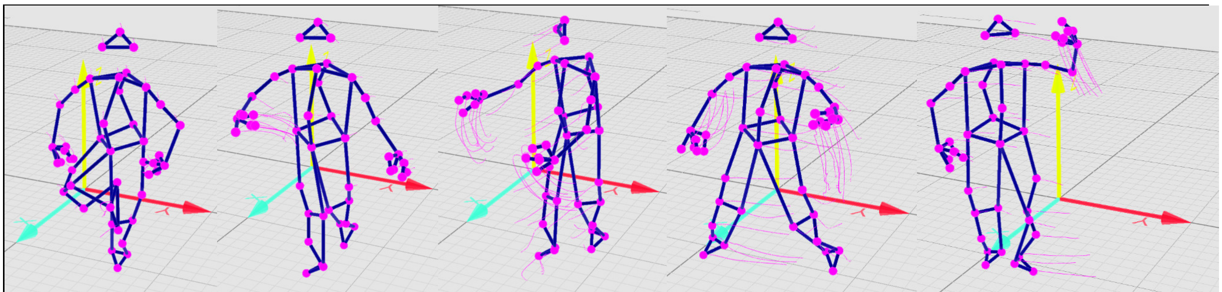
In section 6, we lay out the hypothesis that hierarchical grouping in narrative dance can be mapped to situation structure. We can start by asking how grouping may be used to convey disjointness (e.g. disjoint reference when two characters are introduced into a narrative), as specifically instantiated by Bharatanatyam. We propose the informal rule in (12).

(12) *grouping-based coreference* (first approximation)

a. In the absence of a group boundary, a dance sequence [P_n]-[P_{n+1}] is interpreted as continuous (e.g. describing a narrative about a single individual).

b. If there is a group boundary between two dance positions [P_n] and [P_{n+1}], then a dance sequence [P_n]-[P_{n+1}] is interpreted as discontinuous (e.g. describing a narrative about two separate individuals).

The workings of grouping-based coreference is illustrated for the disjoint reference condition in Figure 4, where an orientation shift occurs between positions [P_{23}] and [P_{24}]. A reader may wish to verify that such an orientation shift does not occur in the coreferent condition, given in Figure 2 above. In terms of Charnavel's grouping preference rules, (11), it is not completely clear whether the rule at work is GPR1 (change of direction) or GPR2 (change of orientation), as a change of direction seems to be combined with a change of orientation in this sequence; however, it is clear that the change from [P_{23}] to [P_{24}] is quite pronounced, in line with GPR10 (intensification).



[P_{21}]	[P_{22}]	[P_{23}]	[P_{24}]	[P_{25}]
↙	↙	↙	↘	↘

→ *time*

Figure 4: orientation shift in the disjoint reference condition

Crucially, if we factor in smaller changes in the dance sequence as group-inducing (at a lower level), then we can posit at least a three-level hierarchical structure, as given in (13), using Charnavel's notation. For the purpose of illustration, we assume that each of the positions in Figure 4 is associated with a low-level group boundary, given that the orientation direction of body parts constantly changes (hand-and-arm in [P_{21}-P_{22}], upper body and arms in [P_{22}-P_{23}], and so forth). The role of *global (whole-body) gestures* comes into play in connection with

Charnavel's GPR10, since such gestures are generally more intense than gestures that only involve individual body parts. In line with GPR1 and GPR2, as stated in (11), we position the larger-level group boundary *between* [P_{23}] and [P_{24}], i.e. in the transition between them (as opposed to identifying it with one of these dance positions).

(13) *structure of the disjoint reference dance sequence*

P_{21} P_{22} P_{23} P_{24} P_{25}
|---|---|---|---| low-level grouping
|---------|-----| larger-level grouping
|---------------| top-level grouping (complete dance)

The core idea here is that group boundaries themselves appear to be meaningful in narrative dance in that they signal *discontinuity*; we expect to find similar effects in other (non-narrative) dance forms.

5. Towards a formal semantic analysis of narrative dance positions

We now take steps towards a formal semantic rendering of the generalizations in section 4. An important first step consists in defining how exactly we should approach the semantics of pictures, i.e. how we could define truth in a visual narrative. In order to answer this question, we build on Abusch (2015), who posits a generalized possible worlds model for informational entities; her idea is that any sentence, picture, etc., counts as an informational entity when it rules out some possibilities, based on the definition in (14).

(14) *possible worlds model of information content* (Abusch 2015:2)
any informational entity such as a sentence or picture rules out some possibilities [= possible worlds, situations, or scenes] and admits others

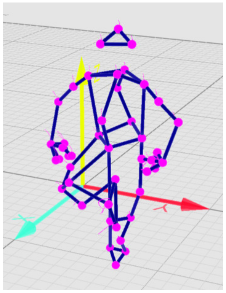
Let us illustrate Abusch's idea for the dance position [P_{21}] in Figure 4. (This example is closely modeled after Abusch's own example that involves two octahedrons.) Assume, for our purposes, that the world is populated by finitely many undistinguishable persons and nothing else. In such a scenario, if I say "There is a person who is sitting.", I rule out a range of possible scenarios (in line with (14)), namely ones in which there is no person, or in which the person is not sitting. The statement in (15) is thus understood to provide new information about a given situation that we are describing.

(15) There is a person who is sitting.

Crucially, Abusch argues that a picture achieves exactly the same result. In parallel to (15), the dance position in (16) can be understood to provide new information about a given situation (namely the current point in time in a narrative that is being told). As Abusch observes, when it comes to the question of what a world or situation is like, (16) rules out possibilities in which no sitting activity takes place, while ruling in possibilities in which a sitting activity takes place. The dance position in (16) thus qualifies as an informational entity in line with (14). Abusch is careful to point out that pictures are often more informative than sentences; taken at face value, a naïve observer may infer from (16) that (in addition to being in a sitting position) the person in the narrative has one leg straight and one leg at an angle.

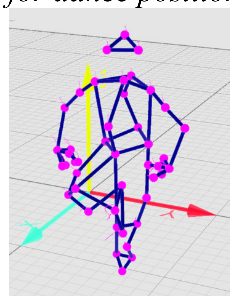
(Of course, this may simply be part of a conventionalized gesture for 'sitting'.) Sentences like (15) can leave such information underspecified; there is no implication from (15) on how exactly the person is sitting.

(16)



Abusch (2015) proceeds to identify the semantics of a picture with the set of possibilities that it admits. This means that we can define the semantics of a picture in terms of possible worlds, situations, or scenes. Treating any given dance position [P_n] as a picture, we can then posit satisfaction conditions as given in (17).[5] Truth in visual narrative is thus defined in terms of how well a dance position [P_n] maps to a situation/scene σ_n in the narrative; i.e. the dance position in (17) counts as satisfied by a fictional situation σ (i.e. "true" in σ) if a sitting activity is taking place in σ.

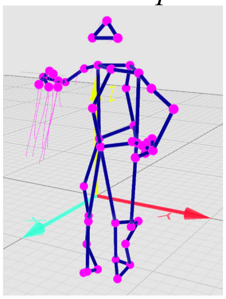
(17) *satisfaction conditions for dance position that describes a sitting activity*

a situation σ satisfies  only if in σ a person is sitting.

For now, the rendering in (17) is connected to narrative—or figurative—dance, which encodes a visual narrative. However, as long as we allow for more abstract, iconic atoms of meaning, it should be clear how this view carries over to all dance forms, including non-narrative dance forms. Schlenker (2017a) identifies meaning in music with inferences that can be drawn on a (fictional) virtual source (e.g. an increasing volume may symbolize that a source is gaining in size, and/or moving closer). Combining Schlenker's *source-based semantics* with Abusch's picture semantics, we could thus posit more abstract satisfaction conditions such as (18), which corresponds to [P_{13}] in Figure 2. (One interesting future direction to explore in this respect touches on correlations between pitch and vertical motion in the bodily responses of (untrained) listeners to music, as discussed by Kelkar and Jensenius, 2018.)

[5] Note that this is glossing over the viewpoint-dependence of pictures. As discussed by Abusch (2013, 2015), pictures are generally related to the objects that they depict by means of projection lines that are oriented towards a given viewpoint.

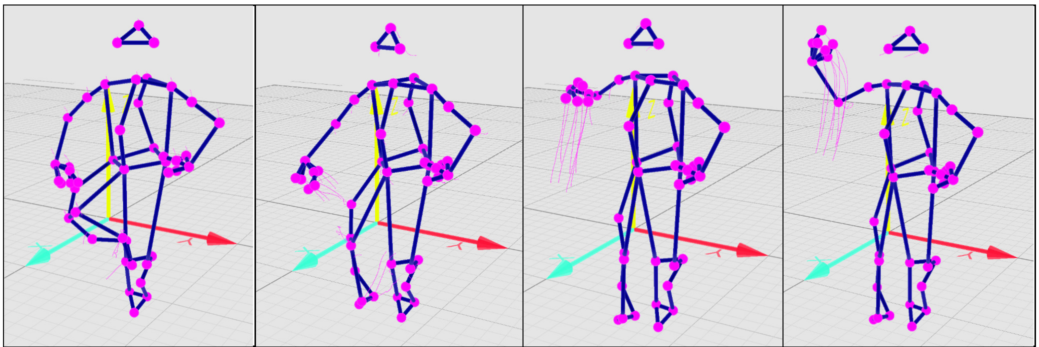
(18) *satisfaction conditions for abstract upward movement of a source*

a situation σ satisfies  only if the virtual source in σ is involved in a (partial or total) upward movement.

Once we look beyond Bharatanatyam, including non-figurative dance, we may thus need a more iconic semantics in line with Schlenker (2017a). An example of future venues for exploration is given by Kelkar and Jensenius (2018), who outline six ways in which (untrained, i.e., for our purposes, "naïve") listeners move their two hands to accompany music that they are hearing. From the perspective of Schlenker (2017a), it is plausible that the two hands separately (or jointly) represent virtual sources, which may give rise to meaning inferences on part of an onlooker.

6. Towards a formalization of grouping-based coreference

Having established an approach to "truth" in narrative dance (in line with Abusch 2015), we can now proceed to reviewing the rule of grouping-based coreference that we introduced in section 4. To that end, let us reconsider the coreferent dance sequence from Figure 2, repeated in Figure 5. In line with Abusch (2013:12, 2014:10), we posit the satisfaction conditions in (19) to (partially) describe the dance positions in Figure 5. We will henceforth use the dance position label, [P_n] to stand in for the actual dance position. This notation is parallel to the way in which Abusch (2013, 2014) labels the panels in a comic. What becomes explicit from (19) is that dance positions [P_n] are mapped to propositions ⟦P_n⟧.[6]



[P_{11}] [P_{12}] [P_{13}] [P_{14}]

Figure 5: coreference condition

(19) a. A situation/scene σ_{11} satisfies [P_{11}] only if in σ_{11} a person is sitting.
b. A situation/scene σ_{14} satisfies [P_{14}] only if in σ_{14} a person is holding a spear.

[6] Note that, since dance is continuous, discrete positions such as [P_{11}] and [P_{12}] must be stipulated. For now, we keep treating dance positions as static images, but one open question concerns the continuity (movement) between them.

Based on our findings with regards to coreference vs. disjoint reference, we formalize the grouping-based coreference rule (or grouping-based coreference principle) as given in (20), building on Abusch (2013:13). We illustrate this rule below, though it is worth guiding the reader's attention to the phrase 'narratively relevant' in (20a) and (20b); as of yet, this is a notion that we leave undefined, to be further explored at a later stage. The underlying intuition is that we are only concerned with situations that are delimited and separated by larger-level grouping boundaries in the sense of (13). This is crucial since a complete narrative dance will of course always describe larger situations that contain *all* dance sequences [P_n] that it contains, i.e. if we were to eliminate 'narratively relevant' from (20), the rule would become void.

(20) *grouping-based coreference* (second approximation)

a. In the absence of a group boundary, a dance sequence [P_n]-[P_{n+1}] is interpreted as corresponding to a larger *narratively relevant* situation σ_{top}.

b. If a narrative dance sequence corresponds to a single *narratively relevant* situation σ_{top} and contains two similar entities α and β, coreference (i.e. $\alpha = \beta$) arises by default when there is no indication that parts of σ_{top} contain more than one entity of this type.

As Abusch (2013) points out, the identification of entities in a single situation, $\alpha = \beta$, may well reflect low-level processes of indexing in vision, see Pylyshyn (2003); as pointed out by Abusch, such extra-linguistic (or pre-linguistic) processes are not in contradiction with the formal semantic approach that we (and Abusch) pursue.

We can now proceed with the coreference sequence in Figure 5 and render (19) as given in (21). We have already established the two satisfaction conditions in (21a) and (21b). By grouping-based coreference, we now derive a larger narratively relevant situation σ_{top} in (21c) (loosely based on Abusch, 2013); this is a situation that has a subpart σ_{11} and a subpart σ_{14}, which each involve existential quantification over a person (α and β, respectively). Since both are part of the same overarching narratively relevant situation, we can, by (20b), identify α and β.

(21) a. σ_{11} satisfies [P_{11}] only if in σ_{11} a person α is sitting.

b. σ_{14} satisfies [P_{14}] only if in σ_{14} a person β is holding a spear.

c. *by grouping-based coreference*
a narratively relevant situation σ_{top} satisfies [P_{11}-P_{14}] only if σ_{top} has a part σ_{11} such that in σ_{11} a person α is sitting, and σ_{top} has a part σ_{14} such that in σ_{14} a person β is holding a spear [via (20a)] and $\alpha = \beta$ [via (20b)].

The important part here is that [P_{11}] and [P_{14}] in Figure 5 are not separated by a larger-level grouping boundary. Contrast this with the disjoint reference condition in Figure 6, adapted from Figure 4. Here, a larger-level group boundary is introduced between [P_{23}] and [P_{24}] due to a change in orientation and direction.

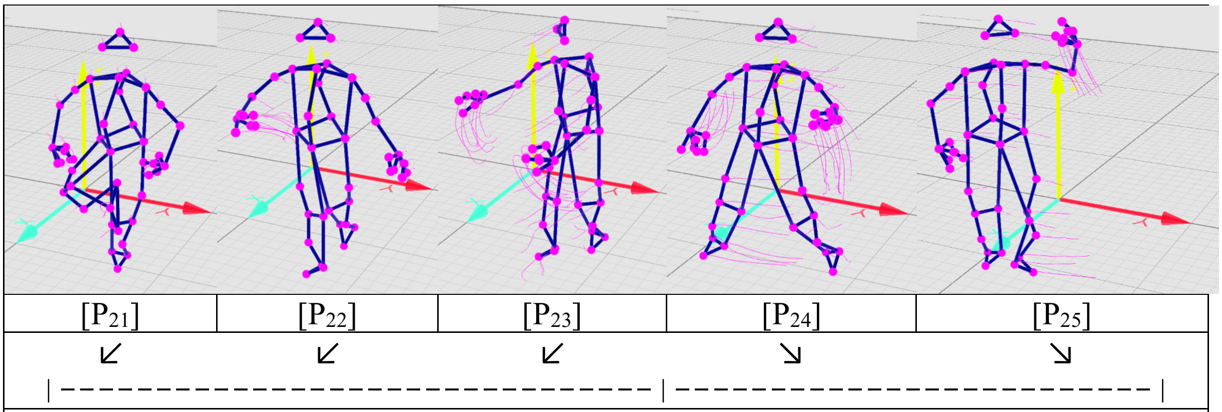


Figure 6: grouping in the disjoint reference condition

The satisfaction conditions in (22a-b) are equivalent to those in (21a-b). (We return to the mirroring of the spear holding in [P_{25}] vs. [P_{14}] below.) The crucial difference is that the group boundary between [P_{23}] and [P_{24}] (which, by transitivity, counts as a group boundary between [P_{21}] and [P_{25}]) blocks the inference to a larger narratively relevant situation σ_{top}.

(22) a. σ_{21} satisfies [P_{21}] only if in σ_{21} a person α is sitting.
b. σ_{25} satisfies [P_{25}] only if in σ_{25} a person β is holding a spear.

Grouping alone may thus be sufficient to block coreference (i.e. referent identification) in a simple narrative like this one, i.e. identification of the agent in the two situations σ_{21} and σ_{25}. An open question (at this point) concerns the exact nature of narratively relevant situations. Since situations are recursively embedded in larger situations, any visual narrative of the type in Figure 6 will contain one larger (non-narratively-relevant) situation that contains σ_{21} and σ_{25}. For present purposes, we exclude such top-level situations, but eventually we aim to determine more precisely which levels matter.

Note that, much in line with Schlenker's (2017a) ideas for the syntax/semantics mapping in music, we propose that grouping in dance serves as a way to organize (sub-)events. Specifically, the introduction of larger-level group boundaries serves to signal discontinuity. Such a signal can have different functions; in other words, it is not necessarily the case that every single grouping boundary indicates a change of character; yet, it is quite plausible that every change of character requires a grouping boundary to be placed.[7]

We can now conclude the discussion of grouping-based coreference and disjoint reference, and move on to a separate question, asking about the types of meaning that are encoded in such dance sequences.

7. Mirroring and the question of *at-issueness in dance*

If we review Figure 6, we observe that disjoint reference is encoded at several levels (going beyond inferences based on grouping). First, the dancer uses a designated *mudra* (hand-and-arm gesture) that symbolizes 'another, a different', as visible in [P_{22}]. She then explicitly introduces a new locus on stage, as visible in [P_{23}], which she then assumes, in [P_{24}]. From

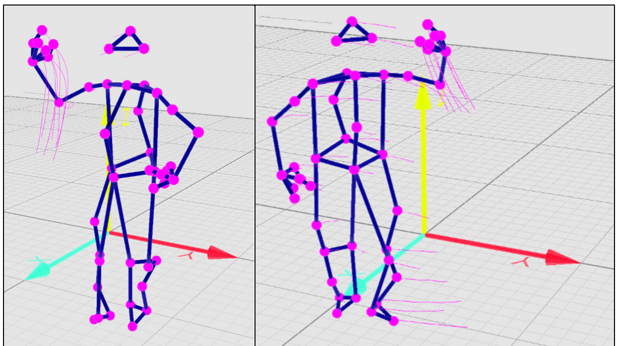
[7] We are grateful to an anonymous reviewer for flagging this point.

the perspective of Abusch's (2013, 2014, 2015) picture semantics, as applied to visual narrative in dance, we could posit satisfaction conditions such as (23).

(23) a. σ_{22} satisfies [P_{22}] only if in σ_{22}, there is an individual *y* such that *y* is distinct from the most salient individual *x*.
b. σ_{23} satisfies [P_{23}] only if in σ_{23} there is a virtual locus *i*.
c. σ_{24} satisfies [P_{24}] only if in σ_{24} the narrative is *at* the virtual locus *i*.

In terms of narrative progression, each of (23a-c) seems to redundantly encode disjoint reference (in addition to what is already achieved by grouping). Note that this does not void grouping-based coreference, (20), which was intended as a more general rule (or principle) of narrative dance that also applies beyond conventional aspects of bharathanatyam. However, there are open questions with regards to, in particular, (23b-c): what, if any, is the shared cognitive underpinning of virtual loci in narrative dance on the one hand, and the loci of Sign Languages on the other hand (see Schlenker, 2017c, for an overview)? A particularly promising idea in this regard may be the hypothesis that even sign language loci may at times be "iconic depictions of their denotations" (Schlenker, 2017c:174, building on research such as Liddell, 2003, and the work by Judy Kegl, as in Neidle et al., 2000), in parallel to the dancer's *virtually assuming* of the position associated with the new locus in [P_{24}].

More intriguingly, for present purposes, is the role of "mirroring" in [P_{25}], which is illustrated in direct comparison in Figure 7. An initial hypothesis could be that this is a trivial reflection of the orientation change. However, in a post-experimental debriefing with the dancer, this mirroring forms an additional part of ensuring that an audience can follow the narrative, i.e. it is a designated means of marking disjoint reference (in addition to (23a-c)).



[P_{14}] *coreference*	[P_{25}] *disjoint reference*

Figure 7: mirroring in Item 1

This naturally raises the question of where in the semantics mirroring could be represented. The satisfaction conditions for [P_{14}] and [P_{25}] are restated in (24a-b), repeated from (21b) and (22b). Crucially, what mirroring may contribute is a non-at-issue inference, as given in (24c) for [P_{25}].

(24) a. σ_{14} satisfies [P_{14}] only if in σ_{14} a person β is holding a spear.
b. σ_{25} satisfies [P_{25}] only if in σ_{25} a person β is holding a spear.

c. *non-at-issue inference (modeled as a definedness condition)*
σ_{25} is defined for [P_{25}] iff the agent of the activity in σ_{25} is distinct from the most salient individual in the current narrative.

Of course, (24c) looks at dance from a linguistic angle, and it is difficult to argue that visual narratives contain something akin to presuppositional content. (For instance, it is rather difficult to conceive how tests for projective content could adequately be carried out.)[8] Nevertheless, the relationship between [$P_{22\text{-}24}$] and [P_{25}] could be likened to that of S_1 and S_2 in (25). It is a standard assumption that S_2 presupposes the same information that S_1 asserts, due to the definite description (with possessive pronoun) *his sister*. Similarly, we conjecture that [P_{25}] may presuppose the same information that is conveyed 'at issue' in [$P_{22\text{-}24}$].

(25) [$_{S1}$ Bill has a sister.] [$_{S2}$ And *his sister* lives in Tromsø.]

In the linguistics literature, there are precedents for non-at-issue content being conveyed outside of speech. For instance, in the realm of speech-accompanying gestures, co-speech gestures (which accompany spoken words) have been argued to encode non-at-issue meaning (see Schlenker, 2017b; Tieu et al., 2017), and Schlenker (2017d) argues that pro-speech gestures (which replace spoken words) can trigger presuppositional inferences (amongst other types of inferences that they can trigger). Moreover, since sign language loci and gestural loci can be linked to presuppositional content (e.g., Schlenker, 2017c:170-171), even the sequence in [P_{22}-P_{24}] may be analyzed at the level of non-at-issue meaning.

Before concluding, it is also worth commenting more on the exact rendering of the inference in (24c). An anonymous reviewer points out that grouping breaks (which we discussed in section 6) can be seen as having "the discourse semantic function [of] introducing a new center" (corresponding to the management of a stack of entities in a dynamic semantics). S/he inquires what the type of these centers should be ("a protagonist, a location, a situation, or a combination of them"). For the purposes of the Bharatanatyam narrative that we have been working with, the center seems to be a protagonist/character in the narrative (rather than a location or situation). However, in a broader view (moving beyond Bharatanatyam) it is plausible that centers are more abstract corresponding to virtual sources in the style of Schlenker (2017a); a larger-level grouping boundary would then indicate a shift from one virtual source (on a stack of contextually given entities) to another virtual source.

8. Conclusion

In this paper, we presented an exploratory production study to investigate the encoding of coreference vs. disjoint reference in Bharatanatyam, a figurative (narrative) dance that serves to tell a story. We maintained that a formal semantics of narrative dance is possible in line with Abusch's (2013, 2014, 2015) approach to the semantics of visual narrative. While our

[8] One test for (non-)at-issueness that may be fruitful involves embedding under negation (or under a negative predicate such as *deny*; we are grateful to Philippe Schlenker for pointing this out). For Item 1, as illustrated in (6b), a relevant item may thus be designed as in (i) below, where the prediction is that the inference in (24c) is not canceled in such a context. We plan to explore such items in future follow-up studies.

i. The witness describes that a strong man was sitting on the ground.
Then she denies that another man was holding a spear.

analysis was closely tied to the nature of Bharatanatyam, we maintain that at least two aspects of the analysis would carry over to other (non-narrative) dance forms:

[i.] dance positions [P_n] (as arbitrary discrete moments in dance sequences) can be described by means of satisfaction conditions that involve a fictional virtual source in the spirit of Schlenker (2017a), as illustrated in (18).

[ii.] a larger-level group-boundary between two dance positions [P_n] and [P_{n+1}] (as triggered in line with grouping preference rules as posited by Charnavel, 2016) triggers discontinuity inferences, which may, for instance indicate non-identity of two virtual sources, see Figure 6.

Open questions to be explored in future studies concern the question of what happens if more than two characters are introduced into a Bharatanatyam narrative; specifically, a question that has arisen from the discussion so far is the extent to which loci in Bharatanatyam can be likened to loci in sign languages. Another goal is to move on to non-figurative dancing and test whether the insights from this study carry over (and to what extent). Here it could also be interesting to investigate to what extent expressive qualities (cf. Krumhansl and Schenck, 1997), as seen in the spatiotemporal features of the gestures (e.g. "jaggedness" in the quality of movement), complement or contradict some of the linguistic meanings. Future studies also need to move on from production to perception, to investigate how observers (both trained and untrained) interpret a given dance sequence, e.g. if and how observers can recognize whether a narrative dance sequence involves one or more protagonists. Moving beyond a sophisticated dance form such as Bharatanatyam, such perception studies would benefit from a shift towards simplified dances/gestures (e.g. using the medium of a simple dance form such as "finger dance" to construct stimuli; see Charnavel, 2016:fn.11).

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Constraining (shifting) types at the interface[1]

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Abstract. This paper argues that traces only range over individual semantic types and cannot be type shifted into higher types to circumvent this restriction. The evidence comes from movement targeting positions where DPs must denote properties and the behavior of definite descriptions in these positions. These constraints on possible traces demonstrate that syntactic operations impose active restrictions on permissible semantic types in natural language.

Keywords: semantic types, traces, movement, reconstruction, type shifting, properties.

1. Introduction

A longstanding problem in semantics is that natural language only makes use of a small subset of the possible semantic types that are generated by the standard recursive definition in (1).

(1) a. e and t are types;

b. If σ and τ are types, then $\langle \sigma, \tau \rangle$ is a type;

c. Nothing else is a type.

This paper argues for the hypothesis that, while types are in principle unconstrained in the semantics, syntactic operations only make use of a small set of those possible types and thus impose an active constraint on permissible semantic types. I present a case study on movement, in particular on what constitutes a *possible trace*, i.e. the λ-bound variables that movement dependencies can map onto. The novel evidence for this study comes from the domain of property-denoting DPs. The argumentation breaks down into two claims. The first claim is that traces only range over individual semantic types, such as entities (e) and degrees (d). Even though natural language has expressions over higher types, like properties ($\langle e, t \rangle$) and generalized quantifiers ($\langle et, t \rangle$), these expressions cannot be represented as traces. I call this the Trace Interpretation Constraint, given in (2) (see also Chierchia, 1984; Landman, 2006).

(2) ***Trace Interpretation Constraint***
$*[\ \mathrm{DP}_1\ \lambda f_\sigma \ldots [\ \ldots [\ f_\sigma\ ]_1 \ldots\ ]\ ]$, where σ is not an individual type

The second claim is that the Trace Interpretation Constraint cannot be circumvented by type shifting an individual-type trace into a higher type. I call this the Trace Rigidity Principle, given in (3) (see also Landman, 2004).

(3) ***Trace Rigidity Principle***
Traces cannot be type shifted.

[1]This paper stems from my dissertation work in Poole (2017a). For helpful discussion on the specific issues in this paper, many thanks to Rajesh Bhatt, Kyle Johnson, Barbara Partee, and Ellen Woolford, in addition to Daniel Altshuler, Dylan Bumford, Danny Fox, Stefan Keine, Angelika Kratzer, Andrew McKenzie, and audiences at GLOW 40, Sinn und Bedeutung 22, UMass, and UCLA. This work was supported by the National Science Foundation Graduate Research Fellowship under NSF DGE-1451512.

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These constraints together conspire to force movement either to map onto a trace ranging over an individual type (4) or to reconstruct by putting the moved expression back in its launching site at LF (5). All other representations are ill-formed. Thus, the interpretation of movement is tightly restricted, which in turn constrains the actively used semantic types.

(4) $[\ \mathrm{DP}_1\ \lambda x_e \ldots [\ \ldots [\ x_e\ ]_1 \ldots\ ]\ ]$

(5) $[\ \_\__1 \ldots [\ \ldots [\ \mathrm{DP}\ ]_1 \ldots\ ]\ ]$
reconstruct

Addressing constraints on permissible semantic types might appear to (and arguably, traditionally does) belong to the domain of lexical items, namely what the semantic types of possible lexical items are. A premise tacitly defended in this paper is that a theory of permissible semantic types must be based on the semantic types of syntactic constituents, which include both *lexical items* and *complex constituents*. In simple cases, the possible types of these two coincide; for example, a verb phrase has the same type as an intransitive verb, $\langle e,t\rangle$, irrespective of its internal structure. However, movement would prima facie have the ability to create constituents whose semantic type would not correspond to any known lexical items. Thus, a theory of possible lexical items is not in and of itself a sufficient theory of permissible semantic types. Rather, it must be coupled with a theory of possible traces, i.e. which of the logically possible movement structures are allowed by the grammar, which is what this paper provides.

2. Trace Interpretation Constraint

DPs come in three semantic guises (Partee, 1986): entities (type e), properties (type $\langle e,t\rangle$), and generalized quantifiers (type $\langle et,t\rangle$).[2] There is abundant evidence that entity traces exist, as these are the canonical traces left by movement types like QR. With respect to generalized-quantifier traces, Romero (1998) and Fox (1999) have shown that such traces are unavailable (contra Rullmann, 1995; Cresti, 1995), based on evidence from the correlation between Condition C connectivity and scope reconstruction. Additional arguments against generalized-quantifier traces based on ACD, extraposition, and parasitic gaps can be found in Poole (2017a: 122–126).

(6) *Entity traces*
$[\ \mathrm{DP}_1\ \lambda f_e \ldots [\ \ldots [\ f_e\ ]_1 \ldots\ ]\ ]$

(7) *Generalized-quantifier traces*
$*[\ \mathrm{DP}_1\ \lambda f_{\langle et,t\rangle} \ldots [\ \ldots [\ f_{\langle et,t\rangle}\ ]_1 \ldots\ ]\ ]$

It has not yet been addressed whether property traces exist.[3] Thus, a central contribution of this project is an empirically motivated argument against property traces (see also Poole, 2017a, b).

(8) *Property traces*
$*[\ \mathrm{DP}_1\ \lambda f_{\langle e,t\rangle} \ldots [\ \ldots [\ f_{\langle e,t\rangle}\ ]_1 \ldots\ ]\ ]$

[2]Properties are intensional, i.e. $\langle s,\langle e,t\rangle\rangle$, but throughout this paper, I will treat them in purely extensional terms for the sake of simplicity. This reduces them to sets of entities.

[3]Chierchia (1984) argues that property variables exist based on anaphora like *such* and *do so*. However, Landman (2006) shows that these cases should be reanalyzed as referring to kinds and do not involve property variables.

This investigation thus supplies the crucial final piece of the argument that the constraint on possible traces is against *any higher-type trace* (9). This is an important advance in our understanding of the syntax–semantics interface.

(9) ***Trace Interpretation Constraint***
$*[\ \mathrm{DP}_1\ \lambda f_\sigma \ldots [\ \ldots [\ f_\sigma\ ]_1 \ldots\ ]\ ]$, where σ is not an individual type

The crucial motivation for the ban on property traces comes from a series of original observations about what I call Π-positions. These are syntactic environments where a DP denotes a property (type $\langle e,t\rangle$). The four Π-positions that form the investigation's empirical base are the pivot of an existential construction (10a), the color term of a change-of-color verb (10b), the name argument of a naming verb (10c), and predicate nominals (10d). Despite their surface heterogeneity, what these four environments have in common is that they require a property-type DP.

(10) *Π-positions*

a. There is [**a potato**]$_{\langle e,t\rangle}$ in the pantry. *Existential constructions*

b. Megan painted the house [**magenta**]$_{\langle e,t\rangle}$. *Change-of-color verbs*

c. Irene called the cat [**Snowflake**]$_{\langle e,t\rangle}$. *Naming verbs*

d. Erika became [**a teacher**]$_{\langle e,t\rangle}$. *Predicate nominals*

For reasons of space, I do not review the arguments that DPs in these positions denote properties. The arguments, however, come from the respective literatures on each of the Π-positions and are thus *independent* from the arguments made here. For change-of-color verbs, the color term denotes a property because these verbs are textbook examples of resultatives (e.g. Kratzer, 2005). For predicates nominals, them being properties is the standard analysis (e.g. Williams, 1983; Partee, 1986). For existential constructions and naming verbs, the arguments are more involved and come from McNally (1992, 1997) and Matushansky (2008) respectively. As a bibliographic note, I use "Π-positions" as a theory-neutral term because these positions belong to a larger syntactic puzzle observed by Postal (1994), which involves more environments and more movement types than are discussed here. For more about Π-positions in the context of Postal's puzzle, see Poole (2017a).

The argumentation in this section proceeds as follows: First, I set the stage by showing that movement types in English differ with respect to whether they shift scope, i.e. whether they can reconstruct. Second, I apply these movement types to Π-positions, showing that only movement that reconstructs can target them, which categorically precludes some movement types. Third, I argue that the Trace Interpretation Constraint derives this pattern, from which I conclude that property traces do not exist.

2.1. Movement and scope shifting

For movement to shift scope means that at LF, the moved DP takes scope in the position achieved by movement. For all overt forms of movement, this corresponds to the DP's surface syntactic position. If movement does not shift scope, the scope of the moved DP at LF mismatches its surface position in that it takes scope in its position prior to movement, viz. its base-generated position. This dichotomy is schematized in (11) and (12) where the check mark represents the moved DP's position at LF.

(11) *Movement that shifts scope*
$[\ \underline{\ \checkmark\ }_{1} \ldots [\ \ldots \underline{\quad}_{1} \ldots]]$

(12) *Movement that does* **not** *shift scope*
$[\ \underline{\quad}_{1} \ldots [\ \ldots \underline{\ \checkmark\ }_{1} \ldots]]$

Against this backdrop, let us consider topicalization, *wh*-movement, and QR.

Topicalization: Topicalization in English obligatorily shifts the scope of the moved DP.[4] To illustrate, first consider the possible interpretations of the baseline sentence in (13), which has narrow-scope and wide-scope readings of *some student* with respect to *every teacher*.

(13) *Every teacher* likes **some student** in the first week.

a. *Narrow-scope reading* $\forall \gg \exists$
For every teacher x, there is some student y such that x likes y.

b. *Wide-scope reading* $\exists \gg \forall$
There is some student y such that for every teacher x, x likes y.

Crucially, in a scenario where the student is a *different* student for each teacher, only the narrow-scope reading in (13a) is true. Topicalizing *some student*, as in (14), bleeds the narrow-scope reading in (13a).

(14) [**Some student**]$_1$, *every teacher* likes $\underline{\quad}_1$ in the first week. $*\forall \gg \exists$; $^{\checkmark}\exists \gg \forall$

The only possible interpretation of (14) is the wide-scope reading, where *some student* takes scope in the landing site of topicalization, above *every teacher*. Consequently, (14) is true iff there is a single student that every teacher likes. In sum, topicalization obligatorily shifts scope and does not allow reconstruction.

***Wh*-movement**: *Wh*-movement optionally shifts the scope of the moved DP. In order to probe scope in constituent questions, we will use *how many*-questions because, in addition to the *wh*-meaning component, *how many* independently carries its own existential quantification that can vary in scope (Kroch, 1989; Cresti, 1995; Rullmann, 1995). Consider the *how many*-question in (15). Under the wide-scope, *de re* reading (15a), it is assumed that there is a certain set of books that Nina should read; the speaker is asking how many such books there are. A possible answer to the wide-scope reading is: 'Three books, namely *Aspects*, *Lectures on Government*

[4]A few disclaimers are in order: First, this behavior is notably distinct from other movement types called "topicalization" in other languages, e.g. German V2-fronting, which are indeed able to reconstruct. Second, topicalization is the name of a movement type and should not be conflated with topichood. Third, when investigating English topicalization, there are a number of factors that must be controlled for, which I gloss over here in the interest of space. See Poole (2017a: 48–51) for a more in-depth discussion which shows that the relevant facts hold even when the necessary controls are in place.

and Binding, and *The Minimalist Program*'. Under the narrow-scope, *de dicto* reading (15b), there is no assumption that there are any specific books that Nina should read. Rather, it is assumed that she should read a certain number of books, without having any particular books in mind. A possible answer to the narrow-scope reading is: 'Three books, any three'.

(15) [**How many books**]$_1$ should Nina read ___ $_1$ this summer?

a. *Wide-scope reading* how many ≫ should
For what number *n*: There are *n*-many particular books *x* such that Nina should read *x* this summer.

b. *Narrow-scope reading* should ≫ how many
For what number *n*: It is necessary for there to be *n*-many books *x* such that Nina reads *x* this summer.

The wide-scope and narrow-scope readings of (15) can be paraphrased as the questions in (16a) and (16b) respectively.

(16) a. *Wide-scope paraphrase of (15)*
How many books are there that Nina should read this summer?

b. *Narrow-scope paraphrase of (15)*
What is the number such that Nina should read that many books this summer?

The scope ambiguity in (15) is the result of the fact that *wh*-movement only optionally shifts scope and thus allows a reconstructed derivation.

Quantifier Raising: By definition, QR cannot reconstruct. However, as a disclaimer, we must distinguish QR for scope shifting and QR for interpreting quantifiers. Although these two functions of QR ordinarily coalesce (at least in English), we will see that this does not hold for Π-positions: quantificational DPs can occur in Π-positions, but they do not enjoy the scopal mobility that QR would afford. For reasons of space, I do not discuss the issue of how to interpret quantificational DPs in Π-positions if not by QR. It is essentially an open question, though see Poole (2017a: 83–87) for discussion and some possible solutions.

2.2. Π-positions

The Trace Interpretation Constraint makes the two predictions about Π-positions in (17). This section shows that both of these predictions bear out for the four Π-positions.

(17) a. ***Scope prediction***
If movement targets a Π-position, it must reconstruct, because an entity trace is type-incompatible with a property-denoting DP.

b. ***Movement-type-prediction***
If a movement type cannot reconstruct, it can never target Π-positions.

Existential constructions: *Wh*-movement can target the pivot of an existential construction (18b), but topicalization (18c) and QR cannot (18d).[5] This confirms the movement-type prediction for existential constructions, because the two movement types that cannot shift scope, topicalization and QR, cannot target the Π-position.

(18) a. There is **a potato** in the pantry. *Baseline*

b. ✓**What**$_1$ is there ___$_1$ in the pantry? *Wh-movement*

c. * [**A potato**]$_1$, there is ___$_1$ in the pantry. *Topicalization*

d. There *must* be **someone** in his house. *QR*: ✓must ≫ ∃; *∃ ≫ must

Even though *wh*-movement can ordinarily shift scope, when it targets the pivot of an existential construction, scope shifting is rendered impossible, and the movement must reconstruct (19).

(19) [**How many questions**]$_1$ *should* there be ___$_1$ on the exam?
*how many ≫ should; ✓should ≫ how many

To appreciate this fact, let us compare the existential construction in (19) with its corresponding copula construction in (20), where *how many* is able to scope above or below *should*. Paraphrases of the (hypothetical) wide-scope and narrow-scope readings of (19) and (20) are given in (21).

(20) *Copula equivalent of (19)* ✓how many ≫ should; ✓should ≫ how many
[**How many questions**]$_1$ *should* ___$_1$ be on the exam?

(21) a. *Narrow-scope paraphrase* ✓existential (19); ✓copula (20)
What is the number such that it is necessary that that many questions be on the exam?

b. *Wide-scope paraphrase* *existential (19); ✓copula (20)
How many questions are there such that it is necessary that they be on the exam?

Consider the appropriateness of (19) and (20) in two different scenarios where I am a TA and the professor is preparing the final exam. In the first scenario, she wants to know the number of questions that I think the exam should have so that the grading is manageable; the identity of the questions does not matter at this point. Both (19) and (20) are appropriate in this context because they both have a narrow-scope reading, as paraphrased in (21a). In the second scenario, the professor has asked me to pick out from a workbook the questions that I think should be on the exam. She wants to know the number of questions that I have selected so that she can gauge the amount of time that the exam room should be reserved for. Thus, she is asking about the cardinality of a set that exists in the actual world, the set of questions that I have picked. While the copula construction in (20) is appropriate in this context, the existential construction in (19) is not. This contrast reflects that (20) but not (19) has a wide-scope reading where *how many* scopes above *should*, as paraphrased in (21b). This difference follows from the fact that *wh*-movement cannot shift scope when it targets a Π-position, thereby forcing a narrow-scope, reconstructed reading of *how many*. This confirms the scope prediction for existential constructions. Further confirmation of the scope prediction comes from negative

[5] The observation that QR cannot target the pivot of an existential construction comes from Williams (1984).

islands, which independently block reconstruction (e.g. Rullmann, 1995). Since negative islands force *how many* to take wide scope and Π-positions force *how many* to take narrow scope, the two should be mutually exclusive. This prediction is borne out, as shown in (22).[6]

(22) a. * [**How many books**]$_1$ aren't there ___$_1$ on the table?

b. ✓[**How many tables**]$_1$ aren't there books on ___$_1$?

Change-of-color verbs: *Wh*-movement can target the color term of a change-of-color verb (23b), e.g. *paint*, *turn*, and *dye*, but topicalization cannot (23c).

(23) a. Megan painted the house **magenta**. *Baseline*

b. ✓[**What color**]$_1$ did Megan paint the house ___$_1$? *Wh-movement*

c. * **Magenta**$_1$, Megan painted the house ___$_1$. *Topicalization*

There is no general prohibition against topicalizing color terms. A color term can be topicalized if it does not occur with a change-of-color verb (24). The prohibition on topicalization targeting color terms applies exclusively to those color terms that are arguments of change-of-color verbs.

(24) { **Green / that color** }$_1$, he never discussed ___$_1$ with me. [Postal 1994:164]

QR also cannot target the color term of a change-of-color verb (25a), which we can compare with QR targeting the object (25b), which is indeed possible.[7]

(25) a. *A (#different) contractor* painted the house **every color**. ✓$\exists \gg \forall$; *$\forall \gg \exists$

b. *A (different) contractor* painted **every house** that ugly green. ✓$\exists \gg \forall$; ✓$\forall \gg \exists$

(25a) is true iff there is a single contractor, who incidentally did lots of painting, but not if there is a different contractor for each color. This confirms the movement-type prediction for change-of-color verbs. Turning to the scope prediction, when *wh*-movement targets the color term, it must reconstruct. Thus, (26) only has the narrow-scope reading, as paraphrased in (26a), and extraction from negative islands is outright ungrammatical (27), thereby confirming the scope prediction for change-of-color verbs.

(26) [**How many colors**]$_1$ *should* Nina paint the house ___$_1$?

a. ✓*Narrow-scope paraphrase:* What is the number such that it is necessary that Nina paint the house that many colors? ✓should $\gg$ how many

b. * *Wide-scope paraphrase:* How many colors are there such that it is necessary that Nina paint the house those colors? *how many $\gg$ should

[6]The same fact can be shown with *wh*-islands; see Poole (2017a: 56–59).

[7]I include *different* to bias towards the inverse-scope reading. The #-mark indicates that *different* is infelicitous if the sentence were uttered out-of-the-blue, because it lacks the inverse-scope reading that would require QR. There is a felicitous reading of (25a) in which *different* is interpreted as different with respect to something previously mentioned in the discourse, e.g. another contractor, but this reading does not involve inverse scope.

(27) a. *[**How many colors**]$_1$ did no one paint their house ___ $_1$?

b. ✓[**How many houses**]$_1$ did no one paint ___ $_1$ lime green?

Naming verbs: The same pattern is observed for naming verbs and predicate nominals, so here the discussion will be more compact. *Wh*-movement can target the name argument of a naming verb (28b), e.g. *name*, *call*, and *baptize*, but topicalization (28c) and QR cannot (28d). As with color terms, there is no general prohibition against topicalizing names (29). Finally, when *wh*-movement targets the name argument, it must reconstruct (30). This confirms the movement-type and scope predictions for naming verbs.

(28) a. Irene called the cat **Snowflake**. *Baseline*

b. ✓[**What name**]$_1$ did Irene call the cat ___ $_1$? *Wh-movement*

c. ***Snowflake**$_1$, Irene called the cat ___ $_1$. *Topicalization*

d. *A (#different) child* called the cat **every nickname**. *QR:* ✓$\exists \gg \forall$; *$\forall \gg \exists$

(29) **Raphael**$_1$, we never discussed ___ $_1$ as a possible name for him. [Postal 1994:164]

(30) [**How many nicknames**]$_1$ *should* Nina call the cat ___ $_1$?
*how many ≫ should; ✓should ≫ how many

Predicate nominals: *Wh*-movement can target predicate nominals (31b), but topicalization (31c) and QR cannot (31d). Furthermore, when *wh*-movement targets a predicate nominal, it must reconstruct (32). This confirms the movement-type and scope predictions for predicate nominals.

(31) a. Erika became **a teacher**. *Baseline*

b. ✓[**What (kind of teacher)**]$_1$ did Erika become ___ $_1$? *Wh-movement*

c. *[**A math teacher**]$_1$, Erika became ___ $_1$. *Topicalization*

d. *A (#different) student* became **every kind of teacher**. *QR:* ✓$\exists \gg \forall$; *$\forall \gg \exists$

(32) [**How many kinds of teacher**]$_1$ *should* Nina become ___ $_1$?
*how many ≫ should; ✓should ≫ how many

2.3. Putting together the pieces

The previous section confirmed the two predictions of the Trace Interpretation Constraint: (i) if movement targets a Π-position, it must reconstruct, because an entity trace is type-incompatible with a property-denoting DP, and (ii) if a movement type cannot reconstruct, it can never target Π-positions. Descriptively, then, what Π-positions reveal is that the semantic representation of scope-shifting movement is incompatible with positions where DPs must denote properties. According to the standard mechanism of interpreting movement (e.g. Heim and Kratzer, 1998), and also the Trace Interpretation Constraint, this follows straightforwardly: the representation of scope-shifting movement involves movement leaving an entity (type *e*) trace. Leaving a type-*e* trace would shift scope, but such a trace does not furnish the property meaning required by Π-positions, yielding ungrammaticality (33). Reconstruction obviates this problem by placing the moved expression back in the launching site of movement at LF. Thus, if a DP would not ordinarily violate the property requirement of Π-positions, then it will not do so under reconstruction either (34).

(33) *Scope shifting ⇏ Π-positions*

$$*[\ \mathrm{DP}_1\ \lambda x_e \ldots [\ \ldots [\ x_e\ ]_{\Pi\text{-pos}} \ldots]\ ]$$

type *e* trace

(34) *Reconstruction ⇒ Π-positions*

$$\checkmark[\ \_\_\__1 \ldots [\ \ldots [\ \mathrm{DP}_1\ ]_{\Pi\text{-pos}} \ldots]\ ]$$

reconstruct

According to this analysis, Π-positions are an instance where movement must reconstruct in order to avoid the semantic-type mismatch that would occur if the moved DP were not interpreted in its base-generated position.

Crucially, the ungrammaticality of scope-shifting movement targeting Π-positions indicates that movement cannot map onto a trace ranging over properties, where the moved DP denotes either a property or a generalized quantifier over properties, as schematized in (35).

(35) *Property traces are ungrammatical*

a. $*[\ \mathrm{DP}_{\langle e,t\rangle}\quad \lambda f_{\langle e,t\rangle}\ [\ \ldots f \ldots]\ ]$

b. $*[\ \mathrm{DP}_{\langle\langle et,t\rangle,t\rangle}\ \lambda f_{\langle e,t\rangle}\ [\ \ldots f \ldots]\ ]$

Empirically, if (35a) and (35b) were not ungrammatical, they would derive the wrong scope facts (see above). Moreover, even in instances that involve apparent quantification over properties, these quantifiers over properties cannot take scope over other scope-bearing elements in the sentence, as shown in (36) for existential constructions.

(36) a. There was*n't* **every kind of doctor** at the convention. ✓not ≫ every; *every ≫ not

b. There was*n't* **only one kind of doctor** at the convention.
✓not ≫ only one; *only one ≫ not

This unavailability of wide-scope is expected if (35b), where a generalized quantifier over properties has undergone QR, is an unavailable representation. Moreover, if a trace ranging over properties is unavailable in (35b), then we can generalize that it is also unavailable in (35a), which completely rules out property traces.[8] Thus, what the ungrammaticality of scope-shifting movement targeting Π-positions ultimately reveals is that *the syntax–semantics mapping does not permit movement to map onto traces ranging over properties*, in accordance with the Trace Interpretation Constraint.

[8] Strictly speaking, (35a) would not affect quantificational scope and therefore can only be ruled out by deduction. However, the alternative analysis, where (35a) is possible but (35b) is not, would require that movement have some way of knowing the semantic type of the moving expression. I do not see how this would be possible under standard conceptions of syntax and its interface with semantics. According to the analysis here, the only trace that movement can leave is an entity trace, and thus all the configurations in (35) are blocked without having to examine the elements involved in the movement chain.

3. Trace Rigidity Principle

The Trace Interpretation Constraint raises the possibility that the grammar could use an entity trace, but type shift that trace into a higher type, e.g. rendering it compatible with Π-positions. This section argues that such a rescue procedure does *not* happen and that traces cannot be type shifted, a principle which I call the Trace Rigidity Principle in (37) (or 'trace rigidity' for short).

(37) ***Trace Rigidity Principle***
Traces cannot be type shifted.

Without trace rigidity, the Trace Interpretation Constraint would effectively be vacuous and unobservable because it could always be circumvented under the surface. Because the Trace Interpretation Constraint can in fact be observed, there is already reason to believe that trace rigidity holds. However, what this section argues is that there is *independent* evidence for trace rigidity. I show that anaphoric definite descriptions, a superset of traces under Trace Conversion, cannot occur in Π-positions, but their nonanaphoric counterparts can. Thus, we are able to view the effects of (37) outside the context of movement. I then argue that it is anaphoric definites that cannot be type shifted and develop a syntactic analysis of this incompatibility in terms of the weak–strong definite distinction (in the sense of Schwarz, 2009). The upshot of this proposal is that trace rigidity follows from how DPs are constructed in the syntax.

The point of departure is the observation that at first glance, seemingly type-*e* elements appear to be able to occur in Π-positions (38). Given the fact that Π-positions require property-denoting expressions, why are the examples in (38) grammatical?

(38) a. Megan painted the house **that hideous shade of purple**. *Change-of-color verbs*
b. Irene called the cat **that dumb nickname**. *Naming verbs*
c. Erika became **that kind of teacher**. *Predicate nominals*

3.1. Type shifting to property

Partee (1986) proposes a set of semantic type shifters that allow DPs to flexibly shift from one of the three possible types to another. The type shifters that are important for our purposes, because they allow shifting into the property domain, are IDENT, PRED, and $\mathcal{BE}$ (39).

(39) a. IDENT: $j \rightarrow \lambda x \,.\, x = j$
b. PRED: $x \rightarrow {}^{\cup}x$
c. $\mathcal{BE} : \mathcal{P} \rightarrow \lambda x \,.\, \mathcal{P}([\lambda y \,.\, y = x])$
$\mathcal{P} \rightarrow \lambda x \,.\, \{x\} \in \mathcal{P}$

The functor IDENT is a total function that maps any element onto its singleton set. The functor PRED maps the entity-correlate of a property onto the corresponding property (Chierchia, 1984). For example, PRED maps ⟦goodness⟧ to ⟦good⟧ and ⟦green⟧ the noun to ⟦green⟧ the adjective.

$\mathcal{BE}$ is a homomorphism between $\langle et,t\rangle$ and $\langle e,t\rangle$. It applies to a generalized quantifier, finds all of the singleton sets therein, and collects the elements of these singleton sets into a set. For more discussion of these type shifters in the context of Π-positions, see Poole (2017a: 199–204).

I propose that DPs never start out denoting properties.[9] A property denotation is always achieved by type shifting from an individual denotation (e) or a generalized-quantifier denotation ($\langle et,t\rangle$). Consequently, Π-positions require a type shifter for the structure to semantically compose, as schematized in (40), because they require property-type DPs. For the sake of simplicity, I will generally assume that the type shifter used is $\mathcal{BE}$, though nothing critical hinges on this.

(40) a. *Existential constructions*
There is [$\mathcal{BE}$(**a potato**)] in the pantry. $\langle et,t\rangle \to \langle e,t\rangle$

b. *Change-of-color verbs*
Megan painted the house [PRED(**magenta**)]. $e \to \langle e,t\rangle$

c. *Naming verbs*
Irene called the cat [$\mathcal{BE}$(**Snowflake**)]. $\langle et,t\rangle \to \langle e,t\rangle$

d. *Predicate nominals*
Erika became [$\mathcal{BE}$(**a teacher**)]. $\langle et,t\rangle \to \langle e,t\rangle$

Let us take stock and look ahead. We now have an explanation for why seemingly type-e (and $\langle et,t\rangle$) expressions can occur in Π-positions: they are type shifted into property meanings. However, thus far, nothing prevents these same type shifters from applying to traces, circumventing the Trace Interpretation Constraint. The next subsection introduces another generalization about Π-positions: they prohibit anaphoric definite descriptions. I argue that the ban on anaphoric definites and the ban on scope-shifting movement from Π-positions are one and the same under Trace Conversion, wherein traces are anaphoric definite descriptions. I then propose a syntactic account of the complementarity of type shifting and anaphoric definites.

3.2. Π-positions prohibit anaphoric definites

While some type-e expressions can occur in Π-positions as a result of property denotations being derived via type shifting, it is not the case that Π-positions permit *all* type-e expressions. As such, this means that not all expressions can type shift into property denotations. This section observes that Π-positions prohibit anaphoric definite descriptions (41). Thus, it must be the case that anaphoric definites cannot be type shifted to type $\langle e,t\rangle$. Following Schwarz's (2009) terminology, I will call anaphoric definite descriptions *strong definites* and nonanaphoric definite descriptions *weak definites*.

(41) **Definite generalization**
Π-positions prohibit anaphoric (= strong) definite descriptions.

Testing for the felicity of strong definites in Π-positions requires some amount of indirect

[9] Poole (2017a: 203–204) suggests that this may explain why property DPs seem to be marked crosslinguistically.

reasoning, which is worth spelling out explicitly. Examples like (38) show that definites are in principle allowed in Π-positions, but they do not reveal what *kinds* of definites. It is possible to create contexts where only a strong definite would be felicitous. There are two properties that distinguish strong definites from weak definites, which can be used to create such contexts: (i) strong definites must have an antecedent and (ii) they do not have to satisfy the standard uniqueness requirement of (weak) definites (Schwarz, 2009). When these two conditions are satisfied and controlled for, definites become unacceptable in Π-positions. Because definites can occur in Π-positions, but not in these contexts that allow only strong definites, we can reason that it must be the case that the definites in Π-positions are necessarily weak definites. With this logic in mind, I show three pieces of evidence below that support the generalization in (41).[10]

First, a strong definite can refer to a previously mentioned indefinite. In (42a), the definite *the shade*, or even *the color*, can refer back to the indefinite *a shade of red*. In this context, there may be multiple shades or colors that Dorothy finds too dark or other colors that Blanche picked out. Thus, it is not the case that *the shade* and *the color* are conveying their referent based on uniqueness. As shown in (42b), a definite description in a Π-position (here, a change-of-color verb) in the same context is infelicitous. What this infelicity discloses is that the definite in (42b) must be a weak definite and its uniqueness requirement is not being satisfied.

(42) Blanche picked out *a shade of red* for the living room. *Color verbs*

a. ✓But Dorothy thought that **the shade/color** was too dark.

b. #And Dorothy painted the room [**the shade/color**]$_{\Pi\text{-pos}}$.

The second piece of evidence is that a strong definite can covary with an indefinite in a quantificational sentence. For example, in (43a), *the color* or *the shade* can covary with *a color*, even though the situations being quantified over, Irene picking out colors, presumably contain more than one color and thus would not satisfy the uniqueness requirement. This kind of covariance requires an anaphoric relationship with the quantifier, which a weak definite cannot achieve. As shown in (43b), a definite description in a Π-position (here, a change-of-color verb) in the same context is infelicitous. As above, this infelicity indicates that the definite in (43b) must be a weak definite and its uniqueness requirement is not being satisfied.

(43) Every time Irene picks out *a color* for the bathroom, … *Color verbs*

a. ✓Helen complains that **the color/shade** is too bright.

b. #Helen has to paint the room [**the color/shade**]$_{\Pi\text{-pos}}$.

(44)–(46) show that the same contrast holds for the other Π-positions as well.

(44) In every hotel room with *an ugly lamp*, … *Existential constructions*

a. ✓**the lamp** is on the dresser.

b. #there is [**the lamp**]$_{\Pi\text{-pos}}$ on the dresser.

[10] Not all of the data is given here, for reasons of space; see Poole (2017a: 204–212).

(45) Every time that my mom found *a new puppy name*, ... *Naming verbs*

a. ✓my dad vetoed **the name**.

b. #she nicknamed the family dog [**the name**]$_{\Pi\text{-pos}}$.

(46) In every store with *a rare type of plant*, ... *Predicate nominals*

a. ✓my aunt bought **the rare type**.

b. #my aunt bought a plant that was [**the rare type**]$_{\Pi\text{-pos}}$.

The third piece of evidence is that while the previous two sets of examples show that strong definites are *ungrammatical* in Π-positions, the inverse can likewise be observed: weak definites are *grammatical* in Π-positions. There are certain contexts that require a weak definite. One such context is bridging contexts where there is a part–whole relation between a definite description and the individuals and events in the preceding discourse, which is sufficient to satisfy the uniqueness requirement of the (weak) definite (Schwarz, 2009). (47) shows that part–whole bridging contexts allow definite descriptions in Π-positions (here, an existential construction).

(47) A: What did you like about *the fridge*? *Existential constructions*
B: Well, there was [**the spacious vegetable crisper**]$_{\Pi\text{-pos}}$.

We now have two generalizations about what is not allowed in Π-positions: the scope generalization (48a), which reduces to an incompatibility with type-*e* traces, the only type of trace available according to the Trace Interpretation Constraint, and the definite generalization (48b).

(48) a. **Scope generalization**
Movement that shifts scope cannot target Π-positions.

b. **Definite generalization**
Π-positions prohibit anaphoric (= strong) definite descriptions.

I propose that these two generalizations are one and the same because "traces" are in fact anaphoric definite descriptions, i.e. strong definites. The idea that traces are related to anaphoric definite descriptions is quite old; see Engdahl's (1980, 1986) early work on the semantics of questions. However, the idea is best known now as Trace Conversion, according to which downstairs copies of moved DPs are rendered interpretable at LF by converting them into definite descriptions with a variable (49) (Sauerland, 1998, 2004; Fox, 1999, 2002, 2003).

(49) a. *Standard traces*
[[**every cat**]$_1$ λx [a child adopted [t_x]$_1$]]

b. *Traces as anaphoric definites*
[[**every cat**]$_1$ λx [a child adopted [**the cat** x]$_1$]]

The technical apparatus performing this operation is a special LF rule that comprises two parts: insertion of a variable (50a) and determiner replacement (50b). The inserted variable is bound by the λ-abstraction introduced below the landing site of movement.

(50) ***Trace Conversion*** [Fox 1999, 2002, 2003]

a. *Variable Insertion*
(Det) Pred → (Det) [[Pred] [$\lambda y \,.\, y = g(n)$]] (where g is the assignment function)

b. *Determiner Replacement*
(Det) [[Pred] [$\lambda y \,.\, y = g(n)$]] → the [[Pred] [$\lambda y \,.\, y = g(n)$]]

The result of Trace Conversion is that traces are anaphoric definite descriptions, which allows the scope generalization to be subsumed under the definite generalization. Accordingly, the Trace Rigidity Principle can be recast as (51) to encompass this combined generalization.

(51) ***Trace Rigidity Principle*** *(revised)*
Traces cannot be type shifted.
⇝ Anaphoric definite descriptions cannot be type shifted.

3.3. Anaphoric definites and type shifting

Under the revised version of the Trace Rigidity Principle in (51), the question of why strong definites (including traces) are disallowed in Π-positions translates into the question of why strong definites cannot be type shifted into property denotations. One possibility that can be immediately set aside is linking the incompatibility directly to anaphoricity. Many of the infelicitous examples of definite descriptions in Π-positions are improved when *the* is replaced with *that*, as illustrated in (52) with a change-of-color verb.

(52) Blanche picked out *a shade of red* for the living room.

a. #And Dorothy painted the room [**the shade/color**]$_{\Pi\text{-pos}}$.

b. ✓And Dorothy painted the room [**that shade/color**]$_{\Pi\text{-pos}}$.

While a definite description *the NP* cannot establish an anaphoric relation in a Π-position (52a), *that NP* can do so (52b). It is not entirely clear where *that NP* fits within the strong/weak definite distinction, but (52) nevertheless shows that anaphoricity alone cannot be responsible for trace rigidity. Rather, it must be something specific about definite descriptions with the determiner *the*. In this section, I develop a syntactic analysis of the Trace Rigidity Principle, capitalizing on one aspect that has been argued to differ between strong and weak definites: their determiners.

Schwarz (2009) proposes that the strong/weak definite distinction results from having two separate definite determiners (53). In (53), I provide Schwarz's more standard denotations that return an expression of type-*e* and also denotations that return a generalized quantifier.[11] Both determiners are associated with uniqueness, represented by the ι-operator. However, the strong-definite determiner also has an *index* (53). The anaphoricity of the strong-definite determiner derives from the index, which can be bound or valued contextually in the same manner as a pronoun, thereby picking out a particular referent rather than relying on uniqueness alone.

[11] Schwarz's (2009) denotations are intensional and include a situation variable. As I have been assuming an extensional system, I have simplified the denotations.

(53) *Schwarz's (2009) weak and strong definite determiners*

a. $[\![\text{the}_{\text{WEAK}}]\!] = \lambda P_{\langle e,t\rangle}\, .\, \iota x[P(x)]$
$= \lambda P_{\langle e,t\rangle}\, \lambda Q_{\langle e,t\rangle}\, .\, Q(\iota x[P(x)])$

b. $[\![\text{the}_{\text{STRONG}}]\!] = \lambda y_e\, \lambda P_{\langle e,t\rangle}\, .\, \iota x[P(x) \wedge x = y]$
$= \underbrace{\lambda y_e}_{\text{index}}\, \lambda P_{\langle e,t\rangle}\, \lambda Q_{\langle e,t\rangle}\, .\, Q(\iota x[P(x) \wedge \underbrace{x = y}_{\text{index}}])$

In some languages, the weak-definite and strong-definite determiners have unique realizations or are individually subject to special morphological operations. For example, in German, the determiner in weak definites contracts with prepositions (subject to gender and case), but not in strong definites (54) (Schwarz, 2009).

(54) *German strong/weak definite distinction*
In jeder Bibliothek, die *ein Buch ber Topinambur* hat, sehe ich
in every library that a book about topinambur has look I
{**#im** / ✓**in dem**} **Buch** nach, ob man Topinambur grillen kann.
in.the$_{\text{WEAK}}$ in the$_{\text{STRONG}}$ book PRT whether one topinambur grill can
'In every library that has a book about topinambur, I check in the book whether one can grill topinambur.' [Schwarz 2009:33]

Crucially, Trace Conversion requires the *strong-definite determiner* in order to establish a connection between the upstairs moved DP and the downstairs definite description. Within the strong/weak definite distinction, Trace Conversion, however, operates somewhat differently. Rather than having two separate rules, one for inserting a variable and another for replacing the determiner, there is only a single rule that replaces the determiner in the downstairs DP with the strong-definite determiner, as this determiner contains the variable, i.e. the index. The index is what is then bound by the λ-abstraction created by movement, as schematized in (55).

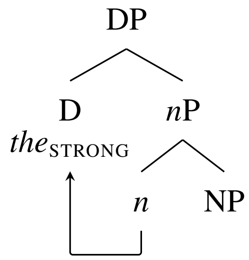
(55) *Trace Conversion with the strong-definite determiner*

$$[\ \text{DP}_1\ \lambda x \ldots [\ \ldots \overbrace{[_{\text{DP}}\ \text{the}_x^{\text{STRONG}}\ \text{NP}\ ]_1} \ldots]\,]$$

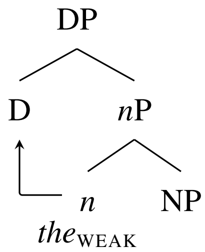
The syntactic analysis of trace rigidity breaks down into two pieces. First, I propose that the weak-definite and strong-definite determiners occupy distinct syntactic positions in the functional structure of a nominal. The strong-definite determiner occupies D^0 (56), and the weak-definite determiner occupies some lower functional head, which I label n^0 for convenience (57).[12][13] In English, n^0 raises to D^0 to form a complex head, which spells out as *the* regardless of whether n^0 or D^0 is the head that contains the determiner (58).

[12]The determiner *that* might also be in n^0, explaining why *that NP* can occur in Π-positions in anaphoric contexts.
[13]The structures in (56) and (57) might fit into a more articulated nominal structure like that of Zamparelli (2000). For similar proposals that the strong/weak definite distinction is syntactically encoded, see Patel-Grosz and Grosz (2017) and Cheng et al. (2017).

(56) *Strong definite*



(57) *Weak definite*



(58) *English Vocabulary Items*

a. $[\mathrm{D} + \sqrt{\text{THE}}_{\text{WEAK}}] \leftrightarrow$ /the/

b. $[\sqrt{\text{THE}}_{\text{STRONG}} + n] \leftrightarrow$ /the/

The denotations of the definite determiners in (53) do not permit an nP headed by *the*$_{\text{WEAK}}$ to serve as the semantic argument of *the*$_{\text{STRONG}}$. Therefore, a given DP can only contain one of the definite determiners.

The second piece of the proposal is that nominal type shifters also occupy D^0, competing with the strong-definite determiner for the same syntactic slot. As such, a DP can either include the strong-definite determiner or a nominal type shifter, but never both. This complementary distribution has two crucial consequences. First, a definite description that has been type shifted is necessarily a weak definite because the only definite determiner that can occur alongside a type shifter is *the*$_{\text{WEAK}}$ (59).[14] This accounts for the observation from section 3.2 that definite descriptions in Π-positions are infelicitous in contexts that only license strong definites and hence are necessarily weak definites.

(59) *Type-shifted definites are always weak definites*

a. $[_{\text{DP}}$ (SHIFTER) $[_{n\text{P}}$ the$_{\text{WEAK}}$ NP]] $\rightsquigarrow$ Weak definite; Type shifting possible

b. $[_{\text{DP}}$ the$_{\text{STRONG}}$ $[_{n\text{P}}$ n^0 NP]] $\rightsquigarrow$ Strong definite; Type shifting impossible

Second, Trace Conversion and type shifting cannot apply to one and the same DP. In a Π-position, it is a lose-lose situation. On one hand, if the converted trace contains a type shifter to achieve the required property denotation, the only definite determiner available is *the*$_{\text{WEAK}}$, which has no variable for the λ-abstraction to bind (60). The result is vacuous quantification and thus ungrammaticality. On the other hand, if the converted trace contains the strong-definite determiner, there is a variable for the λ-abstraction to bind, but the DP does not denote a property and runs afoul of the property requirement of Π-positions (61). Consequently, because either option results in ungrammaticality, the only option left for movement targeting a Π-position is to reconstruct.

(60) $*[\ \mathrm{DP}_1\ \lambda x \ldots [\ \overbrace{[_{\text{DP}}\ \mathcal{BE}\ [_{n\text{P}}\ \text{the}_{\text{WEAK}}\ \text{NP}\ ]\ ]}_{1}\ ]_{\Pi\text{-pos}}\ ]$ ✓ Property ✗ Quantification

?? *no variable to bind*

---

[14]To use $\mathcal{BE}$ for weak definites requires that *the*$_{\text{WEAK}}$ return a generalized quantifier or that D^0 can be $\mathcal{BE} \circ$ LIFT. (53a) provided a denotation for *the*$_{\text{WEAK}}$ that returns a generalized quantifier.

(61) $*[\ \mathrm{DP}_1\ \lambda x \ldots [\ [_{\mathrm{DP}}\ \mathrm{the}_x^{\mathrm{STRONG}}\ [_{n\mathrm{P}}\ n^0\ \mathrm{NP}\ ]]_1\ ]_{\Pi\text{-pos}}\ ]$ ✗ Property ✓ Quantification

This analysis manages to derive both the definite generalization and the scope generalization from one stipulation, namely the complementary distribution of the strong-definite determiner and nominal type shifters.[15] One might wonder whether there is any independent reason to believe that the strong-definite determiner and nominal type shifters should be in complementary distribution. An idea that floats around in the literature is that English *the* is an overt type shifter, e.g. a overt ι-operator or an overt encoding of the "natural" type shifter $\mathcal{THE}$ (e.g. Partee, 1986; Chierchia, 1998). If this were to hold of the strong-definite determiner, then it would compete with the property-yielding type shifters for the D^0 slot because it is itself a type shifter.

4. Conclusion

In this paper, I have presented a case study on what constitutes a possible trace, arguing for the two following constraints on interpreting movement:

(62) ***Trace Interpretation Constraint***
$*[\ \mathrm{DP}_1\ \lambda f_\sigma \ldots [\ \ldots [\ f_\sigma\ ]_1 \ldots\ ]\ ]$, where σ is not an individual type

(63) ***Trace Rigidity Principle***
Traces cannot be type shifted.

The paper began with the problem of the standard recursive definition of semantic types overgenerating. The Trace Interpretation Constraint and the Trace Rigidity Principle demonstrate that movement is one domain in which the grammar only makes use of a small set of the possible types, namely the individual types. I would like to suggest that this is representative of the role that syntactic operations—and perhaps the properties of those operations, like economy—play in restricting the actively used semantic types. That is, while semantic types might be in principle unconstrained in the semantics, they are actively constrained by different modules of grammar.

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[15]Partee (1986) is agnostic about where type shifters live in the grammar. According to this analysis, at least some type shifters exist in the narrow syntax because they are in complementary distribution with the strong-definite determiner. We might take this as evidence that type shifters exist only in the syntax as determiners and that type shifting is not a last-resort mechanism to repair type mismatches.

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Embedding non-restrictive relative clauses

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Abstract. Schlenker (2010) recently provided data from English and French suggesting that, contrary to standard assumptions (McCawley, 1982; Potts, 2005; Arnold, 2007; AnderBois et al., 2011), non-restrictive relative clauses (NRCs) can take narrow scope under operators of the sentence within which they are embedded. This paper presents three experiments in German confirming this claim. The results show that embedded readings are available with NRCs in German and give first insights into the puzzle under which conditions these embedded readings do or do not show up.

Keywords: relative clauses, appositives, projection, rhetorical relations.

1. Introduction

1.1. Standard assumptions

Standardly, it is assumed that non-restrictive-relative clauses (NRCs), despite their embedded position, do not contribute to the truth-conditions of the sentences they are embedded within (their host-clause) but are interpreted similar to independent matrix clauses involving a discourse pronoun (Sells, 1985; Potts, 2005; Arnold, 2007; Nouwen, 2007; AnderBois et al., 2011). Indeed, NRCs pattern quite consistently with their discourse anaphoric matrix clause paraphrases. For example, (1a) roughly can be paraphrased by (1b), but not by (1c).

(1) (Adapted from Schlenker (2013: 7))
   a. If Peter called the dean$_1$, **who$_1$ hates me**, I would be in deep trouble.
   b. $\approx$ If Peter called the dean, I would be in deep trouble. **He hates me.**
   c. $\not\approx$ If Peter called the dean **and he hated me**, I will be in deep trouble.

This sticky wide-scope behavior of NRCs has long been taken as evidence for the assumption that NRCs attach high up in the syntactic tree (McCawley, 1982) or even represent syntactic orphans that are only loosely connected to their host-clause at surface structure (Safir, 1986; Fabb, 1990; Espinal, 1991). Alternatively, it has been assumed that NRCs are attached to their anchor at DP-level (e.g. to *the dean* in (1a)), but contribute projective content (content which is interpreted independently of the main-clause assertion), either because it is semantically interpreted at a different dimension (e.g. as non-at-issue content, Potts (2005)) or because it does not relate to the current question under discussion of the discourse (Simons et al., 2011).[1]

[1]Most of the projection approaches are motivated by the observation that NRCs take widest scope but differ from matrix clause information in their information status (Potts, 2005; AnderBois et al., 2011; Simons et al., 2011). For example, NRCs, unlike assertive (at-issue) content, often cannot be directly denied and in many cases only make poor answers to a direct question.

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1.2. Recent challenges

Schlenker (2010, 2013), however, provided examples from English and French, in which the NRCs take narrow scope with respect to operators of the host-clause and in this case contribute conjunctively to the truth-conditions of the complex sentence.

(2) (Adapted from Schlenker (2013: 7))
  a. If Peter called the dean, who then called the chair, I would be in deep trouble.
  b. $\neq>$ The dean called the chair. *(wide scope)*
  c. $\neq>$ If Peter called the dean, the dean would call the chair. *(modally subordinated)*
  d. => If Peter called the dean and the dean called the chair, I would be in trouble. *(narrow scope)*

The NRC in (2a), for example, does not tell us that the dean called the chair (*global reading*), it does not even have the reading that in any case in which Peter called the dean, the dean would call the chair (which would be equivalent to a potential *modal subordination reading*), it really seems to have the reading that the speaker only would be in trouble, if Peter called the dean and the dean (happened to) call the chair (*local reading*), which is comparable to the interpretation of a local conjunction. As Schlenker (2010, 2013) notes, the sentence is ungrammatical if the NRC is replaced by a parenthetical (3a) or a postponed matrix clause (3b), since in these cases the past tense is no longer bound by the conditional. This provides quite a strong argument for the assumption that the NRC in (2a) is indeed interpreted locally.

(3) (Adapted from Schlenker (2013: 7))
  a. *If Peter called the Dean (he then called the Chair), I would be in deep trouble.
  b. If Peter called the Dean, I would be in deep trouble. *He then called the chair.

Empirical evidence for these embedded readings, however, is rather rare. Schlenker (2013) only reports judgements of very few English and French speakers. Data from other languages is missing completely. Moreover, it still is quite a puzzle under which conditions embedded readings are acceptable, or put otherwise, what makes the difference between (1a) and (2a). Note that (1a) is getting ungrammatical as soon as we turn the NRC's predicate into past-tense (Schlenker, 2013: 7).

(4) *If Peter called the Dean, who hated me, I would be in trouble.

With the experiments reported in this paper, we will provide a first empirical evidence for the existence of such embedded readings in German and try to test some factors that might affect the embeddability of NRCs in German.

1.3. Potential factors affecting embeddability

Schlenker (2013), himself, makes two crucial observations concerning the embeddability of NRCs. First, he observes that the embeddability is dependent on the *position* of the NRC in its host-clause. Embedded readings are best available if the NRC is located at the right edge of the host-clause (in this case at the right edge of the antecedent of the conditional).

(5) Schlenker (2013: 46)
  a. If tomorrow John sent a 2 carat diamond to Ann, *who got all excited as a result*, he would have a better chance of marrying her.
  b. (#) If tomorrow Ann, *who got all excited as a result*, received a 2 carat diamond, he would have a better chance of marrying her.

Moreover, he notes that, even if we keep the NRC at the right edge of its host-clause, embedded readings are not necessarily available. Note that the ungrammatical NRC in (4) (repeated here as (6b)) is located at the same position as the grammatical one in (2a) (repeated here as (6a)).

(6) a. If Peter called the Dean, *who then called the Chair*, I would be in deep trouble. (NARRATION)
  b. *If Peter called the Dean, *who hated me*, I would be in deep trouble. (EXPLANATION)

But what makes the difference between (6a) and (6b)? At first sight, the two NRCs differ at least in (i) the *predicate-type* of the NRC (state/event) and (ii) the presence/absence of the *anaphoric expression* ”then”. Moreover, Schlenker (2013) observes that the two sentences additionally differ with respect to the *rhetorical relation* (Asher and Vieu, 2005) the NRCs establish with their host-clauses. While in (6a) the event described in the NRC follows in time the event described in the antecedent of the if-clause and the NRC, hence, establishes a kind of *Narration* relation with its host-clause, the NRC in (6b) seems to provide sort of an *Explanation* for the assumption asserted in the main clause that the speaker would be in trouble if Peter called the dean. According to Asher and Vieu (2005), *Narration* is a coordinating rhetorical relation while *Explanation* is subordinating. A possible hypothesis might be that the contrast reported in (6) is due to a contrast between NRCs expressing two different types of rhetorical relations (coordinating vs. subordinating). These observations are particularly interesting for German, for which Holler (2005) distinguishes between two types of non-restrictive relative clauses, *appositive* and *continuative* relative clauses, which differ in the position and the rhetorical relation they hold with respect to their host-clause. While appositives can be found in sentence internal and sentence final position and typically express a subordinating rhetorical relation (e.g. EXPLANATION or BACKGROUND), continuatives are characterized by a sentence-final position, establish a coordinating rhetorical relation with their matrix clause (such as NARRATION or RESULT) and typically describe an event which follows in time the event described in the matrix clause. Often continuatives come with an explicit ”then” or ”as a result” marking the coordinating link to the sentence to which they are attached. Since continuative NRCs typically relate two events, Holler (2005) assumes that state-predicates are degraded in continuative NRCs, as well as in their matrix clauses. Another immediate hypothesis that emerges from Schlenker’s data might be that only continuatives (Holler, 2005) can be embedded.[2]

[2]Note, however, that the analysis suggested in Holler (2005) does not make correct predictions about the embeddability of NRCs. Based on differences in position and prosody between the two types of NRCs, Holler (2005)

With three experiments in German, we tried to address the following questions: **(Q1) Are embedded readings available for (host-final) NRCs in German? (Q2) And if so, is the embeddability dependent on (...)** **(a)** the presence or absence of **anaphoric** elements (then) relating NRC and host-clause, **(b)** the **predicate-type** of the NRC, **(c)** the type of **rhetorical relation** (coordinating vs. subordinating) holding between the NRC and host-clause, or **(d)** on the **type of the NRC** (continuative vs. appositive in the sense of Holler 2005)?

2. Experiments

To test the availability of embedded readings, we set up three web-questionnaires (SoSciSurvey) in which we presented the test-sentences together with a context-story. The participants were told to imagine a scenario in which pupils were asked to summarize the information given by a story without leaving out or adding crucial information. The participants had to judge whether or not certain sentences of the pupils (the test-sentences) were appropriate as part of a summary of the respective context-stories. Each story was constructed such that the wide-scope reading (and a potential modal subordination reading) of the target sentence was explicitly ruled out. Thus, if the participants only got a wide-scope reading, they were expected to judge the sentence as inappropriate as part of a summary of the context story.

2.1. Experiment 1

In a first experiment, with 62 German native speakers, we tested the availability of embedded readings depending on the CLAUSE-TYPE of the embedded construction (NRCs, conjunctions, V2-parenthetical) and the PREDICATE TYPE (event vs. state).

2.1.1. Design

The survey consisted of 18 test-items in six conditions in which we compared the interpretations of NRCs to those of the corresponding conjunctions and verb-second-parentheticals. In addition to the CLAUSE-TYPE, we manipulated the PREDICATE-type of the examples (event, state). The items were tested interspersed with 24 filler items in a pseudo-randomized Latin square design such that every participant judged every condition three times, but each item only in one condition. (7) gives an example for a test-item in all conditions.

suggests that appositives are attached at DP-level, while continuatives are attached much higher, at CP-level. According to this analysis, one would expect that, if at all, only appositives (and not continuatives) could take narrow scope. The data reported in Schlenker (2013), by contrast, suggest just the opposite pattern.

(7) **Geschichte (Story):**
Gerd wurde von einer Schlange gebissen und hat nur wenig Chancen zu überleben. Denn das Gift wirkt schnell tödlich. Wenn überhaupt, kann er nur noch Dr. Meier erreichen, der ganz in der Nähe wohnt. Ob dieser jedoch über das äusserst seltene Gegengift verfügt, ist mehr als ungewiss. Nur falls Dr. Meier ihm noch rechtzeitig das richtige Gegengift verabreicht, kann er gerettet werden.
(Gerd got bitten by a snake. There is only little chance that he will survive. The venom is quite deadly. His only chance is to reach Dr. Meier in time, who lives close by. But it's quite unlikely that Dr. Meier has got the antidote Gerd needs. Only if Dr Meier gives him the antidote in time, can Gerd be saved.

Aus der Zusammenfassung des Schülers *(Part of the pupil's summary):*
Wenn Gerd rechtzeitig Dr. Meier erreicht *(If Gerd reaches Dr. Meier in time)*

a. (NRC/event)
, der ihm das passende Gegengift verabreicht,
, who gives him the right antidote,

b. (and/event)
und der ihm das passende Gegengift verabreicht,
and he gives him the right antidote

c. (parenthetical/event)
(der verabreicht ihm das passende Gegengift),
(he gives him the right antidote)

d. (NRC/state)
, der über das passende Gegengift verfügt,
, who has got the right antidote available,

e. (and/state)
und der über das passende Gegengift verfügt,
and he has got the right antidote available,

f. (parenthetical/state)
(der verfügt über das passende Gegengift),
(he has got the right antidote available),

kann Gert gerettet werden.
Gert can be saved.

According to the context story in (7), it is unclear, whether Gerd can be saved even if he reaches Dr. Meier, since we don't know whether Dr. Meier has got the right antidote available. Thus, if the participants only got a wide-scope or modally subordinated reading for the NRC in (7a) (as expected for (7c)), according to which Gerd is saved as soon as he reaches Dr. Meier (since in this case he will inject him the antidote), they were expected to reject the target as part of a summary of the story. Only if the participants interpreted the NRC as contributing to the antecedent of the *if*-clause (such as the conjunction in (7b)), were they expected to accept the target as a summary of the context-story.

In all items the NRCs were presented in clause-final position of the antecedent of the conditional. Unlike in English, relative clauses in German are always obligatorily marked by comma. To ensure that the relative clause is interpreted non-restrictively, the relatives throughout are attached to proper name heads (e.g. ”Dr. Meier”), which should rule out a restrictive interpretation. Additional discourse particles or anaphors in the NRC were deliberately omitted. Parentheticals were graphically marked by setting them off with brackets. Note that in German, relative pronouns and discourse pronouns are homophonous. NRCs and parentheticals, however, are clearly disambiguated by word order. Whereas parenthetical constructions are obligatorily marked by verb-second word-order, NRCs, like other embedded clauses in German, are obligatorily verb-final.[3]

2.1.2. Predictions:

If NRCs invariantly take widest scope, all NRCs should be rejected since the context stories were designed to rule out wide scope interpretations. If NRCs, however, are flexible in scope (Schlenker, 2013), one might assume that at least in some conditions NRCs are judged as acceptable. Under the hypothesis that embedded readings of NRCs are only available with coordinating rhetorical relations (Schlenker 2013) or continuative NRCs in the sense of Holler (2005), we should expect to find a contrast between the conditions with state and event predicate. The test-sentences with conjunctions and parentheticals were used as positive and negative controls. Parentheticals, according to standard assumptions, only have wide scope interpretation and hence should be rejected independently of the predicate-type. Conjunctions, by contrast, only should have embedded readings and be accepted independently of the predicate-type.

2.1.3. Results:

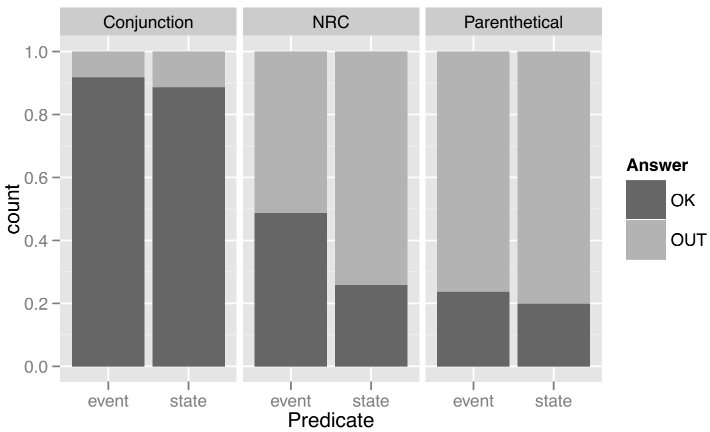


Figure 1: Results Experiment 1

The results of Experiment 1 indicate that NRCs with an event predicate can indeed be interpreted as truly embedded. Although, as expected, a small subset of participants (6) re-

[3]Filler items consisted equally of a context story and a sentence summarizing it either correctly or incorrectly, but did not contain relative clauses.

jected all embedded readings of NRCs, NRCs with event predicates still got overall acceptance rates about 49 percent, lower than the corresponding and-conjunctions (0.92), but significantly higher than the corresponding matrix-clause-parenthetical (0.21). NRCs with state predicate, by contrast, rated nearly as low (0.25) as the corresponding matrix-clause parenthetical. Fitting a mixed model regression with CLAUSE-type and PREDICATE-type as fixed effects and random effects for items and participants with the corresponding slopes,[4] we found a highly significant effect of CLAUSE type ($p < 0.001$) as well as a significant effect of PREDICATE type ($p < 0.001$). Event-NRCs got accepted in about 49 percent of all cases, less often than the conjunctions (0.92), but significantly more often than the parenthetical (0.21). State-NRCs rated nearly as low (0.25) as the parentheticals. The interaction of CLAUSE-type and PREDICATE-type didn't reach significance in the overall data. We therefore fitted separate models testing the effect of PREDICATE-Type for each CLAUSE-type separately. Only for the subset of trials with NRC CLAUSE-type the effect of PREDICATE type turned out to be significant ($p < 0.01$). No significant effect of PREDICATE-type could be found in the subsets with conjunctions and parentheticals. Whereas, as expected, the conjunctions, independently of the predicate type rated consistently high, the corresponding matrix clause parenthetical rated rather low with both state or event predicate. A highly significant contrast ($p < 0.001$) between NRCs with event predicate and the corresponding matrix clause parenthetical indicates that the observed embeddability is not only a discourse effect or a last resort repair strategy but the result of a structural embedding of the NRCs.

2.1.4. Discussion:

The results confirm the observation made by Schlenker (2009/2013) that NRCs, contrary to standard assumptions, can indeed get embedded interpretations, at least if they are of event predicate type. NRCs rated significantly higher than the corresponding parentheticals. This might indicate that there is a true structural difference between NRCs and parentheticals with respect to their embeddability. The fact that the NRCs got lower acceptance rates than the corresponding conjunctions can be accounted for if we consider that the former, in contrast to the latter, are ambiguous between an embedded and a wide scope (or modal subordination) reading.[5] Unlike with parentheticals and conjunctions, the availability of embedded readings improved significantly if the NRC was of event-predicate type. We will discuss several possible explanations for this effect in the introduction part to Experiment 3. Unexpected was the relatively high acceptance rate for V2-parentheticals. According to standard assumptions, parentheticals always take widest scope and should not contribute conjunctively to the antecedent of a conditional. To rule out that this relatively high acceptance rate marks the noise level in our experiment, we decided to run a follow-up study in which we compared the interpretation of NRCs with those of postponed matrix clauses. Postponed matrix clauses definitely should resist an embedded interpretation.

[4]Generalized linear mixed model fit by the Laplace approximation, Formula:
Answer $\sim$ Clause * Predicate + (1 + Clause + Predicate|Person) + (1 + Clause+ Predicate |Item).

[5]Indeed a good number of participants noted in their comments that both readings (wide and narrow scope) were available for them, but that they decided to reject the target-sentence because the pupil could have taken more care to make explicit which of the two readings she had intended in her summary.

2.2. Experiment 2

For Experiment 2, we took a subset of 12 out of the 18 items of Experiment 1 and this time compared the interpretation of the NRCs to the interpretation of the comparable postponed matrix clauses (CLAUSE-TYPE), again each with event and state PREDICATE-TYPE.

2.2.1. Design

As before, the test-items were presented randomized over a Latin square design such that each participant judged each item only in one condition but each item was tested all conditions. (8) gives an example for a test-item with event-predicate. Task and context story were comparable to those used for Experiment 1.

(8) a. Wenn Gerd rechtzeitig Dr. Meier erreicht, **der ihm das passende Gegengift verabreicht**, kann er gerettet werden. (If Gerd reaches Dr. Meier in time, who gives him the right antidote, he can be saved.) **(NRC/event)**

b. Wenn Gerd rechtzeitig Dr. Meier erreicht, kann er gerettet werden. **Der verabreicht ihm das passende Gegengift**. (If Gerd reaches Dr. Meier in time, he can be saved. He gives him the right antidote.) **(Matrix/event)**

2.2.2. Results

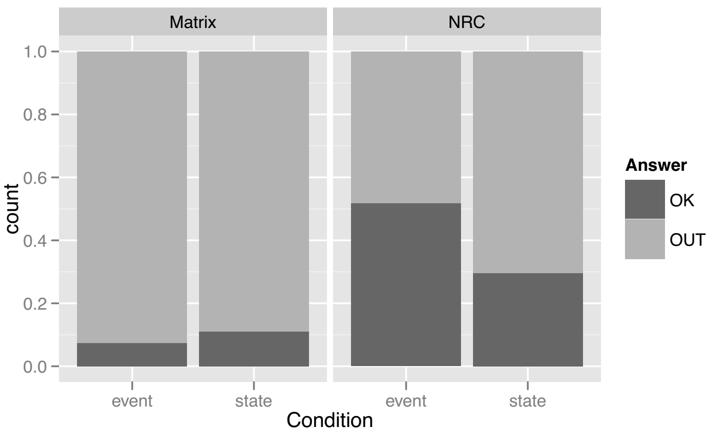


Figure 2: Results Experiment 2

As expected, the postponed matrix clauses got only very low acceptance rates (0.09 overall), ruling out that the acceptability rates for NRCs and parentheticals in the first experiment were only due to the relatively high complexity of the experimental taks. Just as in the first experiment, the NRCs reached an acceptance rate of 41 percent overall. Again the NRCs with event predict rated much higher (0.51) than the NRCs with state predicate (0.29). A mixed model regression with the interaction of CLAUSE-type and PREDICATE-type as fixed effects and the corresponding random effects for items and participants confirms these observations.[6] Overall, we found a significant effect of CLAUSE-type ($p < 0.001$) as well as a significant interaction of CLAUSE-type and PREDICATE-type ($p < 0.01$), such that event predicates improved the ratings of NRCs while the predicate type had no effect on the ratings of the corresponding matrix clauses.

2.2.3. Discussion

The direct comparison with postponed matrix clauses confirmed the embeddability of NRCs. As in the first experiment, embedded readings were accepted for a good proportion of NRC trials. In contrast to the parentheticals in the first experiment, the acceptance rate of postponed matrix clauses dropped almost to zero, confirming that the acceptance rates for NRCs are indeed a reliable indicator for the availability of embedded readings. Just as reported for the first experiment, NRCs with event predicate were much more likely to be interpreted with narrow scope than those with state predicate.

2.3. Experiment 3

The results of Experiments 1 and 2 indicate that the embeddability of NRCs improves significantly if the NRC is of event predicate type. To make a first step in explaining this effect of PREDICATE-type, we decided to set up a third questionnaire designed to tease apart the following potential explanations:

(i) Rhetorical Relations: Schlenker (2013) assumes that the embeddability of an NRC might be dependent on the rhetorical relation (Asher and Vieu, 2005) it establishes with its host-clause. A first guess, hence, would be that by manipulating the predicate type, we manipulated the type of the rhetorical relation holding between the NRC and its host-clause. The test-items of Experiments 1 and 2 were constructed such that all explicit indicators (such as discourse particles or additional anaphoric material) for the rhetorical relation holding between NRC and the clause embedding it were deliberately omitted. Nevertheless, the manipulation of the predicate-type certainly affected the rhetorical relation holding between the NRC and the host-clause. The most salient rhetorical relations for our event-conditions were *coordinating* relations such as NARRATION or RESULT, while in the state-conditions the NRCs most plausibly were related by *subordinating* relations such as EXPLANATION or BACKGROUND. A first hypothesis, hence, could be that embedded readings are only available with coordinating relations.

(i) Structural Ambiguity:
A closely related but much stronger hypothesis would be that the observed contrasts are due to a structural difference between appositive and continuative relative clauses in the sense of Holler (2005).

[6]Generalized linear mixed model fit by the Laplace approximation, Formula: Answer $\sim$ Type * Condition + (1 + Type * Condition | Person) + (1 + Type * Condition | Item).

(ii) Causal Relation:
NARRATION and RESULT are not only coordinating but also causal relations, in which the occurrence of the second event (the event described in the NRC) is dependent on the occurrence of the first one (the event in the antecedent of the conditional). In our example, Dr. Meier only can give Gert the antidote if Gert reaches him. But whether or not Dr. Meier has got the antidote available, is probably quite independent of Gert's reaching him. This might favor an embedded interpretation in the event-condition, although the NRC is not structurally embedded.

To tease apart the options (i) and (ii) more neatly and rule out the worry in (iii), we set up a third experiment in which we focused exclusively on NRCs and explicitly disambiguated the rhetorical relations holding between NRC and the clause embedding it.

2.3.1. Design

In **Experiment 3**, with 41 participants, and a subset of 12 items out of the 18 of Experiment 1, we exclusively tested NRCs, again with event and state PREDICATE-type and manipulated the RHETORICAL relations holding between the NRC and its embedding clause by introducing explicit markers. We either introduced an explicit ”dann” (then) , which should favor RESULT or NARRATION as rhetorical relation, or an explicit ”wider Erwarten” (against expectations), which should establish a CONTRAST-relation holding between NRC and the clause embedding it. Note that CONTRAST just as NARRATION and RESULT counts as a coordinating relation (Asher and Vieu, 2005). Unlike in NARRATION or RESULT, however, CONTRAST is not causal. Again, the four conditions were tested in a Latin square design, such that each of the 41 participants judged each condition three times but each item only in one condition.

(9) a. (event)
Wenn Gerd Dr. Meier erreicht, der ihm **(dann/wider Erwarten)** das Gegengift verabreicht, kann Gerd gerettet werden.
(If Gerd Dr. Meier reaches, who him (then/counter expectations) the antidote gives, can Gerd saved be.)

b. (state)
Wenn Gerd Dr. Meier erreicht, der **(dann/wider Erwarten)** über das Gegengift verfg̈ut, kann Gerd gerettet werden. (If Gerd Dr. Meier reaches, who (then/counter expectations) the antidote has available, can Gerd saved be.)

2.3.2. Predictions:

If coordinating rhetorical relations are responsible for the embeddability of certain NRCs, all NRCs should be acceptable, since in all conditions a coordinating relation is forced (by inserting ”dann”/”then” and ”wider Erwarten”/”counter expectations”). If the embeddability is limited to continuative relative clauses, only NRCs with event predicate are expected to be accepted (both with ”dann” and ”wider Erwarten”), whereas conditions with state predicates would be expected to be degraded (independently of the inserted particle), since according to Holler (2005) state-predicates block continuative readings. If causality plays a role, only NRCs with event-predicate and ”dann” are expected to be acceptable, while ”wider Erwarten” is expected to block embedding.

2.3.3. Results:

In Experiment 3, the results improved overall for all test-sentences independently of the predicate-type.[7] The condition with event-predicate and ”wider-Ewarten” was accepted in 82 percent of all trials, the condition with state-predicate and ”dann” still reached 62 percent of acceptance judgements. In between these two conditions, the results display a clear down step pattern such that NRCs with ”wider Erwarten” rated better than those with ”dann” and within each rhetorical relation, just as in the previous experiments, sentences with event predicate rated better than those with state predicate.

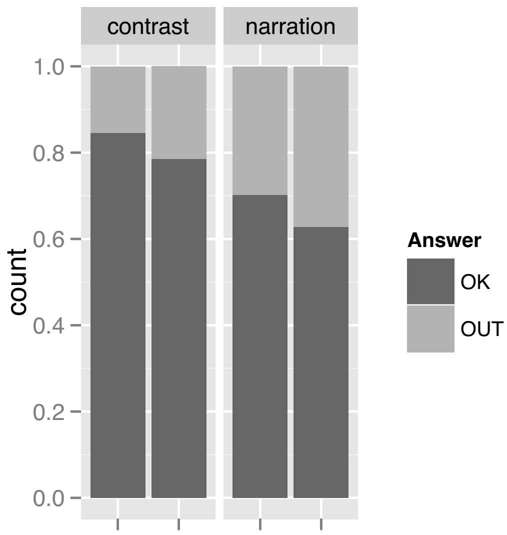


Figure 3: Results Experiment 3

The statistical model confirmed these observations. Fitting a mixed model regression with the interaction of sentence-type and predicate-type as fixed effects and the corresponding random effects for items and participants, we found a significant effect of PREDICATE-type ($p<0.05$) as well as a significant effect of RHETORICAL RELATION ($p<0.05$), but no interaction between these two factors.[8]

[7] Compared to the acceptance rates reached in the first two experiments for test-sentences with NRC sentence-type)

[8] Generalized linear mixed model fit by the Laplace approximation, Formula: Answer $\sim$ Relation * Predicate + (1 + Relation + Predicate | Person) + (1 + Relation + Predicate | Item).

2.3.4. Discussion

The data confirm impressively that sentence-final NRCs in German can be interpreted as embedded. Moreover, they suggest that forcing a coordinating rhetorical relation seems to improve the embeddability.[9] This holds even if the NRC is of state predicate type and even if the relation established between NRC and host-clause is not causal. We therefore assume that the embeddability is neither restricted to continuatives in the sense of Holler (2005) nor to NRCs that are causally dependent on the content of the antecedent.

3. Analysis

The findings confirm that NRCs are flexible in their scope and under certain conditions can contribute locally to the truth conditions of their host-clause (Schlenker, 2010) . The availability of embedded readings, however, seems to be dependent both, on the *position* of the NRC Schlenker (2013) and on the *rhetorical* relation holding between the NRC and its host-clause (this paper). This challenges most of the existing approaches, which presume or predict that NRCs invariantly take widest scope (McCawley, 1982; Potts, 2005; Arnold, 2007; AnderBois et al., 2011). In the following, we will sketch very briefly how far we can go with very basic and traditional assumptions about NRCs to account for the observed scope pattern of NRCs. We will start from the following basic assumptions: (i) NRCs are attached low at *DP-level* (von Stechow, 1979). (ii) *In situ* (host-internal) NRCs are interpreted with widest scope. (iii) Extraposed (host-final) NRCs are flexible in scope. (iv) In the *extraposed* case, the type of rhetorical relation established between NRC and host-clause affects which sentential-node is considered as a suitable attachment point.

3.1. NRCs in situ

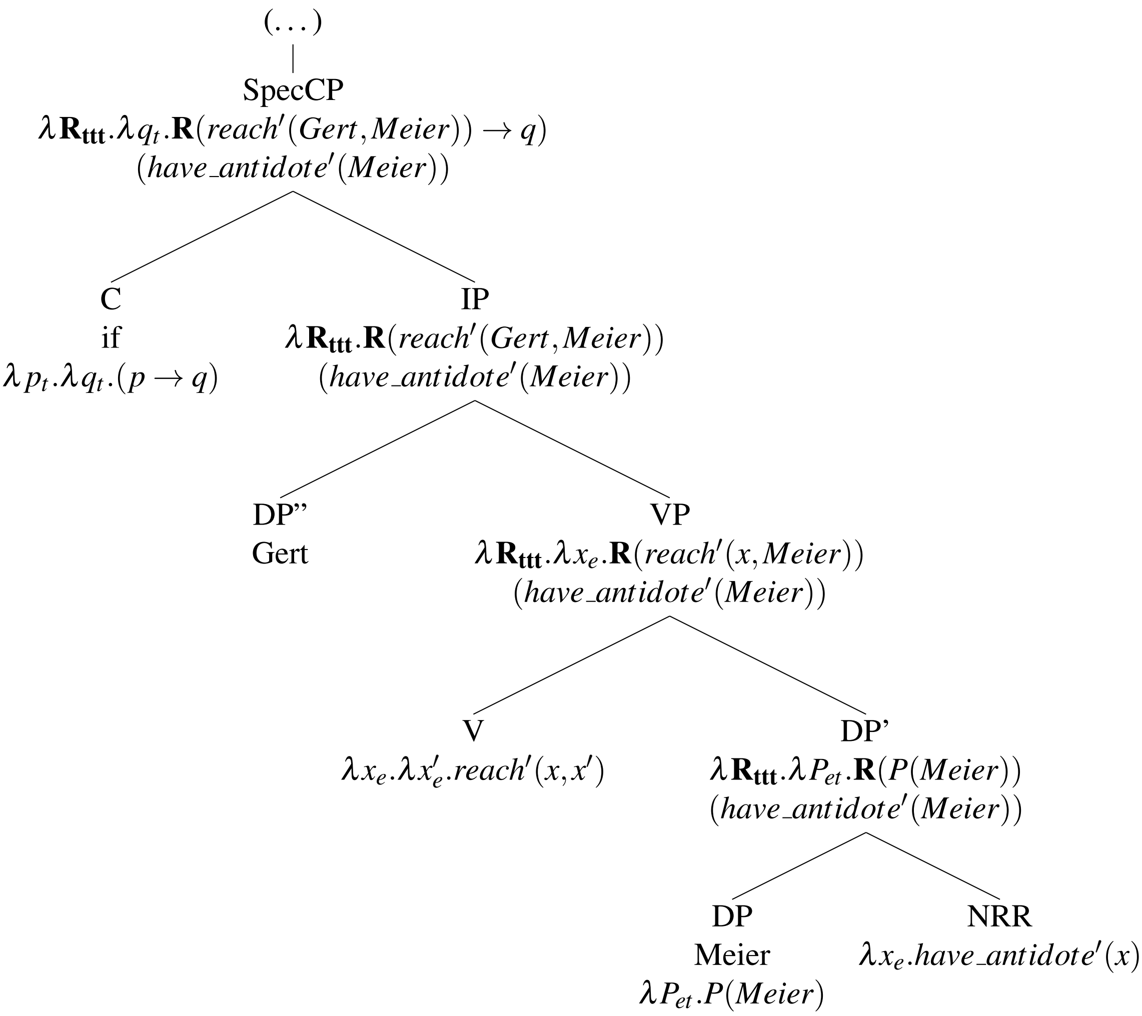
Let us assume that NRCs, just like their restrictive counterparts, are of type $< e,t >$ and attached at DP-level to their head DP (von Stechow, 1979; Heim and Kratzer, 1998). To prevent the NRC from ending up invariantly in the scope of a sentential operator, such as a conditional, we assume that the NRC is attached to the DP by a tentative relation which, at this point in the derivation, is temporarily abstracted from (λR_{ttt}), see figure 4 and rule (10).

(10) **NRC Attachment Rule (in situ):** If C is a branching node consisting of two sister nodes A and B, A with the translation α of type ((et)t) and B with the translation β of type (et), C translates as: $\lambda R.\lambda P.R(\alpha(P))(\alpha(\beta))$

[9] A further reason for the increase in acceptability might be that in Experiment 3, in contrast to the two previous experiments, we only tested NRCs and the design did not include a direct comparison with competing constructions such as and-conjunction or matrix-clause paraphrases.

Since this tentative relation cannot be resolved, it is projected, by standard compositional means (functional composition) up the tree. Notably, it is projected across the IP-node of the conditional antecedent.[10]

Figure 4: **NRC in situ**



At CP-level, the tentative relation still is unresolved and has to be instantiated pragmatically by establishing a suitable rhetorical relation.

(11) Denotation at CP-level:
$\lambda R.R((reach'(Gert, Meier)) \rightarrow (saved'(Gert)))$
$(have\_antidote'(Meier))$

According to this analysis, in situ NRCs always project to matrix level. Note that this analysis makes no predictions about the discourse status of the NRC. Whether or not the NRC is at-

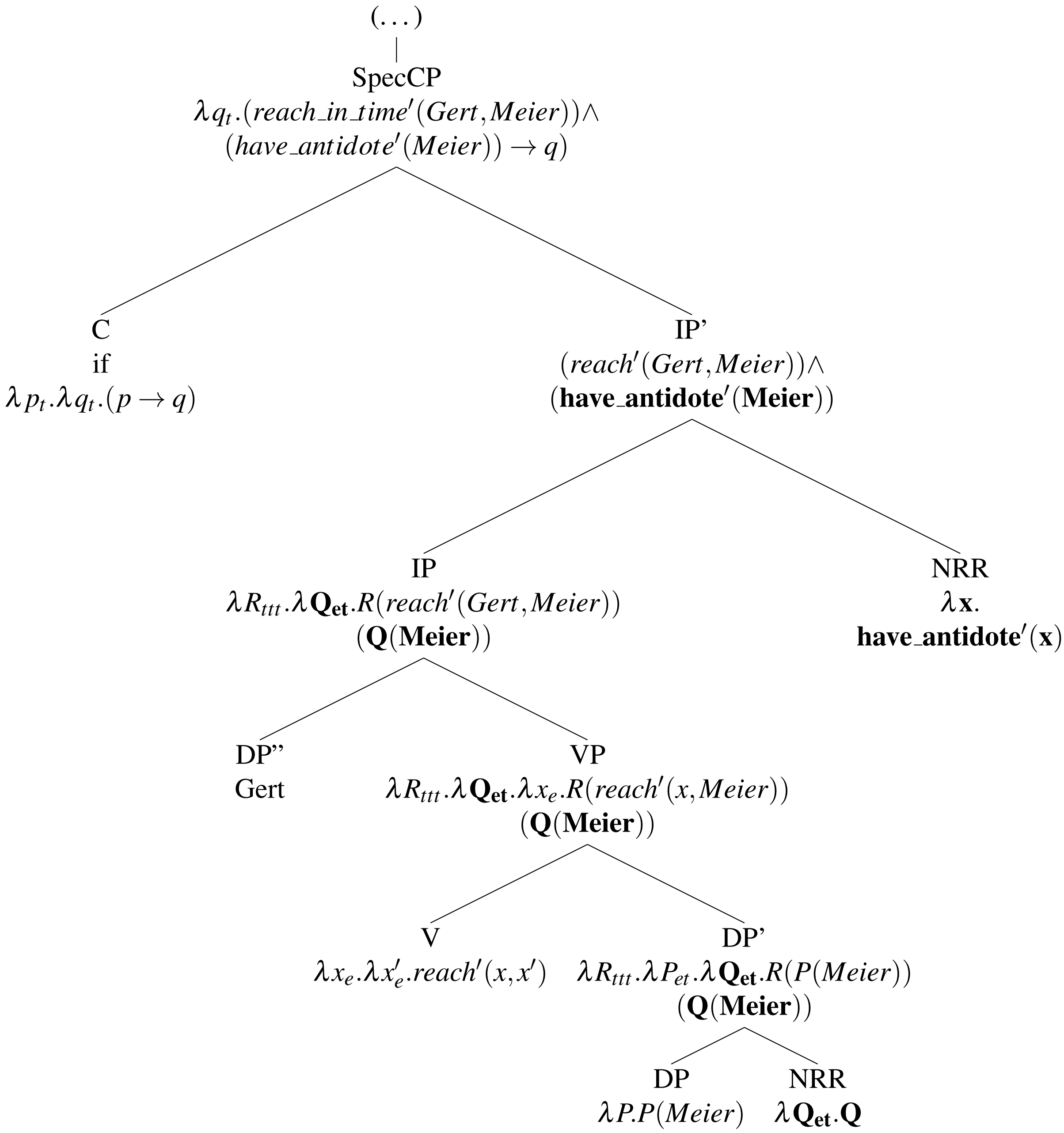
[10]Note that resolving the tentative relation by inserting the *if* in *C* would result in a crash of the derivation as soon as the consequent-clause is added.

issue, for example, might depend on the position (Syrett and Koev, 2015) and the rhetorical relation (Jasinskaja, sion) holding between NRC and the sentence embedding it.

3.2. NRCs ex situ

Things change, if the NRC is extraposed. We assume that in this case, the NRC is moved from its DP-modifying position, where it leaves a trace Q of type et, to the right edge of a clause (at any sentential level IP or CP), where the trace is bound.

Figure 5: **NRC ex situ**



(12) **NRC Adjunction Rule (ex situ):**
If C is a branching node consisting of two sister nodes A and B, A with the translation α being of type ((t(tt))((et)t)) and B with the translation β of type (et), C translates as: $(\alpha)(\wedge)(\beta)$

To make an embedded reading available, we now only have to assume that in the case in which the NRC is extraposed and attached at the right edge of a clause, the missing connective can be instantiated by a conjunction, as spelled out by rule (12) and in figure 5 above. Granted, this analysis is not type-driven but requires some construction specific attachment rules for extraposed NRCs. If, however, we assume such additional rules, the differences between in situ and extraposed NRCs fall out quite neatly. While in situ NRCs are predicted to project to CP-level, extraposed NRCs can be attached to any sentential node to which they are right-adjacent and locally conjoined. Which of these potential attachment points are preferred might depend on pragmatic factors such as context information and the rhetorical relation holding between NRC and host-clause. Moreover, there might be a general preference for high-attachement sites even in case of extraposed NRCs, since in case of low attachment the NRC competes with corresponding and-conjunctions, which are not ambiguous.

3.3. Effect of rhetorical relations

In this subsection, we will sketch very briefly two possible explanations for why and how rhetorical relations might affect the choice between low and wide scope readings of NRCs. Comparing the projection patterns of NRCs, conventional implicatures and presuppositions, Simons et al. (2011) assume that (semantic) operators such as conditionals only target material that is ”at-issue” in a given context, e.g. addresses the actual QUD (Roberts, 1996). A first explanation for the observed contrasts might be that NRCs with coordinating and subordinating relations differ in the way in which they contribute to the QUD addressed by the host-clause.[11]

(13) Wenn Gert Dr. Meier erreicht,
(If Gert Dr. Meier reaches)
a. **der ihm das passende Gegengift verabreicht,**
(who him the right antidote gives) (NARRATION)
b. **der über das passende Gegengift verfügt,** (EXPLANATION)
(who the right antidote has)
ist Gert gerettet. *(is Gert saved.)*

Let us assume that the QUD the main-clause addresses is the question *If what happens can Gert be saved?*. Intuitively, the in NRC (13a) provides part of the answer to the question addressed

[11]This in fact is roughly what Jasinskaja (sion) argues for in her paper on the (non-)at-issue status of (non-embedded) NRCs. She assumes that each discourse unit (also subsentential ones) addresses an issue on its own. In case of coordinating discourse relation the subsequent units can be combined to form a coordinated discourse topic (e.g. be coordinated to address an overarching QUD). In case of a subordinating discourse relation, however, the second unit introduces a subquestion of its own and does not contribute directly to the QUD addressed by the previous unit. If we combine the assumptions of Roberts (1996) and Jasinskaja (sion), we might get an explanation for the contrasts observed.

by the host-clause and is interpreted locally. The NRC in (13b), by contrast, does not give an answer to this question but addresses an issue on its own, namely why Gert is saved as soon as he reaches Dr. Meier. Note, however, that the assumption that projectivity and non-at-issueness are generally related is not uncontroversial. Simons et al. (2011: 315) themselves discuss potential counterexamples to this claim.

(14) Q: Who's coming to the dinner tonight?
A: Well, I haven't talked to Charles, who probably won't be able to come, but I did talk to Sally, who is coming.

Although the NRCs in (14) address the QUD raised by the preceding question, they project. To explain the suitability of the NRCs in (14), Simons et al. (2011: 315) assume that NRCs are non-at-issue by default and, hence, can not address the QUD at all. The utterance of (14) is suitable only since the hearer is able to reconstruct a new QUD for the sentence, for example who A has talked to about the dinner. According to these assumptions, NRCs, are predicted to be always projective, since they are assumed to be inherently non-at-issue. This, however, is not what we found in our experiments.

Another aspect in which coordinating and subordinating discourse relations often differ, is that subordinating discourse relations in contrast to coordinating ones are in many cases *speaker-oriented*. For instance, EXPLANATION is a speaker-oriented relation whose second argument gives support to the first. This, however, means that the speaker must endorse both the explanation and the explanandum, which might explain, why NRCs expressing an EXPLANATION have a strong tendency to be interpreted with widest scope. The example in (15) (provided by Katja Jasinskaja p.c.) illustrates that speaker-orientedness indeed might play a role. In German the discourse connectives ”deshalb” and ”also” both force a coordinating translation. In contrast to ”deshalb”, ”also”, however, is speaker-oriented. ”A deshalb B” in German is equivalent to ”A, and therefore B“, while ”A also B” roughly translates as ”A, and therefore I believe B”. If in (15), the causal relation between Eva's criticism and the Max' anger is expressed by the non-speaker-oriented ”deshalb”, the NRC is interpreted locally as part of the conditional antecedent: ”if Eva criticizes Max and that makes him angry, ...” . By contrast, ”also” makes the utterance infelicitous because the causal antecedent of the speaker's belief that Max is angry is not accessible in the global context. Similarly, in English, (6a) gets awkward if we mark speaker-orientedness as in (16).

(15) Wenn Eva Max kritisiert, der sich **deshalb/??also** ärgert, ...
(*If Eva Max criticizes, who refl therefore/hence is annoyed, ...*)

(16) *If Peter called the Dean, who then (*frankly/*by the way/...) called the Chair, I would be in deep trouble.

As Katja Jasinskaja (p.c.) pointed out to me, asyndetically juxtaposed sentences have a strong tendency to be interpreted as expressing subordinating relations, typically EXPLANATION (Jasinskaja, 2007), while coordinating ones tend to be explicitly marked (cp. (17a) to (17b)).

NRCs, however, are asyndetic (17c). This might contribute to their preference for subordinating relations and high-attachment.

(17) a. Mary fired Bill. He drank too much. (EXPLANATION: drinking causes firing)
b. Mary fired Bill. And he drank too much. (RESULT: firing causes drinking)
c. Mary fired Bill, who drank too much. (EXPLANATION: drinking causes firing)

4. Conclusion

In this paper, we presented the results of three experiments, which show that, contrary to standard assumptions (McCawley, 1982; Potts, 2005; Arnold, 2007; AnderBois et al., 2011), embedded readings are available for NRCs in German. In contexts incompatible with a wide-scope interpretation, NRCs were significantly more often accepted as suitable than the corresponding parentheticals and postponed matrix clauses. This strongly confirms an assumption made by Schlenker (2013) that NRCs can have narrow scope interpretations in which they contribute conjunctively to the content of their host-clause. Moreover, the results suggest that the availability of such embedded readings is dependent on the *predicate* type of the NRC and the type of the *rhetorical relation* established between the NRC and its host-clause (coordinating vs. subordinating). NRCs of event-predicate type were interpreted significantly more often as embedded than those of state-predicate type. If, however, a coordinating relation was forced, by introducing coordinating discourse particles like ”dann” (then) or ”wider Erwarten” (counter expectations), the availability was increased independently of the predicate-type. We took this as a first piece of evidence for the assumption that the embeddability is neither restricted to continuatives in the sense of Holler (2005) nor to NRCs that are causally dependent on the content of the antecedent. Note, however, that we only tested the interpretation of NRCs that were located in clause-final (extraposed) position at the right edge of the antecedent of a conditional. Examples provided by Schlenker (2013) from English and French suggest that embedded readings are available with other (sentential) operators (such as ”conceivable“), but only as long as the NRC is extraposed. To account for these observations, we suggested an analysis according to which *in situ* NRCs are forced to project, while *extraposed* NRCs are flexible in their scope. The observation that rhetorical relations affect the scope of (extraposed) NRCs raises interesting puzzles for any analysis of NRCs and for our understanding of projection in general (Simons et al., 2011). To discuss these questions, however, goes beyond the scope of this paper and should be addressed by further research.

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Split-antecedent relative clauses and the symmetry of predicates[1]

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Abstract. This paper presents the results of two experiments in German testing the acceptability of (non-)restrictive relative clauses (NRCs/RRCs) with split antecedents (SpAs). According to Moltmann (1992), SpAs are only grammatical if their parts occur within the conjuncts of a coordinate structure and if they have identical grammatical functions. Non-conjoined SpAs that form the subject and the object of a transitive verb are predicted to be ungrammatical. Our study shows that the acceptability of such examples improves significantly if the predicate that relates the parts of the SpA is symmetric. Moreover, it suggests that NRCs and RRCs behave differently in these cases with respect to the SpA-construal. We can make sense of this observation if we follow Winter (2016) in assuming that transitive symmetric predicates have to be analyzed as unary collective predicates and thus provide a collective antecedent for the RC at the semantic (not the syntactic) level. As we will argue, this accounts for some of the disagreement we found in the literature and gives us new insights into both the semantics of symmetric predicates and the semantics of NRCs.

Keywords: non-restrictive relative clause, restrictive relative clause, symmetric predicate, split antecedent.

1. Introduction

We speak of a *split antecedent* (SpA) of a relative clause when the antecedent is jointly expressed by distinct syntactic constituents in its host clause, as in (1). This constellation constitutes a challenge for the analysis of relative clauses.

(1) Mary met a man$_i$ and John met a woman$_j$ [who$_{i,j}$ knew each other well].
(Moltmann, 1992: 262)

Moltmann (1992) assumes that split antecedents are only possible if the antecedent phrases occur within the conjuncts of a coordinate structure and if they have identical grammatical functions, which is the case in (1). This generalization correctly excludes the sentence in (2a), where we find an overt conjunction, but the first antecedent phrase is the subject of the first conjunct, and the second antecedent phrase is the direct object of the second conjunct. The generalization also correctly excludes examples such as (2b), where an overt conjunction is

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missing, and the two antecedent phrases again have distinct grammatical functions.

(2) a. *A woman$_i$ came and John met a man$_j$ [who$_{i,j}$ knew each other well].
b. *A man$_i$ saw a woman$_j$ [who$_{i,j}$ had danced together]. (Moltmann, 1992: 263)

However, we would, then, wrongly exclude (3), which is taken from Hoeksema (1986: 64). (3) is generally judged as acceptable, although, just as in (2b), an overt conjunction is missing, and the two parts of the split antecedent form the subject and the object of a transitive predicate.

(3) We always let those boys$_i$ play with those girls$_j$ [who$_{i,j}$ know one another from elementary school].

In this paper, we will explore the idea that one reason for the contrast between (2b) and (3) might be that, in the latter case, the two antecedents are related by a symmetric predicate. According to Winter (2016), transitive symmetric predicates have to be analyzed as unary collective predicates. This might favor an SpA-construal. We will present the results of two experiments in German investigating this effect of the symmetry of the matrix-clause predicate on the acceptability of restrictive and non-restrictive relative clauses with SpAs. Our findings will not only shed new light on the diverging judgments in the previous literature but also provide insights into both the semantics of symmetric predicates and SpA-relatives.

We will first present some basic assumptions on restrictive and non-restrictive relative clauses (RRCs/NRCs), see Section 2. In Section 3, we will present the relevant ideas on symmetric predicates from Winter (2016). We derive two empirical hypotheses from these two sections and present two questionnaire studies that we carried out to test them, see Section 4. In Section 5, we will sketch an analysis compatible with our empirical findings, before we end with a conclusion, see Section 6.

2. Antecedence construal with restrictive and non-restrictive relative clauses

In this section, we will summarize the relevant observations on the relation between RRCs and NRCs and their antecedents.[2]

RRCs are interpreted as predicates where the relative pronoun marks the variable that is abstracted over. The RRC is semantically integrated as a restriction on the denotation of a nominal projection that it attaches to (Heim and Kratzer, 1998). In non-split cases, the antecedent of an RRC is always a syntactic constituent. If we carried this over to the SpA-construal, we would expect that RRCs should be impossible with SpAs unless there is independent evidence for a syntactic constituent consisting of exactly the antecedents.

In her study of relative clause extraposition, Walker (2017) follows Keller (1995) in assuming that the link between an RRC and its antecedent is based on the "local" syntactic and semantic information of the antecedent constituent. "Local" properties include the syntactic category

[2]See Fabb (1990) and Huddleston and Pullum (2002: Chapter 7) for an overview of differences between RRCs and NRCs.

(but not constituent structure information) and lexical semantic information (but not information on quantification or definiteness). This allows for cases like (4) from Walker (2017: 181).

(4) This list does not even include [the house and the car] [RRC: I want for my family].

In this example, the antecedent relation is established between the relevant semantic and syntactic properties of the conjunct *the house and the car*, which do not include the determiner semantics. What is important for us here is that even in such cases, there is a syntactic constituent acting as the antecedent of the RRC.

For NRCs, in contrast, it has been argued that the relative pronoun is equivalent in interpretation to a discourse-anaphoric pronoun (Sells, 1985; Del Gobbo, 2003; Holler, 2005; Schlenker, 2010). Indeed, NRCs often pattern quite consistently with their discourse-anaphoric matrix-clause paraphrases, compare a. and b. as well as c. and d. in (5).[3]

(5) a. *Every climber, who was French by the way, made it to the summit.
  b. Every climber made it to the summit. *He was French by the way.
  c. Most climbers, who were all French by the way, made it to the summit.
  d. Most climbers made it to the summit. They were all French by the way.
  (adapted from Nouwen 2007)

Arnold (2004, 2007) argues that the difference between the two types of relatives does not so much lie in their syntactic attachment —both attach to their respective antecedent — but rather in the semantics of their relative pronoun and, following from this, the antecedent construal and the semantic (non-)integration of the relative clause.

In some cases, however, relative pronouns of NRCs seem to be more restricted than their discourse-anaphoric counterparts. In particular, it can be assumed that an NRC, unlike a discourse-anaphoric pronoun, can only take a discourse referent as its antecedent if it is accessible in its host clause. The antecedent of a discourse pronoun can be introduced in a more ad hoc way – such as by "abstraction" in Kamp and Reyle (1993). In particular, so-called *complement set anaphora* (Moxey and Sanford, 1987; Nouwen, 2003) is possible with discourse-anaphoric pronouns but completely unavailable with NRCs. In (6a), the pronoun *they* can refer to the set of those children that did not eat their ice cream. Such an interpretation is not possible for the relative pronoun in (6b).

(6) Few of the children ate their ice cream, ...
  a. they threw it around the room instead. (Moxey and Sanford, 1987: 192)
  b. *who, by the way, threw it around the room instead.

[3]Del Gobbo (2003) assumes that NRCs such as (5c) are ungrammatical if the NRC is clause-internal. Nouwen (2007), by contrast, argues that a clause-internal NRC is possible in structures like (5c) but, unlike discourse-anaphoric pronouns, can only take the set of climbers as its antecedent, not the subset of climbers who reached the summit. Cf. Poschmann (2013) for experiments on the interpretation and acceptability of such sentences in German.

Given this state of the theoretical discussion, we expected that NRCs with split antecedents should only be possible if we can find independent motivation for the existence of an appropriate plural antecedent in the interpretation of the matrix clause. We will see in the next section that exactly this is actually possible.

3. The symmetry of predicates

Symmetric predicates are such that there are two argument slots that can be interchanged without changing the truth conditions. This is sketched in (7a) for the verb *quarrel*. A non-symmetric predicate, as expressed by *see*, does not allow for such a truth-preserving change in the grammatical function, see (7b).

(7) a. Symmetric predicate: A quarrels with B. $\Leftrightarrow$ B quarrels with A.
    b. Non-symmetric predicate: A sees B. $\not\Leftrightarrow$ B sees A.

Many symmetric predicates allow for a use with a plural in one of the argument slots and a reciprocal pronoun in the other, (8a). In addition, this reciprocal pronoun need not be there, as shown in (8b).[4]

(8) a. Reciprocal use: A and B quarrel with each other.
    b. Collective use: A and B quarrel.

These observations give rise to the following research questions: (i) Is the alternation between a binary use as in (7a) and a unary use as in (8b) productive and systematic? (ii) If so, does the collective use derive from the symmetry of the binary predicate, or does the existence of a binary realization follow from the collectivity of the unary predicate? (iii) Since the alternation has an argument-structural reflex that is semantically induced, the question is at which level of linguistic analysis the alternation will arise.

The answers to these questions are manifold. For example, Gleitman (1965) and Lakoff and Peters (1969) assume that a syntactic transformation links the binary and the unary use of symmetric predicates. They differ, however, in that Gleitman derives the unary use from the binary one, see (9a), whereas Lakoff & Peters do it the other way around, see (9b).

(9) a. John met Mary and Mary met John $\mapsto$ John and Mary met.
    b. John and Mary met. $\mapsto$ John met Mary.

Winter (2016) takes a very different approach. Instead of having a syntactic transformation

[4] In addition to the alternations in English, we find inherently-reflexive realizations of the binary predicate in German, which clearly have the collective rather than a reciprocal meaning. In (i), only the inherently-reflexive realization can be used, not the explicitly reciprocal. We will ignore this complication here and treat the inherently-reflexive realization just on par with a collective realization, which seems to be adequate – at least semantically.

(i) Alex und Chris streiten (sich/ *einander) immer.
    Alex and Chris quarrel themselves/ each other always
    'Alex and Chris always have a fight.'

between a binary and a unary use of a verb, he postulates an underlying *protopredicate* and derives the concrete binary and unary predicates from the denotation of the protopredicate.

The denotation of a protopredicate contains all instances compatible with a particular natural-language expression. Winter discusses the example of the verb *hug*: Some huggings are collective, which means that a protopredicate **hug** will have group objects consisting of collectively hugging people in its denotation. Other huggings are directional, i.e. there is one person hugging and another person being hugged. For these cases, the denotation of **hug** will also contain pairs whose first element is the hugger and whose second the 'huggee'.[5]

Winter (2016) does not use protopredicates directly in sentences. One reason for this is probably that the denotation of a protopredicate may contain both single objects and tuples, whereas predicates in a sentence have a fixed arity. Looking at Winter:16 analysis, there might be a second reason: the structure of the elements in the denotation of the protopredicate is clearly connected to a contentful interpretation of semantic (proto-)roles (in the sense of Dowty 1991). The semantic argument slots in a concrete predicate need not have such a clear-cut interpretation. In particular, Winter (2016) assumes that different argument slots of concrete predicates can bear the same semantic role, whereas this would not be possible for the argument slots in the denotation of a protopredicate.

Winter (2016) defines three mappings from protopredicates to concrete predicates. For the protopredicate **hug**, for example, there is a binary non-symmetric predicate $\mathbf{hug}^{bns}$ and a unary collective predicate $\mathbf{hug}^{uc}$. The denotation of $\mathbf{hug}^{bns}$ is the subset of the denotation of **hug** that contains all hugger-hugged pairs. The denotation of $\mathbf{hug}^{uc}$ is the subset of the denotation of **hug** that consist of all hugging-sets. Winter also provides a binary symmetric predicate, $\mathbf{hug}^{bs}$. The denotation of this predicate is such that for each of the collective huggers $x \oplus y$, it contains the pairs $\langle x,y \rangle$ and $\langle y,x \rangle$.[6]

This system directly accounts for the fact that the binary symmetric use of a predicate is synonymous to its unary collective use, even though the argument frame is different. At the same time, it captures the fact that a binary non-symmetric and a binary symmetric use are non-synonymous even though they have the same number of syntactic arguments.

The verb *quarrel* expresses an inherently-collective concept. Therefore, the protopredicate **quarrel** only contains plural objects and no pairs. Consequently, there can be a unary collective predicate $\mathbf{quarrel}^{uc}$ and a binary symmetric predicate $\mathbf{quarrel}^{bs}$, but the corresponding binary non-symmetric predicate is not defined. Similarly, for a non-symmetric protopredicate, there

[5]Winter (2016) uses a set notation for the collective objects, $\{x,y\}$. We will use the notation $x \oplus y$ here, which makes it clearer that we are dealing with a single entity – in contrast to a tuple of entities, $\langle x,y \rangle$, needed for the non-collective denotations.

[6]Note that symmetric readings are available even if the set consists of more than two members. In this case the symmetric reading (ia) is clearly more expressive than the reciprocal binary paraphrases in (ib). Winter (2016) takes this as evidence for his assumption that collective predicates are basic and irreducible to their binary forms.

(i) a. A, B and C are similar.

b. $\neq$ A is similar to B, B is similar to C, C is similar to A.

will be no corresponding unary collective predicate nor a binary symmetric predicate.[7]

What does this mean for the possibilities of antecedent construals with relative clauses? In the case of a unary collective predicate, there is both a syntactic and a semantic unit that can serve as an antecedent for a relative clause. For a binary non-symmetric predicate, there is neither a syntactic nor a semantic unit, so no antecedent construal should be possible for any type of relative clause. The same is true, in fact, for a binary symmetric predicate: since its denotation is a set of pairs, it is ontologically indistinguishable from a binary non-symmetric predicate.

If, however, we have access to the protopredicate in addition to the concrete predicate, a possible semantic antecedent would be available in sentences with a binary symmetric predicate (and, trivially, for the unary collective predicate). Since this collective argument is not part of the syntactic structure, the antecedent-construal process can only be semantic, not syntactic. We thus expected it to be possible for NRCs but not for RRCs.

To sum up, none of the analyses of symmetric predicates would predict the acceptability of an SpA-construal for RRCs. For NRCs, the picture is slightly different: a syntactic approach à la Lakoff and Peters (1969) assumes the required plural antecedent provided that the underlying syntactic structure can be used for relative clause attachment. Similarly, the semantic analysis in Winter (2016), as it stands, does not seem to predict SpAs for NRCs. However, if we can include the protopredicate in the interpretation, an NRC would be possible, though an RRC would still be excluded.

We have carried out two questionnaire studies to get a clearer picture of the empirical facts and to see which of the approaches to antecedent construal and symmetric predicates can best account for them.

4. Experiments

In this section, we will report the results of two experiments in German that suggest that the symmetry of a binary predicate relating the parts of a split antecedent can indeed affect the acceptability of the SpA-relative clause. Moreover, we will show that RRCs and NRCs behave differently with respect to SpA-construal. Both experiments were conducted as pen-and-paper questionnaires with first-semester students in Frankfurt a.M., Germany.

4.1. Experiment 1

In a first questionnaire, with 39 participants, we tested the acceptability of non-conjoined SpAs depending on the TYPE of the relative clause (RRC vs. NRC) and the SYMMETRY (±symmetric) of the matrix-clause predicate relating the heads of the SpA.

[7]Though, of course, there can be a non-empty reciprocal subset of the denotation of the protopredicate, i.e. all cases where both $\langle x, y\rangle$ and $\langle y, x\rangle$ occur in the denotation of the protopredicate.

4.1.1. Design

All items were constructed such that there was a plural-RC in sentence-final position and a matrix clause with definite DPs as antecedents for the SpA with one antecedent-DP forming the subject and the other the object of a transitive matrix-clause predicate. The relative clause was either an RRC or an NRC and the matrix-clause predicate either symmetric or non-symmetric.[8] Overall, we tested 12 items in 4 conditions (NRC/RRC*±Symmetry) distributed over a Latin-square design, such that every participant judged every condition three times but each item only in one condition. An example for a test item in all four conditions is given in (10).

(10) a. Letzte Woche hat sich mein Hausarzt mit meinem Heilpraktiker **gestritten**, die einander sonst übrigens sehr schätzen.
'Last week, my doctor quarreled with my non-medical practitioner, who by the way normally appreciate each other.' (NRC/+SYMM)
b. Letzte Woche hat mein Hausarzt meinen Heilpraktiker **beleidigt**, die einander sonst übrigens sehr schätzen.
'Last week, my doctor insulted my non-medical practitioner, ... ' (NRC/-SYMM)
c. Letzte Woche hat sich derjenige Hausarzt mit demjenigen Heilpraktiker **gestritten**, die einander sonst sehr schätzen.
'Last week, precisely that doctor quarreled with precisely that non-medical practitioner who normally appreciate each other.' (RRC/+SYMM)
d. Letzte Woche hat derjenige Hausarzt denjenigen Heilpraktiker **beleidigt**, die einander sonst sehr schätzen.
'Last week, precisely that doctor insulted precisely that non-medical practitioner ... ' (RRC/-SYMM)

Non-restrictive interpretations were forced by adding a discourse particle, typically *übrigens* 'by the way', inside the relative, which should rule out a restrictive interpretation.[9] In the RRC-conditions, these particles were omitted, instead the heads of the relative included the determiner *derjenige* 'precisely that', which should rule out a non-restrictive interpretation.[10]

Since in German, the plural form of the relative pronoun is syncretic with its feminine singular form *die*, we designed all test items with exclusively singular masculine subjects and objects. This ensured that the RC was not interpreted solely with respect to one of its antecedents. In all conditions, the RC was extraposed across the clause-final matrix predicate. Unlike in English (Rochemont and Culicover, 1990; Walker, 2017), extraposition from a definite DP is generally

[8]List of predicates used in the symmetric condition: *sich streiten mit* 'to quarrel with s.o.', *telefonieren mit* 'to talk with s.o. on the phone', *sich schlagen mit* 'to fight with s.o.', *diskutieren mit* 'to debate with s.o.', *sich zusammentun mit* 'to team up with s.o.', *übereinstimmen mit* 'to come to an agreement with s.o.', *sich beratschlagen mit* 'to consult with s.o.', *zusammenarbeiten mit* 'to collaborate with s.o.', *aussehen wie* 'to look like s.o.', *sich vertragen mit* 'to make up with s.o.', *sich unterhalten mit* 'to talk with s.o.', *sich treffen mit* 'to meet with s.o.'

[9]Note that in German, unlike in English, both RRCs and NRCs are obligatorily separated by a comma.

[10]A relative clause attached to a *derjenige*-head cannot contain discourse particles:

(i) Derjenige Heilpraktiker, der (*übrigens) Peter beleidigt hat, ist meinem Hausarzt gut bekannt.
'Precisely that practitioner, who by the way insulted Peter, is well-known to my doctor.'

judged as acceptable in German (Holler, 2005; Poschmann and Wagner, 2016), at least across minimal distances (1 word). To keep the distance between the split antecedents and the RC minimal, all test items of Experiment 1 were constructed such that the sentence-initial position (Vorfeld/prefield) of the matrix clause was occupied by a PP or a temporal or locational adverb, while the subject- and object-DPs were located adjacent to each other in the middle field of the matrix clause.

The test items were tested interspersed with 14 fillers, which included 7 examples of clearly acceptable and 7 clearly unacceptable examples of NRCs or RRCs, all without an SpA-construal.

4.1.2. Predictions

The RCs in Experiment 1 are all plural and hence looking for a plural antecedent in the matrix clause to which they can be attached. The matrix clause, however, does not provide such a plural antecedent, at least not at the syntactic level. Both the subject- and the object-DP are singular. Thus, from a syntactic point of view, the matrix clause does not provide a proper antecedent to which the RC can be attached.

Hypothesis I: +SYM > −SYM.
The semantic analysis of binary symmetric predicates could be such that the analysis of a sentence of the form *A quarrels with B* contains a unary collective predicate, *A and B quarrel*, as part of its interpretation. If this hypothesis is on the right track, one might expect that the acceptability of SpA-RCs improves if the parts of the split antecedent are connected by a symmetric predicate, since in this case the symmetric predicate provides a collective antecedent at the semantic level with respect to which the plural-RC can be interpreted. Non-symmetric predicates, by contrast, do not provide such a collective antecedent and should be judged as unacceptable.

Hypothesis II: NRC > RRC
If symmetric predicates provide a collective antecedent, they do so only at the semantic, not the syntactic level. If at all, an effect of symmetry would be expected to show up only in case of NRCs. According to standard assumptions, NRCs are linked to their head-DP only anaphorically – e.g. McCawley (1981); Sells (1985); Holler (2005); Arnold (2007) – and hence might not need a single syntactic antecedent. RRCs, by contrast, are non-anaphoric and seem to need a proper syntactic antecedent to which they can be attached. We hence expected to find an interaction of RC-TYPE and SYMMETRY, such that SYMMETRY only improves the acceptability of NRCs with SpAs but not the acceptability of RRCs with SpAs.

4.1.3. Results

The data reported for Experiment 1 are based on the judgments of 36 out of the 39 tested participants. We had to exclude 3 participants because they rated more than 4 of the 9 negative

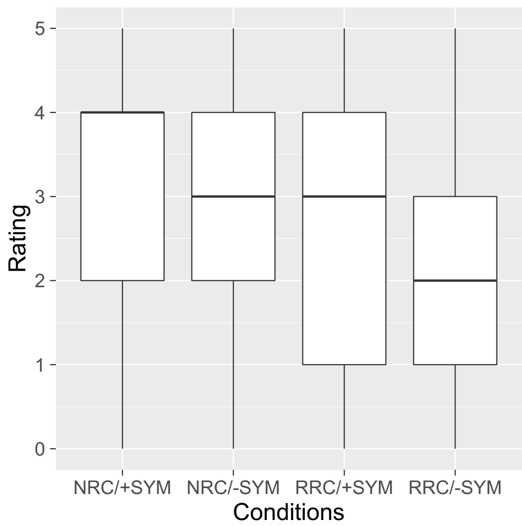

Figure 1: Experiment 1: Test conditions

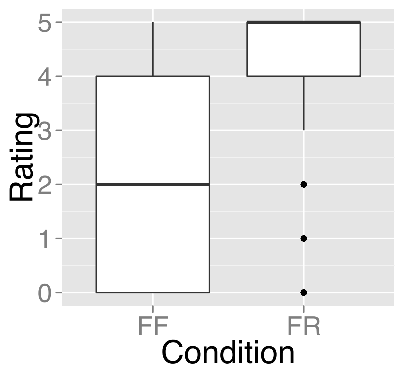

Figure 2: Experiment 1: Filler conditions

fillers as good (≥ 3). The overall results of the experiment are summarized in Figure 1 for the test conditions and in Figure 2 for the filler conditions.

The results confirm that both RC-TYPE and SYMMETRY affect the acceptability of SpA-RCs. As expected, NRCs rated better than RRCs. For both types, SYMMETRY of the matrix predicate significantly improved the acceptability of the SpA-construal. The ratings show a clear downstep pattern. NRCs with a symmetric matrix predicate are rated as more or less acceptable (3.5 on a scale from 0 to 5), lower than the positive controls (4.3) but significantly higher than NRCs with a non-symmetric matrix predicate (2.9). RRCs with a symmetric matrix predicate got marginal acceptance rates (2.5), and RRCs with a non-symmetric matrix predicate rated nearly as low (2.1) as the negative controls (1.9).

Using the lme4 package in R, we fitted a model of mixed logistic regression for the interaction of RC-TYPE and SYMMETRY as fixed effects and random effects for subjects and items including the corresponding slopes (Formula: Rating $\sim$ Typ$*$Sym + (1+Typ*Sym | Person) +

(1+Typ*Sym | Item)). We found significant effects of RC-TYPE ($t = -3.24$) and SYMMETRY ($t = 2.17$).[11] Contrary to our expectations, however, the interaction between RC-TYPE and SYMMETRY did not turn out to be significant in our data. SYMMETRY equally affected the acceptability of NRCs and RRCs.

4.2. Experiment 2

Unlike predicted by Moltmann (1992), the results of Experiment 1 show that SpA-RCs with symmetric matrix predicate are acceptable in German, even if the parts of the split antecedent are not overtly conjoined. One possible explanation for the acceptability of the tested non-conjoined SpA-examples might be that the subject- and object-DP that formed the two parts of the antecedent stood adjacent to each other. This could have invited repair effects in which the participants treated the two antecedents as jointly forming a syntactic constituent. To rule out this possibility, we designed a second questionnaire, in which we tested whether the position of the two parts of the split antecedents with respect to each other affected the acceptability of the SpA-construal.

4.2.1. Design

In this second Experiment, with 45 different participants, we tested the 12 items of Experiment 1 with symmetric predicates only. We manipulated the RC-TYPE and, in addition, the WORD ORDER of the matrix clause, such that in one condition both head-DPs of the relative stood adjacent (+ADJACENCY) in the middle field of the clause, as in (10), whereas in a second condition, one of the antecedents occurred in the prefield and was, thus, separated from the other antecedent by an auxiliary in V2 position. In (11), we provide an example for a test item in all four conditions. As in Experiment 1, the test items were tested in comparison to 7 positive and 7 negative control items.

(11) a. **Mein Hausarzt** hat sich **mit meinem Heilpraktiker** gestritten, die einander sonst übrigens sehr schätzen.
‘My doctor quarreled with my non-medical practitioner, who by the way normally appreciate each other.’ (NRC/-ADJACENCY)

b. Letzte Woche hat sich **mein Hausarzt mit meinem Heilpraktiker** gestritten, die einander sonst übrigens sehr schätzen.
‘Last week, my doctor quarreled with my non-medical practitioner, who by the way normally appreciate each other.’ (NRC/+ADJACENCY)

[11] According to Baayen et al. (2008), we can be confident that the comparison is significant if the absolute value of the *t*-value is bigger than 2 (or: 1.96).

c. **Derjenige Hausarzt** hat sich **mit demjenigen Heilpraktiker** gestritten, die einander sonst sehr schätzen.
'Precisely that doctor quarreled with precisely that non-medical practitioner who normally appreciate each other.' (RRC/-ADJACENCY)

d. Letzte Woche hat sich **derjenige Hausarzt mit demjenigen Heilpraktiker** gestritten, die einander sonst sehr schätzen.
'Last week, precisely that doctor quarreled with precisely that non-medical practitioner who normally appreciate each other.' (RRC/+ADJACENCY)

4.2.2. Predictions

Hypothesis III: +ADJACENT > −ADJACENT
If SpA-RCs are only acceptable if the parts of the antecedent are adjacent to each other, the acceptability of the examples should decrease if subject- and object-DP are separated by the finite verb.

4.2.3. Results

Overall, the ratings for NRCs and RRCs in Experiment 2 were comparable to those of the symmetric conditions in the first experiment, see Figure 3. Again, NRCs with SpAs rated as more or less acceptable (2.9 on a scale from 0 to 5), less than the positive controls (3.6) but significantly better than the RRCs (2.5) and the negative controls (2.5). The means suggest a slight downstep pattern, such that NRCs with adjacent antecedents rated slightly better (3.0) than NRCs with non-adjacent antecedents (2.8). RRCs with adjacent heads were judged a bit more acceptable (2.9) than RRCs in which the two parts of the antecedent were separated by the matrix-clause verb (2.4). However, this downstep was not significant in our data.

Fitting a mixed model regression for the interaction RC-TYPE and WORDORDER and the corresponding random effects and slopes of items and participants (Formula: Rating $\sim$ Type$*$WO + (1+Type$*$WO | Person) + (1+Type$*$WO | Item)), we did find a significant effect of RC-TYPE ($t = -2.441$) but no effect of WORDORDER ($t = 1.681$) and no significant interaction between RC-TYPE and WORDORDER ($t = 0.428$).

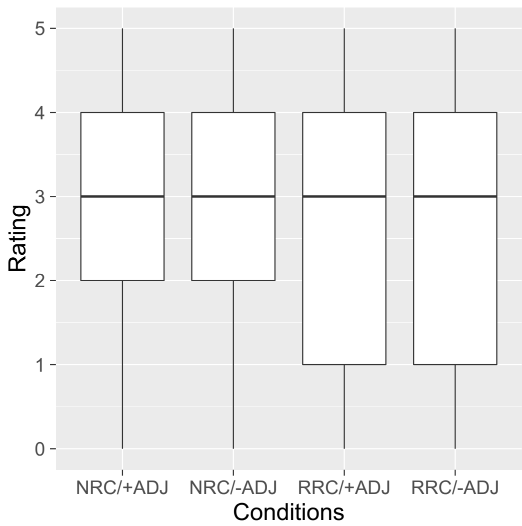

Figure 3: Experiment 2

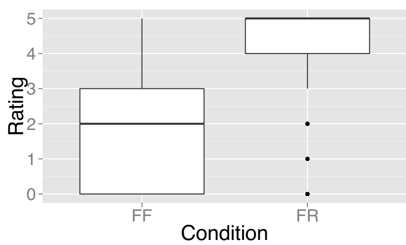

Figure 4: Filler Experiment 2

4.3. Discussion

Our results clearly show that a split antecedent is acceptable for NRCs when the antecedent-DPs are co-arguments of a binary symmetric predicate. We saw in Section 3 that none of the presented approaches would make this prediction directly but that it is possible to mildly twist the account of Winter (2016) to make it fit. All we need to do is to make the protopredicate available in the interpretation of the matrix clause. As a result, a standard semantic-antecedent construal could be used for NRCs, given that the NRC attachment potential of binary symmetric predicates like *A quarrels with B* would be the same as that of unary collective predicates such as *A and B quarrel*. A similar construal is not possible for non-symmetric predicates, where neither the concrete predicate nor its protopredicate provides a collective antecedent.

The judgments for RRCs in our data were altogether rather marginal and significantly lower than those for NRCs. This indicates, as expected, that RRCs cannot find a regular antecedent in the SpA-constellations. It is, however, surprising that there is an effect of symmetry also for RRCs. This might point to the availability of a repair strategy for such sentences. We will come back to this in Section 5.

Another somewhat unexpected result of our experiment is that NRCs with non-symmetric predicates are rated considerably better than RRCs with non-symmetric predicates. We argued above that the antecedent construal of an NRC is a semantic rather than syntactic process, but there is no semantic antecedent available for the NRC in these cases. For cross-sentential discourse pronouns, antecedent construal is possible in such constellations, as illustrated in (12). We take it that the judgments in our study indicate that the participants were able to apply such a discourse-anaphora construal process as a repair strategy in these cases.

(12) Letzte Woche hat mein Hausarzt meinen Heilpraktiker beleidigt. Sonst schätzen sie einander sehr.
‘Last week, my doctor insulted my non-medical practitioner. Normally, they appreciate each other very much.’

The results of Experiment 2 confirmed the contrast between NRCs and RRCs. At the same time, it showed that the relative position of the two antecedent phrases in the sentence does not have any influence. This strengthens the position that an NRC finds its antecedent through semantic rather than syntactic properties. Similarly, the repair strategy speculated about for RRCs with symmetric predicates should be semantic rather than syntactic.

In the next section, we will go through the observations made in this discussion and show how we can integrate them into a concrete approach to symmetric predicates and antecedent construal for relative clauses.

5. Analysis

In this section, we will first develop a version of Winter:16 theory that allows us to account for our empirical findings directly. Then we will go through the four patterns tested in Experiment 1 in the light of our revised approach to symmetric predicates and our assumption on relative clauses from Section 2.

In our discussion of the experimental results in Section 4.3, we mentioned that we need to stipulate the simultaneous presence of the protopredicate **quarrel** and the binary symmetric predicate to account for the well-formedness of SpAs with NRCs and symmetric verbs. Our account of the data would, of course, be much smoother if we only had a single predicate.

We showed in Section 3 that the process to create the binary symmetric predicate is different in quality from the simple subdenotation formation for the other predicates. Instead, it splits plural objects into pairs. If we are, however, not bound to the assumption that a semantic predicate needs to reflect the syntactic properties, we are free to have a verb with more than one syntactic argument and interpret it as the unary collective predicate $\mathbf{quarrel}^{uc}$. The resulting lexical entry is sketched in (13).[12]

[12]We assume a version of a dynamic, DRT-style, semantic framework. “$[x]$” is used for the introduction of a new discourse referent, x. We use the colon, “;”, for dynamic conjunction. Superscripts in the examples indicate the introduction of a new discourse referent, subscripts the use of an already present discourse referent.

(13) Lexical entry of the binary symmetric verb *quarrel*:
a. semantics: $\lambda y \lambda x.[X];(X = x \oplus y);(\mathbf{quarrel}^{uc}(X))$
b. subject: NP
c. complement: *with*-PP

We can, now, use this version of Winter:16 theory to go through the four patterns tested in Experiment 1. A simple version of the pattern in example (10a) is given in (14), together with an analysis that makes use of a lexical specification of a binary symmetric verb as in (13). The main clause introduces three discourse referents: the proper names each introduce one, a (Alex) and c (Chris), and the binary symmetric predicate introduces the group discourse referent X to overcome the difference in number between its syntactic and its semantic arguments – just as indicated in its lexical entry in (13).

When the NRC is attached, its relative pronoun introduces a new discourse referent, Y, that needs to be bound to an already existing discourse referent. Since there is a plural discourse referent, X, accessible, the antecedent construal can proceed as usual.

(14) Alex^a hat sich mit Chris^c gestritten^X, die^Y übrigens öfter mal streiten.
Alex quarreled with Chris, who by the way quarrel every now and then.'
a. Main clause: $[a];[c];(a = \mathbf{alex});(c = \mathbf{chris});[X];(X = a \oplus c);\mathbf{quarrel}^{uc}(X);$
b. NRC: $[Y];(Y = X);\mathbf{quarrel}^{uc}(Y)$

This analysis not only simplifies the analysis of symmetric predicates from Winter (2016) in eliminating the need for the formation of binary symmetric predicates, it also directly introduces the plural object X that can serve as the antecedent for an NRC.

In (15), we provide an example with a non-symmetric predicate and an NRC – just as (10b) above. The translation of the main clause is given in (15a). When the NRC is translated, as in (15b), there is no appropriate plural antecedent available to bind Y to.

(15) ?*Alex^a hat Chris^c beleidigt, die^Y sich sonst gut vertragen.
'Alex insulted Chris, who get along well normally.'
a. Main clause: $[a];[c];(a = \mathbf{alex});(c = \mathbf{chris});\mathbf{insult}^{bns}(a,c);$
b. NRC: $[Y];(Y =?);\mathbf{get\text{-}along}^{uc}(Y)$

Participants who do not fully reject examples of this type might be able to backtrack and to create an appropriate plural antecedent on the fly. This will allow them to combine the two introduced discourse referents a and c into a group referent X. The corresponding parts to be inserted would look as in (16).

(16) Created antecedent: $[X];(X = a \oplus c);$

Let us now turn to the situation with RRCs. We will start with an example with a conjoined antecedent, where the possibility of attaching an RRC is uncontested. We will, then, use the binary symmetric version of this example and show that the ordinary RRC-interpretation mechanism does not work. Finally, we will speculate on a possible repair strategy.

A relevant example is given in (17). The conjunction is formed by the introduction of a new discourse referent, X, which consists of the referents x and y. The mechanism for RRC-attachment in Walker (2017) ensures that the relative pronoun is interpreted as the main discourse referent of the antecedent and that the entire RRC is integrated in such a way that it imposes a further restriction on this discourse referent.[13] The interpretation would be just the same if the RRC were extraposed.

(17) Heute haben sich [diejenige^x Katze und derjenige^y Hund]^X, die$_X$ gestern so heftig gestritten haben, wieder vertragen.
'Precisely that cat and precisely that dog who had quarreled fiercely yesterday got along again today.'
a. Conjunction (including the RRC):
$[x]; \mathbf{cat}(x); [y]; \mathbf{dog}(y); [X]; (X = x \oplus y); \mathbf{quarrel}^{uc}(X);$
$+$ uniqueness of the referent satisfying the conditions on X up to now
b. Main-clause VP: $\mathbf{get\text{-}along}^{uc}(X)$

In (18), we give the binary version of example (17). In this case, extraposition is the only possibility. Contrary to what happens in the unary case, it is now the binary symmetric predicate *sich vertragen* 'get along' that introduces the plural discourse referent X, not a nominal constituent. The relative clause, however, needs a nominal antecedent.

(18) ?*Heute hat sich diejenige^x Katze mit demjenigen^y Hund wieder vertragen^X, die$_X$ gestern so heftig gestritten haben.
'Today precisely that cat got along with precisely that dog again who had quarreled fiercely yesterday.'
a. Main clause: $[x]; \mathbf{cat}(x); [y]; \mathbf{dog}(y); [X]; (X = x \oplus y); \mathbf{get\text{-}along}^{uc}(X);$
$+$ uniqueness on x and y
b. RRC: $\mathbf{quarrel}^{uc}(X)$

What could a repair mechanism look like that will mitigate the unacceptability of (18) but not of analogous examples with non-symmetric predicates? Given the presence of a plural discourse referent, there is at least the semantic half of what an RRC needs for its attachment, with only the syntactic part missing. Consequently, we might assume that some participants in our study added the missing syntactic information on the fly, which would, then, allow them to construct the same semantic representation as for (17).

[13] We only provide the existential component of the definite subject and gloss over the uniqueness condition.

6. Conclusions

Our study confirms that SpAs are possible at least with NRCs and shows that the symmetry of the matrix predicate can remedy examples in which the two antecedents of an SpA are neither overtly conjoined nor have identical grammatical functions.[14] This accounts for some disagreement we find in the literature and gives us new insights into both the semantics of symmetric predicates and the semantics of NRCs.

Concerning the first point, we could show that our data motivate a simplification of the theory of symmetric predicates developed in Winter (2016), where we could eliminate the mapping from protopredicates to binary symmetric predicates. Note that Winter:16 candidate for a universal, given in (19), can still be maintained in our system.

(19) **Symmetry as collectivity**: All symmetric binary predicates, in all natural languages, are derived from collective concepts through c-type protopredicates and the symmetric-binary strategy. (Winter, 2016: 30)

In our system, we assume the same protopredicates as Winter (2016) but only the formation of unary collective and binary non-symmetric ordinary predicates. It is, of course, more transparent to realize these predicates in such a way that the number of syntactic arguments matches the number of semantic participants. This 1-to-1 mapping is violated for binary symmetric verbs. Consequently, Winter:16 observation that unary collective predicates are primary to binary symmetric predicates is fully incorporated in our analysis.

As for the analyses of NRCs, our study provided new evidence that the antecedent of an NRC needs to be a discourse referent that is introduced within the clause hosting the NRC. This discourse referent need not be explicitly linked to a syntactic constituent, though it is not sufficient to be able to create such an antecedent by some general discourse process. Our data also support a combination of semantic and syntactic factors for RRC-attachment. This double requirement is responsible for the unavailability of SpAs with RRCs.

The careful reader will have noticed that the original well-formed examples of SpA-construal from Moltmann (1992) and her generalizations from them involved the coordination of sentences. Clearly, our paper did not say anything about such cases; we explained the contrast between (2b) and (3) but did not say anything about the contrast between (1) and (2a). Our analysis suggests that there needs to be an appropriate plural discourse referent introduced in the coordination for (1) to be grammatical and that such a discourse referent is absent in (2a).

A natural speculation would be that the subjects of the coordinated clauses in (1) form a joint discourse function. Rooth (1992: 91) explicitly connects his analysis of contrastive focus to the phenomenon of split antecedents with plural discourse anaphora, introducing an appropri-

[14] Stockwell (2017) reports similar effects of symmetry on the acceptability of participant mismatch VP ellipsis.

(i) a. John_1 **met** with Mary_2, even though she_2 didn't want to ⟨**meet** him_1⟩.

b. *John_1 **criticised** Mary_2, even though she_2 wasn't supposed to ⟨**criticise** him_1⟩.

ate joint discourse referent in the interpretation of a sentence with two foci. It is plausible to assume the formation of discourse referents for other discourse functions as well. Moltmann's observations on SpAs seem to pattern with complex topics as in (20). The question in (20) marks Alex and Chris as jointly bearing the discourse function topic. In (20a) and (20b), the two re-appear in different clauses but with the same grammatical function, which is a fully acceptable answer to the question. In (20c), the two elements of the topic have distinct grammatical functions, which blocks the association with the same discourse function.

(20) Wie kommen Alex und Chris heute nach Hause?
'How will Alex and Chris get home today?'
a. ALEX läuft und CHRIS fährt mit der U-Bahn.
'Alex will walk and Chris will take the subway.'
b. Jo bringt ALEX nach Hause und Kim fährt CHRIS heim.
Jo will walk Alex home and Kim will give Chris a ride.'
c. ?*ALEX läuft und Kim fährt CHRIS heim.
'Alex will walk and Kim will give Chris a ride.

If this speculation goes in the right direction, Moltmann's generalization would be reducible to general processes of the creation of discourse functions across coordination in combination with our generalization for the antecedent construal for NRCs.[15]

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[15] An initial look at a wider range of data suggests that having a joint discourse function is more important than having the same grammatical function. In (ia), the two antecedents constitute a joint discourse function but bear different grammatical functions. In the less acceptable (ib), both are subjects but differ in their discourse status.

(i) Wer fällt dir grad im Bus auf? 'Who are you noticing in the bus right now?'
a. Vorn sitzt KIM und hinten sehe ich ALEX, die sich zum verwechseln ähnlich sehen.
'Kim is sitting in the front and I spot Alex in the back, who resemble each other a lot.'
b. ?*Vorn sitzt KIM und hinten sieht mich ALEX, die sich zum verwechseln ähnlich sehen.
'Kim is sitting in the front and Alex spots me, ...

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Responsive predicates are question-embedding: Evidence from Estonian[1]

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Abstract. The proper semantic treatment of the complements of Responsive Predicates (ResPs), those predicates which may embed either declarative or interrogative clauses, is a long-standing puzzle, given standard assumptions about complement selection. In order to avoid positing systematic polysemy for ResPs, typical treatments of ResP complements treat their arguments either as uniformly declarative-like (propositional) or interrogative-like (question). I shed new light on this question with novel data from Estonian, in which there are verbs *think*-like meanings with declarative complements and *wonder*-like meanings with interrogative complements. I argue that these verbs' meaning is fundamentally incompatible with a proposition-taking semantics for ResPs, and therefore a question-taking semantics is to be preferred.

Keywords: responsive predicates, embedded clauses, interrogatives, contemplation, Estonian.

1. Introduction

It is well-established that clausal-selecting predicates differ in the types of complements they permit. **Rogative** predicates (terminology after Lahiri 2002) like *wonder* and *ask* only permit interrogative complements, **anti-rogative** predicates like *think* and *believe* only permit declarative complements, and **responsive** predicates (ResPs) like *know* and *say* permit either type of complement. The three predicate classes are exemplified in (1).

(1) a. Prudence thinks/believes {that/*why} wombats are herbivores. *Anti-rogative*
 b. Prudence wonders/asks {*that/why} wombats are herbivores. *Rogative*
 c. Prudence knows/says {that/why} wombats are herbivores. *Responsive*

Clausal arguments are argued in large part to be s(emantically)-selected (Grimshaw, 1979; Pesetsky, 1982, 1991)–that is, a clause-taking predicate lexically imposes a requirement that its complement be of a particular semantic type. ResPs pose a problem for this view given the widely-held assumption that declarative clauses denote propositions and interrogative clauses denote sets of propositions. Unless ResPs are systematically polysemous, there is no simple way for it to embed these two different types of arguments–and if they *are* systematically polysemous, it remains to be seen why that should be the case.

One indication we may not want to stipulate the selectional behavior of such verbs directly into the lexicon as opposed to deriving their selectional restrictions from independent properties of their semantics is that this tripartite categorization is also attested cross-linguistically. For

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instance, in Estonian, just as in English, there are indeed clausal-embedding verbs of all three selectional categories:

(2) a. Kirsi usub, {et/*miks} lapsed on aias.
Kirsi believes that/why children are garden.INESS
'Kirsi believes that/*why the children are in the garden.' *Anti-rogative*
b. Kirsi küsib, {et/miks} lapsed on aias.
'Kirsi asks *that/why the children are in the garden.' *Rogative*
c. Kirsi teab, {et/miks} lapsed on aias.
'Kirsi knows that/why the children are in the garden.' *Responsive*

Indeed, far from being a quirk of English, the differential selectional behavior of clausal-embedding predicates is observed in many languages: therefore, to the extent possible, a general solution is preferable. But how can we reconcile our assumptions about selection with the existence of responsive verbs like *know*?

1.1 Prior solutions to the ResP puzzle

The dominant approach to solving the ResP puzzle is to reduce all clausal complements of ResPs to the same type. One flavor of this tactic is the *proposition-embedding* account of ResPs, in which the meaning of interrogative complements is reduced to a proposition, which are taken to be the denotation of declarative clauses (Karttunen, 1977; Groenendijk and Stokhof, 1984; Heim, 1994; Dayal, 1996; Lahiri, 2002; Egré, 2008; Spector and Egré, 2015; Mayr, 2017: a.o.). While this approach captures the behavior of responsive predicates, the existence of anti-rogatives becomes mysterious, since it will be necessary to justify the exclusion of type-shifted interrogative complements on independent grounds.

The mirror-image approach is the *question-embedding* account, which reduces the meaning of a declarative clause to a question, a position articulated most completely by Uegaki (2016) (though see also Elliott et al., 2017). Uegaki's primary motivation for this approach comes from contrasts between anti-rogatives and ResPs with regards to their entailment patterns with content DP complements:

(3) a. John believes the rumor that Mary left.
$\vDash$John believes that Mary left.
b. John knows the rumor that Mary left.
$\nvDash$John knows that Mary left. (Uegaki 2016: 626)

Uegaki argues that only a propositional-embedding predicate can yield the entailment in (3a), and if *know* were also embedding propositions, there would be no way to derive the contrast between (3a) and (3b). There is no way, he claims, for *the rumor that Mary left* to denote a proposition without yielding the entailment of (3b). The question-embedding approach to ResPs must also argue on independent grounds why any verb should be purely rogative.

A third option is to dispense with the assumption that declaratives and interrogatives denote different sorts of formal semantic objects to begin with, a treatment baked into frameworks like Inquisitive Semantics (Ciardelli et al., 2013; Theiler et al., 2016; Roelofsen, 2017; Roelofsen et al., to appear). Under such a view, the existence of ResPs is not only expected, but it is the default behavior of clausal-embedding verbs; the behavior of (anti-)rogatives must be derived on independent grounds. This option will not be considered in detail here, as the predictions it generates for ResPs are identical to the question-embedding perspective; both treat the denotation of any ResP complement clause as a set of propositions. Because this paper is only concerned with responsive predicates, it cannot adjudicate between this approach and a question-embedding approach.[2]

Ultimately, the treatment of ResPs should be empirically motivated: can we find ResPs whose meaning is fundamentally incompatible with one type of complement or another? In this paper, I will argue that the answer to this question is yes–and that the question-embedding semantics of ResPs is preferable–based on novel data from the Estonian verb *mõtlema* 'think, consider'. The basic fact which comprises the bulk of the argument is that *mõtlema* canonically signals that the attitude holder stands in a **belief** relation to an embedded declarative (4a), and an **ignorance** relation to the true answer to embedded interrogative (4b)-(4c):

(4) a. Liis mõtleb, et sajab vihma.
Liis MÕTLEMA that falls rain
'Liis thinks that it's raining.'

b. Liis mõtleb, kas sajab vihma.
Liis MÕTLEMA Q falls rain
'Liis wonders whether it's raining.'

c. Liis mõtleb, kus sajab vihma.
Liis MÕTLEMA where falls rain
'Liis wonders where it's raining.'

The chimerical behavior of *mõtlema*, in which its interpretation is fundamentally dependent on the type of its complement, is superficially surprising. However, I argue that *mõtlema* provides evidence in favor of the question-embedding account. In a nutshell, *mõtlema* indicates that an individual is thinking *about* something. That something cannot be plausibly thought of as being propositional.

The paper is structured as follows. Section 2 discusses properties of the *mõtlema* and argues that its behavior cannot be fully capture by a proposition-taking semantics. Section 3 introduces the idea of a contemplation state and argues that *mõtlema* can be profitably analyzed as simply situating an embedded question in an attitude holder's contemplation state. Section 4 derives the interpretation of *mõtlema* in context from its denotation and general pragmatic principles. Section 5 concludes.

[2]Groenendijk and Stokhof (1984, 1989) also treat clausal complements as uniform, but, for them, the denotation of embedded questions is propositional.

2. The case of Estonian *mõtlema*

What is striking is that *mõtlema* seems to convey radically different attitudes–paraphrasable roughly as *think* and *wonder*–depending on the type of its complement. A natural reaction to examples like (4) would be to simply assume that there are two different lexical items who share the same phonological form of *mõtlema*: one which takes a declarative complement and one which takes an interrogative.

While this approach could quite possibly achieve descriptive adequacy, I believe it falls short of explaining the pattern for at least two reasons. The first is that *mõtlema* is not alone in this kind of behavior even in Estonian: similar patterns can be observed with *mõtisklema* 'consider', *vaatlema* 'observe,' and *meelisklema* 'muse'.

(5) Mõtisklen, et kuidas teie ärimudel skaleeruvale startupile
contemplate.1SG that how your business.model scalable.ALL startup.ALL
vastab.
satisfies.3SG
'I'm wondering how your business model succeeds as a scalable startup.'

(6) Autor vaatleb, kas põgenedes on võimalik tagasi jõuda.
author observes Q escape.PL.INESS is possible back be.able.INF
'The author looks at whether it is possible to escape.'[3]

Furthermore, the Finnish verb *miettiä*, a presumed cognate of *mõtlema*, displays the same sort of behavior, suggesting that the generalizations to be derived about *mõtlema* can at least be extended to neighboring languages:

(7) a. Mietin, olisi=ko nyt hyvä hetki myydä.
think.1SG would.be=Q now good moment sell.INF
'I wonder whether now would be a good time to sell.'
b. Mietin, että nyt voisi olla hyvä hetki myydä.
think.1SG that now might be.INF good moment sell.INF
'I think that now might be a good time to sell.'[4]

The second argument against a bifurcated lexical approach comes from conjunction. A declarative and interrogative complement can be felicitously conjoined under a single use of *mõtlema* with a sufficiently rich context. In these instances, the interpreted attitudes are equivalent to each clausal complement with *mõtlema* in isolation.

(8) *Context: Your computer won't turn on. You think the problem is the hard drive, but you aren't completely sure so you take it to a computer repair shop. You also don't know if your computer is beyond the point of saving. Later, you tell your friend:*

[3] `http://opleht.ee/2014/03/kolmeteistkumnenda-aasta-kolmteist-parimat-2/`
[4] Thank you to an anonymous reviewer for these examples.

Ma mõtlen, et mu kõvaketas on katki ja kas nad saavad selle korda.
I MÕTLEMA that my hard.disk is broken and Q they can.3PL it.GEN fix.INF
'I think that my HDD is broken and I wonder if they can fix it.'

These two uses of *mõtlema* in (4) seem at odds with one another, given that belief and ignorance are contradictory. While belief is doxastic commitment on the part of the attitude holder towards a proposition *p*, ignorance entails the *absence* of any such commitment to *p* or any of its alternatives. Cross-linguistically, verbs that encode representational belief (in the sense of Hintikka 1962) when taking a declarative complement typically do not also permit interrogative complements (Egré, 2008; Spector and Egré, 2015) modulo doxastic factives like *know*.

Therefore, an analysis of *mõtlema* has two major desiderata: one, it needs to treat clausal complements in a unified way, and two, it needs to derive the interpretation of *mõtlema* with different complements. In pursuit of these goals, I turn now to consider what, exactly, *mõtlema* can mean in different contexts.

2.1 Interpretation with embedded declaratives

Out of the blue, *mõtlema* utterances with declarative complements are interpreted simply as belief ascriptions:

(9) Nad mõtlevad, et valijad on lambad.
they MÕTLEMA that voters are sheep
'They think that voters are sheep.'

However, *mõtlema* differs from the ResP *know* (and its Estonian counterpart *teadma*), in that it is nonfactive, despite the fact that both verbs can be used to ascribe a belief to an attitude holder. Hence, although the *but*-clause in (10) is judged infelicitous because in contradicts the presupposition introduced by *know*, its correspondent in (11) is not:

(10) Ambrose knows that it is raining, #but it isn't raining.

(11) Liis mõtleb, et sajab vihma, aga ei saja.
Liis MÕTLEMA that falls rain but NEG fall.NEG
'Liis thinks that it's raining, but it isn't raining.'

Mõtlema may also be used to attribute beliefs to third parties with whom the speaker disagrees: in (12), the speaker indicates that Aarne has a belief that Helsinki is in Sweden, and follow up this claim with an explicit declaration that the attitude holder is incorrect. In these cases, *mõtlema* behaves similarly to well-studied verbs of representational belief like *think* and *believe*, or their approximate Estonian counterparts, *arvama* and *uskuma*.

(12) Aarne mõtleb, et Helsingi on Rootsis. Ta on nii loll!
Aarne MÕTLEMA that Helsinki is Sweden.INESS he is so dumb
'Aarne thinks that Helsinki is in Sweden. He's so dumb!'

Unlike *arvama*, *mõtlema* may be used to introduce beliefs not actually held by the attitude holder in the world of evaluation, but rather hypothetical scenarios she is entertaining. For instance, in (13), the speaker is explicit about her commitment to dinosaurs not being alive, but nonetheless, she is considering the counterfactual situations in which they are indeed alive.

(13) *Context: I am discussing with my friend what life would be like if an asteroid had not collided with the earth at the end of the late Cretaceous period.*

Ma	{mõtlen/#arvan},	et	dinosaurused	on	ikka	elus,	kuigi	ma	tean,	et	ei
I	MÕTLEMA/think	that	dinosaurs	are	still	alive	although	I	know	that	NEG

ole.	
be.NEG	

'I'm thinking about dinosaurs still being alive, even though I know that they aren't.'

In all, the interpretation of *mõtlema* with a propositional argument *p* is dependent on the speaker's assessment of the attitude holder's doxastic state. If the attitude holder is assumed to hold a belief that *p*, *mõtlema* can felicitously be used to describe this belief. However, if the context is such that the speaker's beliefs contradict *p*, then *mõtlema* receives an imaginal interpretation. These generalizations are summarized in (14).

(14) Interpretations of *x mõtlema p*

	$DOX_x^w \subseteq p$	$DOX_x^w \cap p \neq \emptyset$	$DOX_x^w \cap p = \emptyset$
x mõtlema p	'x thinks p'	'x thinks about the possibility that p'	'x imagines p'

2.2 Interpretation with embedded interrogatives

Unlike with declarative complements, *mõtlema* with an embedded interrogative typically has an inquisitive flavor. For instance, a speaker could felicitously utter (15) in a context in which she is not expecting any company and there is a knock by an unknown person at the door:

(15)

Ma	mõtlen,	kes	ukse	taga	on.
I	think.1SG	who	door.GEN	behind	is

'I wonder who is at the door.'

Given that *mõtlema* does not seem to entail commitment with an embedded declarative, it is worth asking ourselves whether it entails agnosticism to the true answer to an embedded interrogative. As it turns out, the answer is no, given a sufficiently rich context.

(16) *Context: Liis hears a knock at the door. She was expecting her friend Kirsi to come over, but she fantasizes for just a moment all the famous celebrities who could be showing up instead.*

Liis	mõtleb,	kes	ukse	taga	on,	kuigi	ta	teab,	et	on	Kirsi.
Liis	thinks	who	door.GEN	behind	is	although	she	knows	that	is	Kirsi

'Liis is thinking about who is at the door, even though she knows, that it is Kirsi.'

Again, just as with embedded declaratives, the interpretation of *mõtlema* with an embedded interrogatives depends on the attitude holder's doxastic state: if she is agnostic about the true answer to *q*, *mõtlema* is much like English *wonder*, but if she is not, then the question is treated as 'musing' or 'hypothetical'.

(17) Interpretations of *x mõtlema q*

	$\exists p_n \in q[DOX_x^w \subseteq p_n]$	$\nexists p_n \in q[DOX_x^w \subseteq p_n]$
x mõtlema q $(q = \{p_1, p_2, ...\})$	'x thinks about q'	'x wonders q'

2.3 Challenges for Proposition-Taking Theories of ResPs

The two main reductive approaches for the semantics of ResPs, as discussed in §1, are to treat all their clausal complements as proposition-denoting or question-denoting. While in principle the proposition-denoting story is appealing, as it makes the simplifying reduction from questions to propositions as opposed to the complexifying operation in the other direction, *mõtlema* is simply not compatible with a propositional semantics when it has an interrogative complement.

The motivations for the proposition-taking analysis of ResPs are, at first brush, incredibly appealing. George (2011) and Spector and Egré (2015) articulate a key intuition about the relationship between the meanings of responsive predicates with declarative complements (18a) and interrogative complements (18b). Namely, that in worlds where the handmaiden is the true chalice thief, (18a) and (18b) are essentially equivalent:

(18) a. Gertrude knows that the handmaiden stole the chalice.
b. Gertrude knows who stole the chalice.

To put it more plainly, to *know* an embedded interrogative *q* means, for some *p* that is the true answer to *q*, to be in a *know*-relationship to *p*. This straightforward propositional meaning for interrogative complements does not hold for rogative verbs like *ask*, which do not similarly encode a relationship between an individual (namely the 'attitude holder') and a proposition.

(19) a. Agatha asked what Vlad added to the tripe.
b. *Agatha asked that Vlad added polonium to the tripe.

Under this view, *ask* is a bonafide question-taking verb, but *know* selects propositions. In Estonian, if we consider only the semantics of *teadma* 'know', this pattern holds up: *teadma q* is interpreted as *teadma p* for some *p* which is an answer to *q*:

(20) Eestlased teavad, mis kohv on Ladina-Ameerikast.
Estonians know what coffee is Latin-America.ELA
'Estonians know which coffee is Latin American.'

$\rightarrow \exists$p[p = ‘x coffee is Latin American’ and **know**(Estonians, p))]

For Spector and Egré (2015), these observations are taken as evidence that ResPs take propositional complements. However, the pattern is not the same for *mõtlema*: not only does *mõtlema q* not entail *mõtlema p* for any *p* which is an answer to *q*, it implicates ignorance on the part of the attitude holder:

(21) Liis mõtleb, kes ukse taga on.
Liis thinks who door.GEN behind is
‘Liis wonders who's at the door.’
$\rightsquigarrow$ Liis doesn't know who's at the door.

While the propositional complement analysis correctly predicts that responsive predicates can embed both declaratives and interrogatives, this is a feature shared with the question-embedding account. In addition to the burden of coming up with a propositional meaning for the interrogative complement in (21), the account faces two chief explanatory hurdles. The first is that there must be an operator or other mechanism which does the clausal type-shifting of interrogative ResP complements to begin with, which in the absence of independent motivation must be stipulated. The second is that additional stipulations are required to explain the ungrammatically of sentences like (22), where an anti-rogative verb appears with an embedded interrogative:

(22) *Shirley thinks whether she will win the lottery.

If type-shifting of embedded interrogatives is an available option for ResP complements, an independent reason for ruling out sentences like (22) is required. Accounts vary on how precisely they achieve this, though many problems arise from the various approaches. While an examination of each of these approaches is outside the scope of this paper, more extensive argumentation about the inadequacies of a question-to-proposition complement approach can be found in Uegaki (2016).

3. *Mõtlema* as a question-embedding verb

In order to capture the ”contemplative” nature of a *mõtlema* utterance, I propose that contemplatives like *mõtlema* straightforwardly denote a relationship between an attitude holder and what I term her CONTEMPLATION STATE, and as I will argue, this denotation captures *mõtlema*'s intuitive range of meanings combined with relatively fundamental pragmatic principles.

3.1 Contemplation states

Attitude verbs specify relationships between attitude holders and propositions in a variety of different ways. For instance, some verbs make reference to an individual's beliefs, such as the many attitude verbs which relate propositions to the doxastic states of individuals like *think* and *believe* (Hintikka, 1962; Kratzer, 2006; Anand and Hacquard, 2013, 2014: *inter alia*). Others, like *want*, relate an attitude holder to her desires.

It is a question of serious theoretical importance which attitudes linguistic expressions are sensitive to. The intuition with *mõtlema* utterances is that they are used to describe the content of what one is thinking about, rather than what they are committed to. It is easy, for instance, for one to think about both the way the world *is* and the ways it *could be*, and compare those side by side. I define this imaginal space as a 'contemplation state' of an individual as in (23).

(23) A **contemplation state** of an individual x CONTEM_x^w is the set of pairs of sets of worlds and issues (sets of sets of worlds) $\{\langle W_1,Q_1\rangle, \langle W_2,Q_2\rangle,...,\langle W_n,Q_n\rangle\}$ such that for all $\langle Q_m,W_m\rangle$, Q_m is a partition of W_m and Q_m is under active consideration by x in w.

In prose, a contemplation state consists of pairs of sets of worlds of evaluation W and ways of carving up that set of worlds Q, much like the partition semantics for questions of (Groenendijk and Stokhof, 1984). A contemplation state is, in effect, an attitude holder's 'mental workspace.' The precise W may vary: a potential default W might be the set of world's compatible with x's beliefs, since frequently people are tasked with situating themselves in (and uncovering truths about) the actual world modeled by their beliefs. There are, of course, many possible partitions over the same domain of worlds; and as the definition is formulated here, multiple questions may in principle be in an agent's contemplation state simultaneously.[5]

3.2 *Mõtlema* and contemplation

With the definition of contemplation in mind, I propose that *mõtlema* straightforwardly denotes a relationship between an attitude holder and an embedded question, and militates that that question forms a partition in the attitude holder's contemplation state. The formal denotation for *mõtlema* is given in (24).

(24) $[\![\textit{mõtlema}]\!]^w = \lambda x_e.\lambda Q_{\langle st,t\rangle}.\exists W_{st}[\langle W,Q\rangle \in \text{CONTEM}_x]$

Informally, this denotation captures the intuition that *mõtlema* is used to indicate that an individual is thinking about a question: but while this question is under active consideration, the attitude holder need not have any other attitude in particular toward it.

Given the denotation of a contemplative verb complement as that of a question, it is necessary to invoke some sort of type-shifting operation for the complements that superficially appear to be declaratives. Following Uegaki (2016), I utilize the type-shifting operator ID, which takes a proposition as an argument and returns the singleton set containing that proposition. For independent evidence motivating the existence of this sort of type-shifting operator, see Partee

[5]These questions may even be partitions of different W's, as in examples like the following:

(i) *Context: I invited John and Mary, two professors, for dinner. Only one said they would come, but I can't remember which, but I know that they don't have the same taste in food.*
I am contemplating which professor is coming to dinner and what I will cook.

It is not difficult to imagine that the speaker's space of possible meals to cook is at least partially dependent on which professor will be in attendance. Should we involve a contemplation state in the meaning of the English verb *contemplate*, the relevant questions may partition different sets of worlds.

(1986). The denotation of ID is given in (25).

(25) $[\![\text{ID}]\!]^w = \lambda p.[\lambda q.q{=}p]$

What ID allows us to do is pair *mõtlema* with embedded declaratives without a type mismtch. If *mõtlema Q* implicates ignorance, it may not be immediately obvious why *mõtlema P* does not generate the same implicature; the derivation of different interpretations of *mõtlema* will be elaborated in Section 4.

3.3 Comparison with Rawlins (2013)

The idea of non-representational ways of reasoning about alternatives is not new. Rawlins (2013), for instance, references the related but distinct concept of abstract 'content.' Content, in the sense of Hacquard (2006, 2010), is a property of eventualities: the content of a belief eventuality, for instance, is the intersection of all of the propositions that the relevant individual believes.

Rawlins's notion of content is slightly different. For him, content is a curried equivalence relation on worlds, which partitions $\mathbb{W}$ into sets of worlds which satisfy this equivalence relation, intuitively partition the space of possible worlds as a set of alternatives.

Unlike Rawlins's content, the idea of contemplation introduced here is inherently cognitive and agent-oriented, like belief or desire. The primary empirical focus of Rawlins is English PPs headed by the preposition *about*, which is highly promiscuous in the sorts of complements it may appear in. The motivation of contemplation as I have defined it is a relatively small class of attitude verbs which resist analysis as proposition-embedding despite their frequent use in representational contexts.

Rawlins proposes that attitude predicates like *think* denote content-bearing properties of eventualities in the vein of Kratzer (2006) and Moulton (2009). But a reason we might wish to have a distinct notion of contemplation apart from content is precisely the fact that we see verbs like *mõtlema* and *contemplate*, which appear with declarative and interrogative complements without the crutch of a content-selecting PP head like *about*.

As for why not just assume that *mõtlema* takes content-complements, note also that whereas questions and NPs may be the complement of *about*, propositions may not. So the types of semantic object that may constitute an argument of an Estonian contemplative versus *about* may also differ in a more ontologically robust way[6]:

[6]It is also worth mentioning that NPs marked with allative case in Estonian are also permissible as complements of *mõtlema*:

(i) Ta mõtles Suurele Vennale.
he MÕTLEMA.PAST big.ALL brother.ALL
'He thought about Big Brother.'

It might be tempting for this reason to throw up our hands and simply treat *mõtlema* as *think* and the allative case as *about* here–however, the allative case marking is not licensed in other complements of *mõtlema*, nor does

(26) *Joyce thought about (that) it was raining.

In short, Rawlins's content and my contemplation states broadly share similarities in describing ontologically underspecified notions of largely conceptual semantic objects as partitions over sets of worlds. Contemplation is fundamentally attitudinal: a tool of characterizing particular mental states, namely the internal consideration of a question which may or may not be resolved. Content is also a general way of describing the content of an attitude as an equivalence relation over sets of worlds. One way in which contemplation is perhaps more flexible is in the ability of different elements in the contemplation state to partition different sets of worlds with different contextual domain restrictions; it is not clear how such cases might be tackled in Rawlins's system.

3.4 Comparison with Ciardelli and Roelofsen (2015)

The approach sketched here also overlaps in many ways with Ciardelli and Roelofsen's (2015) extension of epistemic logic, in which agents can both *know* information and *entertain* issues. In particular, there is some similarity between contemplation and C&R's *entertain* modality E_a, which has the following semantics:

(27) Semantics of E_a (C&R 2015: 3.4)

Let M be an inquisitive model and s be an information state in M.
$\langle M, s\rangle \models E_a\varphi \Leftrightarrow$ for any $w \in s$ and for any $t \in \Sigma_a(w), \langle M, t\rangle \models \varphi$

In other words, an agent a entertains φ iff in each world w in her information state, every resolution of her inquisitive state supports φ. When φ is interrogative, entertainment is quite similar to contemplation: the speaker declares a particular issue to be settled by resolutions of her inquisitive state.

However, when φ is a declarative, $E_a\varphi$ entails knowledge of φ, since the inquisitive state with respect to φ is already resolved.

The crucial difference is that this knowledge entailment is not present for contemplation, which merely asserts that an issue is being considered by an agent, irrespective of her actual beliefs. This is evidenced by 'faultless retraction' cases in Estonian with *mõtlema*, as in the now-familiar dinosaur example:

(28) Ma mõtlen, et dinosaurused on ikka elus, kuigi ma tean, et ei ole.
I think that dinosaurs are still alive although I know that NEG be.NEG
'I'm thinking about dinosaurs still being alive, even though I know they're not.'

If *mõtlema* has the denotation in (24), (28) is not contradictory: the speaker's contemplation of

this observation help us understand why *mõtlema* can embed declaratives but *about* cannot. But the connection certainly merits further investigation.

the existence of dinosaurs may or may not match her true beliefs. But if *mõtlema* denotes E_a, (28) *is* contradictory: the speaker indicates she believes both that dinosaurs are still alive and that they are not alive.

We can rectify this contradiction if each clause is evaluated dynamically relative to a different information state: In the *mõtlema*-clause, the speaker behaves as if she is adopting an information state in which dinosaurs exist. In the second clause, the speaker reveals that her information state in w_0 is one in which dinosaurs do not exist.

But, if an information state-shifting mechanism is in principle a possibility, we have no reason to expect the infelicitous English example in (29) should be anomalous:

(29) #I wonder why dinosaurs are still alive, even though I know they aren't.

While the CONTEM modality and the E modality are similar both in nature and intent, the fact that $E_a\varphi$ entails $K_a\varphi$ in C&R's logic necessitates additional mechanisms to correctly predict the felicity of faultless retraction with *mõtlema*.

4. Pragmatic derivation of meaning with *mõtlema*

4.1 Embedded interrogatives

Recall one of the central puzzles presented in this paper: how do verbs like *mõtlema* yield such different interpretations dependent solely upon the type of their complement? The semantics here involves an agent weighing a set of alternatives–different possible resolutions to a question–against one another. If a *mõtlema*-sentence expresses a purely mental calculus about an agent's evaluation of alternatives: why should such a sentence indicate anything about 'wondering' or 'ignorance'?

Upon closer investigation, that *mõtlema* with an embedded interrogative canonically implicates ignorance is unsurprising given its semantics. If a person is weighing different alternative answers to a question against one another, the most natural reason for them to do so is that they are seeking the true answer to the question. While people can and do 'muse' about questions regularly, the precise reason for them doing so becomes much clearer in context. If a knock is heard at the door, a speaker who utters (28) can reasonably be understood to be ignorant of the true identity of the knocker. If they did in fact know who was at the door, it would be quite bizarre for them to indicate they were merely thinking about the possible alternatives, because it would not be a sufficiently informative reaction to the situation, a Quantity violation in the spirit of Grice (1975).

We can generalize this intuition: in any case where a *mõtlema P* alternative to a *mõtlema Q* utterance could have been cooperatively uttered by the speaker to further a conversational goal, the *mõtlema P* version will be more informative. To illustrate, let us revisit the now familiar case of (4), reprinted below as (30), with the attitude holder's contemplation state:

(30) a. Liis mõtleb, et sajab vihma.
Liis thinks that falls rain
'Liis thinks that it's raining.'
CONTEM$_{\text{Liis}}$ = $\langle\{$it is raining$\}$, W$_1\rangle$

b. Liis mõtleb, kas sajab vihma.
Liis thinks Q falls rain
'Liis wonders whether it's raining.'
CONTEM$_{\text{Liis}}$ = $\langle\{$it is raining, it is not raining$\}$, W$_2\rangle$

In both cases, the W–the set of worlds under consideration–is taken by default to be the set of worlds compatible with Liis's beliefs in the absence of evidence to the contrary. In the case of (30a), Liis is only considering worlds in which it is raining, whereas (30b) includes both rain-worlds and non-rain-worlds. Holding all of Liis's other beliefs constant, the set of worlds in Liis's contemplation state in (30b) is a superset of those in (30a).

Because (30b) allows for there to be both rain-worlds and non-rain-worlds in Liis's contemplation state–and again, these worlds are those compatible with Liis's beliefs. Because there is the additional possibility of non-rain-worlds in Liis's contemplation state with the embedded interrogative but not the embedded declarative, (30a) is a strictly more informative utterance. If only the proposition 'it is raining' is compatible with Liis's doxastic state, there is a pragmatic preference for uttering (30a) over (30b).

There are cases where *mõtlema Q* does not license an ignorance inference, but these are precisely the sort of cases where the 'contemplative' nature of an agent is at-issue.

(31) *Context: Siim is reading a book about Estonian history. It got him thinking about all the reasons there were for Estonia to lose the war with Russia in the 1500s.*

Siim mõtleb, miks Eesti kaotas sõja.
Siim thinks why Estonia lost war
'Siim is thinking about why Estonia lost the war.'

In context, Siim knows full well why Estonia lost the war: for the reasons delineated in his book. Nonetheless, the topic sparked his imagination, and all of those reasons–as well as possible alternatives–are now a topic of active consideration for him. He is not ignorant as to why the war was lost, but merely a curious pontificator. While *mõtlema* can implicate ignorance towards an embedded question, this arises from the pragmatics of contemplation, rather than an entailment in the lexical entry for *mõtlema*.

This is a different route to agnosticism than the one taken by true anti-rogatives. For instance, (Uegaki, 2016) takes anti-rogatives like *wonder* to presuppose ignorance: i.e., that at least two of the alternatives in the embedded interrogative are live possibilities for the attitude holder. This is cashed out as a presupposition of these predicates that the cardinality of their complement is at least 2.

(32) $[\![\text{wonder/ask/inquire}]\!]^{w}(Q)(x)$ is defined only if the following proposition is compatible

with x's beliefs: $\lambda w.\exists p \in Q[p(w)] \wedge \exists p \in Q[\neg p(w)]$ (Uegaki 2016: 647)

While Uegaki's presupposition captures the facts nicely for *wonder*, it does not make quite the right predictions for all anti-rogatives, like Estonian *küsima* 'ask'. Consider the following sentence, uttered to describe a pedagogical context:

(33) Õpetaja küsib, kas [p] ahtushäälik on.
teacher asks Q fricative is
'The teacher asks whether [p] is a fricative.'

Presumably the teacher actually knows the answer to the embedded question; (33) simply describes an inquisitive speech act he is performing in order to quiz students on their knowledge. By the letter of Uegaki's definition, this renders the presupposition of *küsima* unsatisfied. What is crucial is that the teacher is *behaving as though* he does not know the answer to the question in some relevant way. Therefore, I propose a small tweak to Uegaki's definition, bolded:

(34) $[\![\text{wonder/ask/inquire}]\!]^w(Q)(x)$ is defined only if the following proposition is compatible with **what x presents to be x's beliefs**: $\lambda w.\exists p \in Q[p(w)] \wedge \exists p \in Q[\neg p(w)]$

Since *wonder* can only take questions as complements, this requires that the subject is 'wondering' about at least two possible alternatives. Even if the type-shifted version of an embedded interrogative is available to *wonder*, a question-version of a declarative sentence contains only one proposition. While I hesitate to make a direct comparison between *mõtlema* and *wonder* per se, suffice it to say that *mõtlema* has no such presupposition of ignorance–which may, in turn, connect to its freer range of permissible complements than *wonder*.

4.2 Embedded declaratives

We have seen many uses of *mõtlema* paired with a declarative complement which most naturally generates a belief interpretation, despite the fact that nothing about the proposed contemplative semantics for *mõtlema* entails such an interpretation. To see how belief interpretations may naturally arise, consider the following:

(35) Mu kass mõtleb, et pitsapoiss on mu omanik.
my cat MÕTLEMA that pizza.boy is my owner
'My cat thinks that the pizza boy is my owner.'

In a typical situation, no ignorance of any sort is implicated by uttering (35): the speaker is intending to (anthropomorphically) ascribe a belief to his cat, namely the belief that the pizza boy is the speaker's owner (the pizza boy brings the speaker food, the ostensible mark of ownership).

Why should this be the case? Note that a *mõtlema p* sentence requires its complement to first be type-shifted into a set of propositions through application of ID. The attitude holder is then taken to be contemplating a single-alternative question, which constitutes a trivial partition over the contextually relevant set of worlds.

For similar reasons to *mõtlema q* implicating ignorance, *mõtlema p* implicates belief. If an agent only has one alternative under consideration, a natural inference is that that alternative is the most viable candidate for the actual world, as far as the agent is concerned. Were there to be multiple candidates for true resolutions to a particular question under discussion (with respect to some agent's epistemic state), it would be misleading to utter *mõtlema p*, because the ¬P candidates are not mentioned. In normal circumstances, then, the speaker is taken to be asserting, indirectly, information about an agent's beliefs. In the case of (35), the speaker emphasizes that his cat is only considering the alternative where the pizza boy is the speaker's owner, rather than any other possible state of affairs.

This indirect method of belief ascription also naturally carries the implication that the purported belief in P is somehow 'weaker' than total commitment. While describing beliefs with *mõtlema* is frequent in naturally occurring speech, there exist other belief verbs like *arvama*, *uskuma*, and *teadma* which lexically encode this belief. Because alternative ways of describing belief that *entail* that belief are available, the use of belief-implicating *mõtlema* is weaker by comparison. In effect, there is pragmatic competition between different verbs which can functionally be used to ascribe belief.

This line of thinking makes empirically testable predictions. For instance, consider the case of predicates of personal taste. When a PPT under a belief verb, the understood interpretation is that the 'judge' against whom the truth of the embedded predicate (following Stephenson (2007)) is evaluated is the attitude holder. In the intended interpretation of (36), the speaker's sister is the one who judges chocolate to be delicious. There is a felicitous use of *mõtlema* here, under the somewhat anomalous reading where the speaker's sister is asserting chocolate to be delicious as an objective truth, rather than merely her opinion, deriving the anomalous interpretation that she intends to project her opinion by fiat:

(36) Mu õde {arvab/#mõtleb}, et šokolaad on maitsev.
my sister thinks that chocolate is delicious
'My sister thinks that chocolate is delicious.'

A speaker's commitment to her belief in a taste predicate must be total, under the assumption that taste predicates require a 'judge' to be semantically evaluated (Stephenson, 2007). Thus, if a commitment-entailing verb exists in the lexicon, ascribing a taste predicate belief to an individual should require the use of such a verb rather than a weaker, commitment-implicating verb like *mõtlema*.

Along similar lines, in cases where a speaker may intentionally wish to convey their relative lack of commitment, *mõtlema* should be preferable to *arvama*. This is indeed borne out. Simons (2007) points out that verbs like *think* can be used as not-at-issue matrix verbs in cases where speakers wish to distance themselves from commitment to an embedded *p* or indicate the weakness of their evidence for *p*. Should this be true, *mõtlema* is predicted to be preferred to *arvama* in cases where speakers intend to hedge. This is borne out in (37).

(37) *Context: My coworker asks where Mary is. I heard a rumor that she was on vacation in Boston, but I don't really know her well enough to be really sure.*

Ma {mõtlen/?arvan}, et Mary on Bostonis.
I think that Mary is Boston.INESS
'I think that Mary is in Boston.'

If a speaker uses *arvama* in (37), they indicate they have good evidence for knowing Mary's whereabouts, rather than hearsay or conjecture which might negatively impact their confidence in the assertion. When compared side by side in the same context, *arvama* is always judged to indicate that the attitude holder has greater commitment towards an embedded proposition than does *mõtlema*.

It is important, however, to keep in mind that the implicit belief associated with *mõtlema* is defeasible in a sufficiently rich context. While all else being equal, an utterance of *mõtlema p* would be likely to be understood as a belief report, in a context in which my beliefs are clearly contrary to that of the proposition that would be denoted by an embedded declarative, *mõtlema* can be used instead to indicate that I am hypothetically entertaining that proposition, as in the example reprinted below:

(38) *Context: I am discussing with my friend what life would be like if an asteroid had not collided with the earth at the end of the late Cretaceous period.*

Ma {mõtlen/#arvan}, et dinosaurused on ikka elus, kuigi ma tean, et ei
I MÕTLEMA/think that dinosaurs are still alive although I know that NEG
ole.
be.NEG
'I'm thinking about dinosaurs still being alive, even though I know that they aren't.'

5. Conclusion

In this paper, I have argued for an analysis of the superficially responsive Estonian verb *mõtlema* in which its surprising interpretative sensitivity to the type of its complement follows straightforwardly from a sufficiently bleached semantics and general pragmatic principles. Furthermore, the incompatibility of *mõtlema*'s interrogative complements with propositional interpretations suggest that analyses of responsive predicates which uniformly treat their complements as propositions cannot account for the behavior of at least some ResPs. And while the account presented here maintains the assumption that declarative and interrogative clauses denote different types (à la Uegaki, 2016), it could just as easily fit into the framework of (Theiler et al., 2016), who argue on independent grounds for a uniform typing of clausal complements.

In developing a semantics for *mõtlema*, also introduced a new type of attitude, contemplation, which broadly concerns an individual's mental workspace, and offers some empirical advantages over related proposals. The idea of contemplation spaces may also be useful in analyzing clauses which serve as the complements of verbs like *contemplate* in English, or even those which are complements of prepositions like *about*. If contemplation is indeed an ontological primitive to which at least *mõtlema* is sensitive, we would expect other languages to lexically encode information about contemplation states as well.

Ultimately, however we choose to represent clausal complements, an ideal big-picture account of clausal-embedding verbs would be able to derive their selectional behavior from independent properties of their lexical semantics. However, in order to push this idea to the limit, continued close investigation of these verbs in a wide variety of languages is absolutely essential.

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Presuppositional implicatures: quantity or maximize presupposition?[1]

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Abstract. Schlenker (2012) proposes that when framed within a modern Stalnakerian view of presupposition and common ground (Stalnaker, 1998, 2002), *Maximize Presupposition!* (Heim, 1991; Sauerland, 2008) can be viewed as a special case of the maxim of Quantity (Grice, 1975). We provide data suggesting that in some cases, *Maximize Presupposition!* applies even when speakers are not expected to use a presupposition as vectors of new information. We argue that these data support the view that *Maximize Presupposition!* is an independent pragmatic principle, distinct from Quantity.

Keywords: maximize presupposition, quantity, presuppositional implicatures, scalar implicatures.

1. Introduction

Much current discussion in pragmatics has been concerned with *Maximize Presupposition!* (Heim, 1991; Percus, 2006; Chemla, 2008; Sauerland, 2008; Schlenker, 2012), a rule of conversation proposed to account for the infelicity of certain utterances in contexts where a presupposition absent from them is felicitous. More specifically, we say that an utterance F is infelicitous if there exists some presuppositionally stronger alternative F' whose presupposition p is appropriate within the context. Such a statement will be clearer once the notions of *presuppositional alternative*, *presuppositional strength* and *presuppositional appropriateness* are properly defined.

In section 2, we present an overview of *Maximize Presupposition!* and the so-called presuppositional implicatures it predicts (Leahy 2016). Section 2.1 discusses the principle as it has classically been described (Heim, 1991; Percus, 2006; Sauerland, 2008), *viz.* as predicting how the use of presuppositionally weak alternatives will generate the inference that the presuppositions of their stronger alternatives are not common belief. In section 2.2, we discuss Chemla's (2008) arguments that adopting a modern Stalnakerian view of presupposition and common ground (Stalnaker, 1998, 2002) can account for the stronger inferences one gathers from the use of certain presuppositionally weak alternatives. In section 2.3, we discuss Schlenker's (2012) arguments that within this framework, one can understand presuppositional implicatures as following from the maxim of Quantity (Grice, 1975) rather than from an independent principle such as *Maximize Presupposition!*.

In section 3, we discuss problems with the proposals of Chemla and Schlenker. In section 3.1, we note that the notion of *authority*, introduced by Chemla to implement a modern Stalnakerian

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view, is too strong and predicts a number of unattested inferences. We propose to restrict his account by introducing the notion of speaker reliability. In section 3.2, we discuss how this notion makes different predictions depending on whether one treats *Maximize Presupposition!* as an independent principle or as a special case of Quantity. We offer data suggesting that it favors treating the principle as independent. In an appendix, which is not essential to our arguments, we spell out a proof of a result that is assumed in Chemla (2008).

2. Previous accounts of presuppositional implicatures

2.1. *Maximize Presupposition!*

In order to define the notion of presuppositional alternative, we must first define the set of *presuppositional scales* (Percus, 2006). Much like the scales used to define alternatives in neo-Gricean accounts of scalar implicature (Horn, 1972; Gazdar, 1979), this set will consist of a list of given pairs of lexical items. Here, we assume the set to contain exactly three elements, *viz.* the pairs $\langle a(n), the \rangle$, $\langle all, both \rangle$ and $\langle believe, know \rangle$.[2]

(1) Presuppositional scales
The set of presuppositional scales $\Sigma_\pi = \{\langle a(n), the\rangle, \langle all, both\rangle, \langle believe, know\rangle\}$

A given utterance will be a presuppositional alternative to another whenever both utterances differ syntactically only with respect to the substitution of one member from a scale for another member of that scale.

(2) Presuppositional alternatives
F' is a presuppositional alternative to F, written as $\mathrm{Alt}_\pi(F', F)$, iff F' is identical to F save for the substitution of one member of a scale in Σ_π for another of that same scale.

We say that F' is presuppositionally stronger than F whenever the set of worlds in which F is neither true nor false strictly entails the set of worlds in which F' is neither true or false.[3]

(3) Presuppositional strength
F' is presuppositionally stronger than F, written as $F' \prec_\pi F$, iff
$\{w \in W : F = \#\} \subset \{w \in W : F' = \#\}$

The scales assumed above have been laid out in such a way as to ensure that the substitution of the rightmost element of a given scale for its leftmost element results in a presuppositionally stronger alternative. Indeed, we will assume that the extensions of the members of any given scale are identical save for an added presupposition in the item on the right. The table below (Marty, 2017) displays for each scale what the added presupposition of the rightmost item is.

[2] See Rouillard and Schwarz (2017) for an account of presuppositional alternatives which dispenses with scales and opts instead for a complexity based account to alternatives modeled on that of Katzir (2007) for scalar implicatures.
[3] One might argue that another important condition on some F' being presuppositionally stronger than some F would be that both share the same asserted content. While this is certainly true, the scales assumed here make stating this condition unnecessary for our purposes.

weak item	strong item	differential presupposition
a	the	uniqueness of the complement
all	both	domain contains exactly two of the complement
believe	know	the complement is true

We will for the moment assume that an utterance F' is presuppositionally appropriate whenever for any proposition p presupposed by an utterance of F', p is common belief. The notion of common belief is defined relative to the set of beliefs of the speaker s and her addressee a. Assuming the operator B_i to signify '*i believes ...*', we can define the set $\mathscr{B}$ of higher-order beliefs of s and a according to the recursive definition in (4) (Stalnaker, 2002; Chemla, 2008; Schlenker, 2012).

(4) (i) $\forall i \in \{s,a\}, \mathrm{B}_i \in \mathscr{B}$
(ii) $\forall \mathrm{B}, \mathrm{B}' \in \mathscr{B}, \mathrm{BB}' \in \mathscr{B}$
(iii) Nothing else is in $\mathscr{B}$

Using this definition for $\mathscr{B}$, we can now define what it means for a proposition p to be common belief.

(5) Common Belief
A proposition p is common belief, written as $\mathrm{C}[p]$, iff for every B in $\mathscr{B}$, $\mathrm{B}[p] = 1$.

For an utterance F' to be presuppositionally appropriate, it must be the case that each of its presuppositions be common belief. That is, for any given p presupposed by F', it must be the case that $\mathrm{B}_s[p]$, $\mathrm{B}_a[p]$, $\mathrm{B}_s\mathrm{B}_a[p]$, $\mathrm{B}_a\mathrm{B}_s[p]$, $\mathrm{B}_s\mathrm{B}_s[p]$, $\mathrm{B}_a\mathrm{B}_a[p]$, ad infinitum.

(6) Presuppositional appropriateness
F' is presuppositionally appropriate, written as $\mathrm{App}_\pi(F')$, iff for all p presupposed by F', $\mathrm{C}[p]$

A formal definition of *Maximize Presupposition!* (MP) can now be given in (7), which takes a form similar to that of a conversational maxim.

(7) Maximize Presupposition!
A speaker s must not utter some F if there is an F' such that s believes that:
(i) $\mathrm{Alt}_\pi(F', F)$
(ii) $F' \prec_\pi F$
(iii) $\mathrm{App}_\pi(F')$

The literature on presuppositions reports the infelicity of examples such as those in (8a-10a) to be attributable MP (Heim, 1991; Singh, 2011).

(8) a. #An independence of the United States is celebrated in July.
b. The independence of the United States is celebrated in July.

(9) a. #Mary believes that 2+2=4.
b. Mary knows that 2+2=4

(10) a. #John opened all his eyes at the same time.
b. John opened both his eyes at the same time.

Given the scales assumed above and the extensions assumed for their members, it follows that the *b* examples are presuppositionally stronger alternatives of the *a* examples, meaning that (7i) and (7ii) are met for MP. Moreover, in any normal context, the presupposition of the *b* examples will be common ground, ensuring that (7iii) is also met. Hence, the infelicity of the *a* examples is straightforwardly captured by the definition of MP in (7).

More than simply predict the infelicity of utterances who have presuppositional alternatives appropriate in all normal contexts, MP also predicts that one will draw inferences whenever the presuppositionally weaker of two alternatives is employed (Percus, 2006; Sauerland, 2008). Indeed, it will follow from the utterance of a weak presuppositional alternative that the speaker does not believe the utterance of its stronger counterpart to have been appropriate. According to the definition of appropriateness assumed so far, this will lead to the inference that the speaker does not believe that the presupposition of the stronger alternative is common belief. Such *presuppositional implicatures* (PIs) are illustrated by the examples in (11-13).

(11) John is looking for the number of a girl he met in Berlin.
PI: $\neg B_s C$[*that John met exactly one girl in Berlin*]

(12) All of the papers Mary submitted were rejected.
PI: $\neg B_s C$[*that Mary submitted exactly two papers*]

(13) John believes that Mary is pregnant.
PI: $\neg B_s C$[*that Mary is pregnant*]

Ascertaining whether such inferences are in fact drawn from the examples in (11-13) is a difficult task due in no small part to how weak the predicted inferences are. Indeed, for it not to be the case that *s* believes that *p* is common belief, it need only be the case that for some arbitrary B in $\mathscr{B}$, $\neg B_s B[p]$. Thus for example, it will not be the case that *s* takes *p* to be common belief in cases ranging from her believing *p* to be false, believing that *a* takes *p* to be false, believing that *a* is unsure about the truth of *p*, being unsure herself of the truth of *p*, believing that *a* does not believe *s* to believe *p* to be true, and so on. Certainly the weakness of such an inference casts doubt on the value of its prediction by MP, as any attempt to test for the presence of such an inference seems entirely hopeless.

2.2. Authority (Chemla 2008)

Chemla (2008) notes that the notion of presuppositional appropriateness discussed in (6) is too weak to capture the inferences one intuitively gathers from the utterance of certain presuppositionally weak alternatives. Indeed, what one infers from an utterance of the examples in (14-16) is not simply that *s* does not take the presupposition of their stronger alternatives to be common ground, but rather that s herself does not believe the presupposition of these alternatives to be true.

(14) A bathroom in my apartment is flooded.[4]
Predicted PI: $\neg B_s C$[*that there is exactly one bathroom in s's apartment*]
Actual PI: $\neg B_s$[*that there is exactly one bathroom in s's apartment*]

(15) All my brothers fought in Vietnam.
Predicted PI: $\neg B_s C$[*that s has exactly two brothers*]
Actual PI: $\neg B_s$[*that s has exactly two brothers*]

(16) John believes that I have a sister.
Predicted PI: $\neg B_s C$[*that s has a sister*]
Actual PI: $\neg B_s$[*that s has a sister*]

Chemla proposes to solve this problem by transitioning to a modern Stalnakerian view of presupposition and common ground (Stalnaker, 1998, 2002). Under this account, Stalnaker defines presuppositional appropriateness similarly to how it was defined in (6), meaning that for a speaker to presuppose p is appropriate implies that $B_s C[p]$. However, the innovation in this account is that appropriateness is defined not as requiring p to be common belief prior to its presupposition by s, but after it has been presupposed. The driving force behind this idea is that if after p's presupposition a comes to believe p, then it will follow that $C[p]$. In order to address this issue, we refer to Chemla's proposal that an epistemic step is involved in the derivation of PIs, which appeals to the notion of *authority*. A speaker s is an authority relative to a and with respect to some presupposition p whenever s presupposing p will cause a to *accommodate* and believe p. More generally, authority can be viewed as a special case of the assumption that s is correct in her beliefs, and this by assuming that whenever s presupposes p, she is committed to the truth of p. To this effect, we adopt Schlenker's (2012) formalization of authority below.

(17) Authority
$B_a[B_s[p] \Rightarrow p]$

A concept such as *authority* offers a new way of describing presuppositional appropriateness. In order for some F' to be presuppositionally appropriate, the maxim of Quality (Grice, 1975) requires a cooperative speaker to believe every presupposition he makes when uttering F'. However, rather than require that some p be common belief prior to its presupposition by s, all that is needed is for s to be an authority on p such that p becomes common belief following s's presupposition of p.[5]

(18) Presuppositional appropriateness
$\mathrm{App}_\pi(F')$ iff for all p presupposed by F', $B_s[p] \wedge B_a[B_s[p] \Rightarrow p]$

Now consider once again the examples in (14-16) in light of our new notion of presuppositional

[4]This example was devised by Michael Wagner, (p.c.)
[5]See the appendix for a discussion on how the notion of presuppositional appropriateness in (18) paired with the assumption that s is an authority on some presupposition p is sufficient to guarantee that a presupposition p becomes common belief following its utterance.

appropriateness. For s to utter these presuppositionally weak alternatives will cause a to infer that s does not believe that uttering their stronger alternatives is appropriate ($\neg B_s(B_s[p] \wedge B_a[B_s[p] \Rightarrow p])$). In other words, from an utterance of weaker alternatives, a will derive the PI that either s does not believe p or that s does not believe that she is an authority on p.

(19) Presuppositional implicature
$\neg B_s[p] \vee \neg B_s B_a[B_s[p] \Rightarrow p]$

The epistemic step Chemla proposes in order to obtain the inferences observed in (14-16) relies on the interaction between the predicted disjunctive PIs in (19) and what he dubs the *Authority Assumption* (AA). Simply put, the AA is an assumption made by a whereby she assumes that s believes herself to be an authority on p.

(20) Authority assumption
$B_s B_a[B_s[p] \Rightarrow p]$

With our new definition of presuppositional appropriateness and the AA, it becomes easy to see how one obtains from (14-16) their attested inferences. Let F be any of these utterances and F' be its presuppositionally stronger alternative such that F' presupposes p but F does not. MP predicts that an utterance of F by s will lead a to draw the PI in (19). However, in these cases, a assumes that s believes herself to be an authority on p. As a result, the inference drawn from F can be strengthened such that what a concludes from its utterance is that s does not believe p.

(21) Left Side PI strengthening
$(\neg B_s[p] \vee \neg B_s B_a[B_s[p] \Rightarrow p]) \wedge (B_s B_a[B_s[p] \Rightarrow p]) \vDash \neg B_s[p]$

Chemla's account makes a further prediction, *viz.* that whenever it is clear that s believes p, any PI regarding p will be strengthened on the right-side, *i.e.* the PI will be strengthened such that what is entailed is that s does not believe herself to be an authority on p.

(22) Right Side PI strengthening
$(\neg B_s[p] \vee \neg B_s B_a[B_s[p] \Rightarrow p]) \wedge B_s[p] \vDash \neg B_s B_a[B_s[p] \Rightarrow p]$

Chemla argues that the example in (23) provides evidence that right side strengthening does indeed appear where predicted. (23) competes with a presuppositionally stronger alternative, leading to the PI in (19). However in this utterance, s clearly states that she believes Mary is pregnant. Chemla's account therefore predicts that from an utterance of (23), a will infer that s does not believe herself to be an authority on Mary being pregnant. Chemla claims that this is the intuitive reading one obtains from (23), but problems with this analysis will be discussed in section 3.1.

(23) I believe that Mary is pregnant.
Predicted PI: $\neg B_s B_a[B_s[\textit{that Mary is pregnant}] \Rightarrow \textit{that Mary is pregnant}]$

2.3. *Maximize Presupposition!* as Quantity (Schlenker 2012)

Schlenker (2012) notes the parallel between the drawing of PIs from presuppositionally weak alternatives and the drawing of scalar implicatures within a neo-Gricean framework. He attempts to reduce MP as an independent principle to Gricean reasoning by proposing that the conversational principle according to which one must always use the presuppositionally stronger of two alternatives follows from the need to be as informative as possible. In other words, Schlenker proposes to reduce MP to Quantity, and as such reduce PIs to scalar implicatures.[6]

Schlenker makes use of Chemla's notion of authority to account for how presuppositions can be informative in a context where a does not believe p. Assuming s to be an authority on p, her uttering p will result in a believing p. In such cases, presupposing p therefore seems to be a means of transmitting p as new information. Thus, in a context where s believes p and believes that she is an authority on p, her using the weaker of two presuppositional alternatives can be interpreted as a violation of Quantity (Grice, 1975), as the presuppositionally stronger alternative would have been more informative. From the point of view of a, the reasoning follows very closely that of scalar implicatures. Assume that a does not believe p but makes the AA. If s uses the presuppositionally weak F rather than its stronger alternative F', a will reason that if s believed p, her failure to use F' would result in a violation of Quantity. Therefore a will infer that s, who is taken to be cooperative, does not believe p.[7] Following Schlenker, one can propose a definition of *informativity* which states that an utterance F' is more informative than an utterance F whenever it is presuppositionally stronger than F or strictly entails F.

(24) Informativity
F' is more informative than F, written as $F' \prec F$, iff
$\{w \in W : F = \#\} \subset \{w \in W : F' = \#\}$ or $\{w \in W : F' = 1\} \subset \{w \in W : F = 1\}$

In order to propose a general pragmatic principle which equates PIs to scalar implicatures, it will also be necessary to extend the notions of *alternatives* and *appropriateness*. The first step in accomplishing this is to define a set of scales which includes not only presuppositional scales, but also scales relevant to scalar implicatures, in this case $\langle some, all\rangle$ and $\langle or, and\rangle$.

(25) Scales
The set of scales $\Sigma = \{\langle a(n), the\rangle, \langle all, both\rangle, \langle believe, know\rangle, \langle some, all\rangle, \langle or, and\rangle\}$

[6] Leahy (2016) pursues the same approach, but for reasons of space we confine attention to Schlenker's execution of the idea.

[7] As noted in the literature (Heim, 1991; Percus, 2006), MP does not hold only in situations where a is assumed to not believe p, but crucially also holds when p is common belief prior to its presupposition by s. To account for these cases, Schlenker introduces the idea that there exists parallel to any given common ground a weakened common ground where it is not common belief that p, and this on account of the small chance that a will have forgotten p. Through a mechanism Schlenker calls *recoverability*, such weakened common grounds can be updated following a presupposition of p by s, ensuring that even when p is already common belief, it will be informative insofar as it updates the weakened common ground.

This extended set of scales can be used to define a set of alternatives which can therefore be used both for the computing of scalar implicatures as well as what has so far been assumed to be PIs.

(26) Alternatives
F' is an alternative to F, written as $\mathrm{Alt}(F', F)$, iff F' is identical to F save for the substitution of one member of a scale in Σ for another member of that same scale.

Finally, we can extend the notion of appropriateness by stating that F' is appropriate if both its presupposed and assertive contents are believed by s and if s is an authority on both.

(27) Appropriateness
F' is appropriate, written as $\mathrm{App}(F')$, iff for all p presupposed or asserted by F', $\mathrm{B}_s[p] \wedge \mathrm{B}_a[\mathrm{B}_s[p] \Rightarrow p]$

With these notions in hand, we can now propose a general pragmatic principle, *Be Informative!* (BI), according to which speakers should not use some utterance F if there exists some F' which is an alternative to F, more informative than F and appropriate.

(28) Be Informative!
A speaker s must not utter some F if there is an F' such that s believes that:
(i) $\mathrm{Alt}(F, F')$
(ii) $F' \prec F$
(iii) $\mathrm{App}(F')$

3. Authority and reliability

3.1. Problems With Authority

Let us for the moment set aside possible reductions of MP to Quantity and return to a framework where the two principles are disjoint. Consider once again Chemla's prediction in (22), where he claims that in a sentence like (23), restated below, a will infer that s is not an authority on Mary being pregnant.

(23) I believe that Mary is pregnant.
Predicted PI: $\neg \mathrm{B}_s \mathrm{B}_a[\mathrm{B}_s[\textit{that Mary is pregnant}] \Rightarrow \textit{that Mary is pregnant}]$

Chemla purports that what one intuitively gathers from (23) is that s is not an authority about Mary being pregnant, but it is not so clear that this is truly the inference one draws from that sentence. Recall that *authority* in its technical sense is defined as a's willingness to accommodate a presupposition p if s believes p. To say that (23) yields the inference that s does not believe she is an authority about Mary being pregnant implies that s does not believe that, had she presupposed that Mary is pregnant, a would not have accommodated this presupposition. This seems far too strong an inference for what one intuitively gathers from (23), *viz.* that s does not believe she is a reliable source of information regarding whether or not Mary is pregnant. In fact, the contrast between (29a) and (29b) may provide further evidence that the reliability of the speaker is important to the computing of PIs. Consider the difference between the PI in (29a) and (29b).

(29) a. John believes that I have a sister.
PI: $\neg B_s$[*that s has a sister*]
b. John believes that Mary has a sister.
Unattested PI: $\neg B_s$[*that Mary has a sister*]

It is far from clear that from (29b) one can infer very much about *s*'s beliefs on whether or not Mary has a sister. Indeed, the contrast between the inference drawn from (29a) and that of (29b) can be made sharper if one considers whether or not it is acceptable for *a* to question the inference. As noted by Marty (2017), PIs can be disputed using the *Hey, wait a minute!* test first discussed by von Fintel (2004). We report our judgments that while it is fine for *a* to call into question *s* having a sister following an utterance of (29a), it is odd for *a* to question Mary having a sister following (29b). This may provide further evidence that the reliability of *s* regarding the presupposition of an utterance's alternative is important to whether or not one strengthens the PI. While in (29a) it seems reasonable to assume that *s* is a reliable source of information regarding whether or not she has a sister, one assumes that in (29b), *s* is not reliable regarding whether or not Mary has one.[8]

(30) a. *s*: John believes that I have a sister.
a: Hey, wait a minute! You don't have a sister?
b. *s*: John believes that Mary has a sister.
a: #Hey, wait a minute! Mary doesn't have a sister?

There is in fact good reason to believe that defining presuppositional appropriateness in terms of *s*'s beliefs on *p* and on whether she is an authority on *p* provides an account of MP which is much too strong. Consider once again the examples in (11-13), and consider the failure of the *Hey, wait a minute!* test on these.

(31) a. *s*: John is looking for the number of a girl he met in Berlin.
a: #Hey, wait a minute! John met more than one girl in Berlin?
b. *s*: All of the papers Mary submitted were rejected.
a: #Hey, wait a minute! Mary submitted more than two papers?
c. *s*: John believes Mary is pregnant.
a: #Hey, wait a minute! Mary isn't pregnant?

Compare these results with those we obtain when considering the examples in (14-15).

(32) a. *s*: A bathroom in my apartment is flooded.
a: Hey, wait a minute! There's more than one bathroom in your apartment?

[8]In fact, the strong inference derived from (29a) does not appear in contexts where *s* is not reliable on whether she has a sister. Consider its utterance in a context where *s* is an orphan, and has been told by some acquaintance that he recalls her adoption papers mentioning that *s* had a sister. Here, one would not draw from (29a) the inference that *s* does not believe she has a sister.

b. s: All of my brothers fought in Vietnam.
a: Hey, wait a minute! You have more than two brothers?

For Chemla's account of PIs to not predict strengthened PIs from the utterances in (11-13), it would have to be the case that for each of these, the AA is not made by a. But this is once again a highly questionable premise as there is no question that, baring disagreement, a would accommodate the presuppositions of the stronger alternatives of each of these sentences. Why then would a not assume that s believes herself to be an authority on these presuppositions? To argue that this is what one concludes from the data would be to set the stage for a circular argument, and what one wants here is not to simply state the facts, but to offer an explanation for them. What seems necessary is to strengthen our notion of presuppositional appropriateness so as to weaken our PIs. As noted above, s's reliability seems to play an important role regarding whether or not PIs are strengthened, and would thus serve as a good candidate to strengthen appropriateness. Of course, even when s is unreliable regarding some p, if a already believes p, then it will be appropriate for s to presuppose p so long as s also believes p. Hence, presuppositional appropriateness can be strengthened in (33) by adding to its definition that it must either be the case that s is reliable about p or that a already believes p.[9]

(33) Presuppositional appropriateness
$\mathrm{App}_{\pi}(F')$ iff for all p presupposed by F', $\mathrm{B}_s[p] \wedge \mathrm{B}_a[\mathrm{B}_s[p] \Rightarrow p] \wedge (\mathrm{B}_a[p] \vee \mathrm{Rel}(s,p))$, where $\mathrm{Rel}(s,p)$ is to be read as '*s is reliable about p*'

Trivially, whenever a already believes p, it follows that s is an authority on p. From this, it is easy to see that for s to be an authority on p and for a to already believe p is equivalent to simply saying that a believes p. From this result, we can show that our definition of presuppositional appropriateness is equivalent to the one in (34)[10].

(34) Presuppositional appropriateness (equivalent formula)
$\mathrm{B}_s[p] \wedge (\mathrm{B}_a[p] \vee (\mathrm{B}_a[\mathrm{B}_s[p] \Rightarrow p] \wedge \mathrm{Rel}(s,p)))$

Now imagine that s is not reliable with respect to some presupposition p. In such a situation, it follows that $(\mathrm{B}_a[\mathrm{B}_s[p] \Rightarrow p] \wedge \mathrm{Rel}(s,p))$ is false, in which case, $(\mathrm{B}_a[p] \vee (\mathrm{B}_a[\mathrm{B}_s[p] \Rightarrow p] \wedge \mathrm{Rel}(s,p))$ is equivalent to simply $\mathrm{B}_a[p]$. In such contexts, a presupposition would be appropriate only when both s and a believe p.

(35) Presuppositional appropriateness (when s is not reliable on p)
$\mathrm{B}_s[p] \wedge \mathrm{B}_a[p]$

[9]See Rouillard and Schwarz (2017) for arguments that surprisal and even speaker efficiency also play a role in determining whether a presupposition is appropriate. What seems plausible is that appropriateness should be strengthened by the conjunction of a series of disjuncts, among which would be reliability, the addressee's beliefs in p, surprisal and efficiency. For the sake of simplicity and clarity, we assume here only reliability and the addressee's belief.

[10]This can be shown by the following reasoning:
$\mathrm{B}_s[p] \wedge (\mathrm{B}_a[\mathrm{B}_s[p] \Rightarrow p] \wedge (\mathrm{B}_a[p] \vee \mathrm{Rel}(s,p))) \equiv$
$\mathrm{B}_s[p] \wedge ((\mathrm{B}_a[\mathrm{B}_s[p] \Rightarrow p] \wedge \mathrm{B}_a[p]) \vee (\mathrm{B}_a[\mathrm{B}_s[p] \Rightarrow p] \wedge \mathrm{Rel}(s,p))) \vDash$
$\mathrm{B}_s[p] \wedge (\mathrm{B}_a[p] \vee (\mathrm{B}_a[\mathrm{B}_s[p] \Rightarrow p] \wedge \mathrm{Rel}(s,p)))$

Assuming that s is not reliable with respect to p in (11-13), we predict the PI for each of these utterances to be the formula in (36).

(36) Presuppositional Implicature (when s is not reliable on p)
$\neg B_s[p] \vee \neg B_s B_a[p]$

3.2. Presuppositional implicatures from Quantity? Comparing Predictions

Let us now return to the reduction of MP to Quantity discussed in section 2.3. Much like the version of MP in section 2.2, this account relies heavily on *authority* in order to show how presuppositions could be used to update contexts. As discussed, this will run into problems when considering the examples in (11-13) as, barring disagreement, it is hard to imagine why s would ever use the weaker alternative of some F' presupposing p. Consider the vantage point of a for any of these utterances when assuming that speakers are expected to obey BI as stated in (28). Assuming a does not already believe p (but does not believe p to be false), a will reason following these utterances that there exists for each of them a more informative alternative F'. From this, a will infer that either s does not believe the presuppositions of F' or does not believe herself to be an authority on them. As discussed earlier, there is no reason for a not to make the AA, as it is a matter of common sense that she would have accommodated the presuppositions, in which case the inferences predicted from (11-13) will be that s does not believe the presuppositions of their alternatives. As discussed above, these predictions are inaccurate. A natural move to make here would be to amend appropriateness in BI in the same way it was amended for MP in section 3.1, *viz.* by restricting appropriateness with the disjunction of reliability and addressee belief in p.

(37) Appropriateness
App(F') iff for all p presupposed or asserted by F',
$B_s[p] \wedge B_a[B_s[p] \Rightarrow p] \wedge (B_a[p]) \vee \mathrm{Rel}(s,p))$

However, it is easy to see that such a formulation of appropriateness is far too strong. Consider once again the utterance in (29b), stated in (38a), as well as the very similar utterance in (38b).

(38) a. John believes that Mary has a sister.
b. John believes that Jane has a sister.

We assume that in each of these cases, the weak PIs obtained are the result of s being unreliable with respect to the presuppositions of their alternatives, *i.e.* s is unreliable on Mary having a sister and unreliable on Jane having a sister. But now consider the example in (39a) in a context where a does not know about whether Mary or Jane have siblings, which competes with the alternative in (39b).

(39) a. Mary has a sister or Jane has a sister.
Inference: $\neg B_s$[*Mary has a sister and Jane has a sister*]
b. Mary has a sister and Jane has a sister.

Given our assumption that s is not reliable on Mary having a sister and Jane having a sister, one would predict for (39a) an inference on par with that in (36). That is, one would predict from (39a) the inference in (40).

(40) $\neg \mathrm{B}_s[\textit{that Mary has a sister and Jane has a sister}] \vee \neg \mathrm{B}_s \mathrm{B}_a[\textit{that Mary has a sister and Jane has a sister}]$

This is of course not what one intuitively gathers from (39a), from which speakers infer (in addition to ignorance inferences) that it is not the case that both Mary and Jane have a sister. One could attempt a further restriction on appropriateness such that it applies solely to presuppositions, as in (41).

(41) Appropriateness
$\mathrm{App}(F')$ iff for all p presupposed or asserted by F',
$\mathrm{B}_s[p] \wedge \mathrm{B}_a[\mathrm{B}_s[p] \Rightarrow p]$ and
for all q such that q is presupposed,
$\mathrm{B}_a[q] \vee \mathrm{Rel}(s,q)$

Such a notion of appropriateness, however, runs into an important conceptual problem if one tries to reconcile it with treating presuppositions as informative. Consider once more a context in which s is not reliable on some presupposed p. The notion of appropriateness when considering the presupposition p will be the one in (35), restated below.

(42) Appropriateness (when s is not reliable on p)
$\mathrm{B}_s[p] \wedge \mathrm{B}_a[p]$

This suggests that, were s to believe p to be true but not believe that a takes p for granted, presupposing p would be judged inappropriate by s. For s to judge p to be inappropriate on account of a not already knowing p seems to run counter to the idea that presuppositions are to be understood as vectors of new information. The question becomes how to maintain the distinction between (29a) and (29b), where (29a) seems to generate an inference similar to a scalar implicature while (29b) does not, while nevertheless preventing appropriateness from taking the form in (42). One solution is to remove any mention of a's beliefs from the conditions on presuppositional appropriateness. That is, rather than have these conditions be the disjunction $(\mathrm{B}_a[p] \vee \mathrm{Rel}(s,p))$, these can be simply stated as $\mathrm{Rel}(s,p)$. This would however appear to be too strong a notion of appropriateness. Indeed, this would predict that it is inappropriate for s to ever presuppose some proposition p on which s is not a reliable source of information. We know, however, that p will always be appropriate when it is already taken for granted by both conversational partners, and this irrespective of whether or not s is reliable on p. Faced with such a problem, it would appear that modifying the notion of appropriateness is incompatible with an account of MP which treats presuppositions as informative. The soundest move from here would be to redefine our notion of informativity. That is, we will assume that unless s is reliable on p, p cannot be informatively used as a presupposition.

(43) Informativity
$F' \prec F$ iff,
(i) $\{w \in W : F = \#\} \subset \{w \in W : F' = \#\}$ or $\{w \in W : F' = 1\} \subset \{w \in W : F = 1\}$
(ii) For every p presupposed by an utterance of F', $\mathrm{Rel}(s, p)$

Let us now assess what predictions our amended version of BI makes when s utters the weaker of two alternatives F such that s is not reliable on the presupposition p of the stronger alternative F'. Given that s is not reliable on p, it will follow from our definition of informativity that F' is not more informative than F. As a result, s is not expected to use the stronger alternative and, thus, no inference is predicted from her utterance of F. We now have a clear difference in the predictions of MP as an independent principle and BI. When s is unreliable on the presupposition p of F', MP predicts that an utterance of F will generate the inference in (44). On the other hand, BI predicts that no inference will be generated from such an utterance.

(44) $\neg \mathrm{B}_s[p] \vee \neg \mathrm{B}_s\mathrm{B}_a[p]$

Of course, the inference in (44) is extremely weak, and it is unclear whether one could ever report perceiving such an inference from the utterance of some weak presuppositional alternative. However, following Chemla's idea of an epistemic step for MP, we can verify whether this disjunctive inference is strengthened in contexts where a assumes one of the disjuncts to be false. For instance, if a assumes s to believe that p, an utterance by s of some weak F competing with an F' presupposing some p (for which s is unreliable) will be predicted to yield the inference in (44) which, given a's beliefs, will be strengthened to simply $\neg \mathrm{B}_s\mathrm{B}_a[p]$. To test this, consider an utterance of (11), within a context where a knows that John met exactly one girl in Berlin and is certain that s is also aware of this.[11] The judgment is subtle, but seems correct. If a speaker were to utter (11) when we know very well that she knows John met exactly one girl, we would infer that she takes us, as addresses, to be unaware of this fact. This intuition can be reinforced by considering the felicity of the dialog in (45), where a calls attention to s's use of the weaker alternative.

(45) *s:* John is looking for the number of a girl he met in Berlin.
a: Hey, wait a minute! *A* girl he met in Berlin? We both know he met one girl there.

The same test can be applied to (12) and (13). In (12), we assume a to be certain about s knowing that Mary submitted exactly two papers while in (13), a is certain about s knowing that Mary is pregnant.

(46) *s:* All of the papers Mary submitted were rejected.
a: Hey, wait a minute! *All* of the papers Mary submitted? We both know she submitted two.

(47) *s:* John believes that Mary is pregnant
a: Hey, wait a minute! John *believes* that Mary is pregnant? We both know that she is.

[11] We require that a be certain that s is aware of this fact in order to prevent a from revising her beliefs on s's belief that John met exactly one girl in Berlin.

Clearer judgments are perceptible when (44) is strengthened by assuming the right-hand disjunct is false. This can be achieved by having a assert (or presuppose) p, only to have s respond to a by using the weaker F rather than the presuppositionally stronger F'. In this case, we predict the inference in (44) to be strengthened such that what is infered is that s does not believes p, $(\neg B_s[p])$.

(48) a. a: Is John looking for the number of the girl he met in Berlin?
s: John is looking for the number of a girl he met in Berlin.
b. a: Whatever happened to the two papers Mary submitted?
s: All of the papers Mary submitted were rejected.
c. a: Did you hear the news from John? He just told me Mary is pregnant.
s: John believes that Mary is pregnant.

In all of these cases, s's avoidance of the presuppositionally stronger alternative generates the predicted inference. Crucially, this is not predicted from BI, as the presupposition of the alternative is not taken to be informative on account of s's lack of reliability.

4. Conclusion

This paper argues that a challenge to attempts at reducing presuppositional implicatures to scalar implicatures arises once it is recognized that *authority* in and of itself is insufficient to account for such inferences. Indeed, a principle such as BI, even when enriched by the notion of reliability, does not predict weak inferences from the utterances in (11-13). On the other hand, a principle such as MP independent of notions of informativity seems not only able to predict these inferences, but moreover predicts the epistemic strengthening operated on examples (14-16). It would appear as though the imperative to presuppose as much as possible is not fully explicable in terms of informativity. Rather, speakers must sometimes reason not only about what is accommodatable in the common ground, but also about what is common ground prior to their utterances. That is, speakers are not expected to use presuppositions for which they are not reliable unless these are already taken for granted by them and their addressee.

Appendix

The modern Stalnakerian view of presupposition and common ground argues that a presupposition is appropriate if it becomes common belief after its utterance that p. To this effect, Schlenker (2012) assumes that when s presupposes p, it becomes common belief that s believes p will be common belief at some time t at which a checks the presupposition p. With this in mind, he proves that at t, if $CB_sC[p]$ is true and a has indeed accommodated p $(B_a[p])$, it follows that $C[p]$. We show here that the definition of presuppositional appropriateness in (18) paired with the assumption that s is an authority on p will be sufficient to ensure that p is common belief after it is presupposed by s, thus deriving the results of Schlenker's proof without the need to assume that s presupposing p leads to inferences about s's beliefs on the future. In order to prove this, we must first introduce the lemma in (49).

(49) Lemma 1
$\forall i[B_i[p] \Leftrightarrow B_iB_i[p]]$

We follow Stalnaker (2002) in assuming that beliefs are represented by an accessibility relation R_i such that $B_i[p]$ is true if and only if for all worlds satisfying wR_iw', p is true in w'. We further assume that R_i is transitive, euclidean and serial.[12]

(50) a. Transitivity: $\forall w\forall w'\forall w''[wR_iw' \wedge w'R_iw'' \Rightarrow wR_iw'']$
b. Euclideanity: $\forall w\forall w'\forall w''[wR_iw' \wedge wR_iw'' \Rightarrow w'R_iw'']$
c. Seriality: $\forall w\exists w'[wR_iw']$

Assume that $B_i[p]$ is true in w. Then p is true in all worlds w' satisfying wR_iw'. By transitivity, it follows that all worlds w'' satisfying $w'R_iw''$ also satisfy wR_iw'', and thus that p is true in all such worlds. From this, we can conclude that in all w' satisfying wR_iw', $B_i[p]$ is true, and thus it must be the case that $B_iB_i[p]$ is true in w. In other words, for all i, if $B_i[p]$, then $B_iB_i[p]$.

Assume that $B_iB_i[p]$ is true in the world of evaluation w for some arbitrary i. Then, for all worlds w' satisfying wR_iw', it will be the case that $B_i[p]$, and in all worlds w'' satisfying $w'R_iw''$, it will be the case that p. Given that R_i is transitive, it follows that all worlds w'' satisfying $w'R_iw''$ also satisfy wR_iw''. Hence in all such worlds $B_i[p]$ holds. Given euclideanity, all worlds w' satisfying wR_iw' must also satisfy $w''R_iw'$, and hence in all such worlds it must be the case that p. Thus, in all worlds w' satisfying wR_iw', it must be the case that p, and therefore it must be the case that $B_i[p]$ in w. This in turn entails that if $B_iB_i[p]$ is true in w, then so is $B_i[p]$.

Having shown that for all i, if $B_i[p]$, then $B_iB_i[p]$ and if $B_iB_i[p]$, then $B_i[p]$, we conclude that for all i, $B_i[p]$ is true if and only if $B_iB_i[p]$. QED

The second lemma we introduce will be that whenever the common ground entails that it is common belief that $B_s[p]$ and it is common belief that $B_a[p]$, it will be common belief that p.

(51) Lemma 2
If
(i) $CB_s[p]$
(ii) $CB_a[p]$
then
(iii) $C[p]$

Assume that both $CB_s[p]$ and $CB_a[p]$ are true.

$C[p]$ is true according to our definition of common belief in (4) if and only if for all B in the set $\mathscr{B}$, $B[p]$ is true. This entails on the one hand that both $B_s[p]$ and $B_a[p]$ are true and on the other that for any sequence S of two or more belief operators, $S[p]$ is also true.

[12]While seriality is not essential to our proofs, it does simplify them by allowing us to disregard all cases where there is no w' satisfying wR_iw'.

If $CB_s[p]$, then it follows by our definition of common belief that $B_sB_s[p]$. We can conclude from (49) that because $B_sB_s[p]$, then $B_s[p]$. Hence, it follows from $CB_s[p]$ that $B_s[p]$. If $CB_a[p]$, then it will be the case that $B_aB_a[p]$ according to our definition of common belief, and from (49) we can conclude that $B_a[p]$. It therefore follows that if $CB_s[p]$ and $CB_a[p]$, then $B_s[p]$ and $B_a[p]$.

Let S be an arbitrarily chosen sequence of two or more belief operators from $\mathscr{B}$. Then it is either the case that S ends in B_s or in B_a.

Case 1: Assume S ends in B_s. Then S can be represented as the concatenation $S'B_s$ of some non-empty sub-sequence S' of S and B_s. Clearly, S' is a sequence of at least one belief operator. Given our assumption that $CB_s[p]$, it follows by our definition of common belief that $S'B_s[p]$ is true, and thus that $S[p]$ is also true.

Case 2: Assume S ends in B_a. Then once again S is the concatenation $S'B_a$ of some non-empty sub-sequence S' and B_a. Once again, S' is a sequence of belief operators and thus it follows from our assumption that $CB_a[p]$ that $S'B_a[p]$, and therefore that $S[p]$.

We can conclude from this that for any sequence S of two or more operators, $S[p]$ holds if both $CB_s[p]$ and $CB_a[p]$ do. This in addition to the fact that $B_s[p]$ and $B_a[p]$ follow from $CB_s[p]$ and $CB_a[p]$ allows us to conclude that if $CB_s[p]$ and $CB_a[p]$ are true, then for all $B \in \mathscr{B}$, $B[p]$ is true. This in turn entails by our defintion of common belief in (4) that $C[p]$ is also true. QED

Following Stalnaker (2002), we assume that *s*'s speech act of presupposing *p* is a *manifest event*, *i.e.* an event which ensures that after it occurs it will be common belief that it has occurred. Hence, when *s* presupposes *p*, it becomes common belief that *s* believes *p* is appropriate, or equivalently, it becomes common belief that *s* believes *p* and common belief that *s* believes she is an authority on *p*.

(52) $CB_s[p] \wedge CB_sB_a[B_s[p] \Rightarrow p]]$

Let us assume that *s* presupposes *p* at some time *t*. As a result of this speech act, it becomes common belief at *t*+1 that *s* believes that it is appropriate to presuppose *p*, in which case it follows that (52) is true. If *s* is in fact an authority on *p*, *i.e.* if *a* is willing to accommodate *p* when *s* believes *p*, then it follows that *p* is common belief.

(53) If
(i) $CB_s[p]$
(ii) $CB_sB_a[B_s[p] \Rightarrow p]$
(iii) $B_a[B_s[p] \Rightarrow p]$
then
(iv) $C[p]$

Assume that $CB_s[p]$, $CB_sB_a[B_s[p] \Rightarrow p]$ and $B_a[B_s[p] \Rightarrow p]$ are all true.

Consider all possible sequences of members of $\mathscr{B}$ that can precede B_a in $CB_a[p]$. B_a can be preceded by a sequence with only instances of B_s, a sequence with only instances of B_a, or a sequence S containing both instances of B_s and B_a.

Case 1: Let B_s^n be a sequence of n instances of B_s, where $n \in \mathbb{N}$. Given that $CB_sB_a[B_s[p] \Rightarrow p]$, it follows that $B_sB_sB_a[B_s[p] \Rightarrow p]$ is true, which by (49) entails that $B_sB_a[B_s[p] \Rightarrow p]$. Given that $CB_s[p]$, it follows that $B_sB_aB_s[p]$. $B_sB_a[B_s[p] \Rightarrow p]$ and $B_sB_aB_s[p]$ together allow us to conclude that $B_sB_a[p]$, which we can rewrite as $B_s^1B_a[p]$. Now let there be some arbitrary $m \in \mathbb{N}$ such that $B_s^mB_a[p]$ is true. By (49), it follows that $B_s^{m+1}B_a[p]$, in which case we can conclude by mathematical induction that for all $m \in \mathbb{N}$, $B_s^mB_a[p]$, and hence we conclude that $B_s^nB_a[p]$ is true.

Case 2: Let B_a^n be a sequence of n instances of B_a, where $n \in \mathbb{N}$. Given that $CB_s[p]$, we know that $B_aB_s[p]$. Paired with our assumption that $B_a[B_s[p] \Rightarrow p]$, this entails that $B_a[p]$. Through the same reasoning as in case 1, it follows that for all $n \in \mathbb{N}$, $B_a^n[p]$ is true.

Case 3: Let S be a sequence of B_s and B_a. Then either S is the concatenation $S'B_a^1B_s^n$ of some (possibly empty) sub-sequence S' of S, one instance of B_a and some arbitrary sequence of n instances of B_s where $n \in \mathbb{N}$, or S is the concatenation $S'B_s^1B_a^n$, where $n \in \mathbb{N}$.

Case 3.1: Assume S is the concatenation $S'B_a^1B_s^n$. Given our assumption that $CB_sB_a[B_s[p] \Rightarrow p]$ is true, it follows that $S'B_a^1B_s^{n-1}B_sB_a[B_s[p] \Rightarrow p]$. Likewise, given that $CB_s[p]$ is true, so must be $S'B_a^1B_s^{n-1}B_sB_aB_s[p]$. Together, these entail that $S'B_a^1B_s^{n-1}B_sB_a[p]$, or equivalently that $S'B_a^1B_s^nB_a[p]$.

Case 3.2: Assume S is the concatenation $S'B_s^1B_a^n$. Given that $CB_sB_a[B_s[p] \Rightarrow p]$ is true, so must be $S'B_sB_sB_a[B_s[p] \Rightarrow p]$, which by (49) is equivalent to $S'B_sB_a[B_s[p] \Rightarrow p]$. Given that $CB_s[p]$ is true, it follows that $S'B_sB_aB_s[p]$ is also true. Together, these entail that $S'B_sB_a[p]$, which can be rewritten as $S'B_s^1B_a^1[p]$. Assume that $S'B_s^1B_a^m[p]$ is true for some arbitrarily chosen m such that $m \in \mathbb{N}$. Given (49), it follows that $S'B_s^1B_a^{m+1}[p]$, and thus by mathematical induction, for all $m \in \mathbb{N}$, $S'B_s^1B_a^m[p]$ is true. We can thus conclude that $S'B_s^1B_a^{n+1}[p]$ is true, or in other words, that $S'B_s^1B_a^nB_a[p]$ is true.

We see that for any sequence S of members of $\mathscr{B}$, $SB_a[p]$ is true, and thus by our definition of common belief, $CB_a[p]$ must be true. Since both $CB_s[p]$ and $CB_a[p]$ are true, by (51) it follows that $C[p]$. QED

An important point noted by Chemla is that in case of a disagreement on a given proposition p, it will not be the case that s is an authority on p. We let the reader convince herself that if s is not an authority on p, it will not be the case that an utterance of p by s will make p common belief. A further point to note is the fact that in cases where a already believes p, s's authority on p is trivially met. Here too we let the reader convince herself that if a already believes p at the moment of its utterance by s, p will be common belief following this utterance.

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The semantics of Turkish numeral constructions[1]

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Abstract. This paper explores Turkish numeral constructions, which have typologically two interesting properties: (i) the existence of an optional classifier, (ii) the incompatibility of plurals with them. I argue that numerals are modifiers of type <<e,t>,<e,t>> defined only for atomic properties (Ionin and Matushansky 2006). The explanation rests on the semantics of bare singulars proposed to denote sets of atoms (contra Bale et al. 2010), and the semantics of the classifier claimed to be a partial identity function presupposing atomic properties.

Keywords: numerals, atomicity, number neutrality, plurality, kinds, optional classifiers.

1. Introduction

Turkish numeral constructions have two typologically interesting properties: (i) the existence of an optional classifier, *tane*, and (ii) the incompatibility of plurals with them as shown in (1a) and (1b) below.[2]

(1) a. iki (tane) kitap
two CL book
'two books'

b. *iki (tane) kitap-lar
two CL book-PL
'two books'

This paper argues that Turkish numerals are modifiers of type <<e,t>,<e,t>> that combine with atomic properties as proposed by Ionin and Matushansky (2006), contra Bale et al. (2010) where they are treated as restrictive modifiers. The analysis revolves around the semantics of *bare singulars* which are proposed to denote sets of atoms here instead of being number neutral as claimed in Bale et al. (2010). In addition, the classifier *tane* is claimed to be a partial identity function presupposing atomic properties.

Notes on terminology: I refer to nouns unmarked for number as bare singulars, whereas I refer to nouns inflected with *-lAr* as bare plurals following the convention in Carlson (1977) and neo-Carlsonian studies for English bare plurals. As stated above, this paper shows that singularity of bare singulars is not only a morphological but also a semantic property contrasting with the accounts positing a number neutral denotation to them. Since Turkish lacks an overt definite article, both bare singulars and bare plurals can freely occupy argument positions, as opposed to English in which bare singulars do not have this freedom.

This paper is organized as follows. Section 2 introduces two distinct accounts of the semantics

[1] I am indebted to Veneeta Dayal, Simon Charlow and Mark Baker for their generous comments on this work. I also thank Ömer Demirok, Jess Law, Lucas Champollion, and Haoze Li for helpful discussions.

[2] Turkish has two classifiers besides group denoting ones. One is *tane*, compatible with all count nouns, and the other is *adet*, compatible with non-human count nouns. In this study, I will only refer to *tane* since the distribution of both classifiers is the same. They are considered to be classifiers since they have similar properties as the classifiers in other languages. As defined in Kim (2009), (i) classifiers are only compatible with count nouns whereas measure words are compatible with both count and mass nouns, (ii) they cannot be modified by an adjective as opposed to measure words, and (iii) they can be used with quantifiers compatible with count nouns.

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of Turkish numerals and clarifies the relevant details. Section 3 provides an analysis for the semantics of bare singulars showing that they denote atomic properties. Section 4 incorporates the optional classifier *tane* into the overall picture. Section 5 concludes.

2. The Semantics of Numerals

Numerals have been treated as both determiners of type <<e,t>,<<e,t>,t>> (Bennett 1974, among others) and predicates of type <e,t> (Partee 1987, Link 1987, Landman 1989, among others). Among the ones who treat numerals as predicates, Link (1987) analyzes them as restrictive modifiers. However, all of these works focus only on simplex numerals. On the other hand, Ionin and Matushansky (2006) (I&M, henceforth) treat numerals as modifiers of type <<e,t>, <e,t>> the lexical complement of which has to be atomic. Their illustration is given in (2) (pg. 321). Informally, $[\![$*two books*$]\!]$ can be stated as in (3).

(2) a. $[\![two]\!] = \lambda P\, \lambda x\, \exists S\, [\prod (S)(x) \wedge |S| = 2 \wedge \forall s \in S\, P(s)]$
b. $\prod (S)(x) = 1$ iff
S is a cover of x, and
$\forall z, y \in S\, [z = y \vee \neg\exists a\, [a \leq_i z \wedge a \leq_i y]]$
c. A set of individuals C is a cover of a plural individual X iff X is the sum of all members of C: $\sqcup C = X$

(3) $\lambda x \in D_e$. x is a plural individual divisible into 2 non-overlapping individuals p_i such that their sum is x and each p_i is a book.

I&M show that if simplex numerals were determiners it would not be possible to derive the semantics of complex numerals, like *two hundred*. Namely, if *hundred* (presumably of type <<e,t>,<<e,t>,t>>) combined with *books* (of type <e,t>) first, the resulting NP would be a generalized quantifier of type <<e,t>,t>. Consequently, this NP could not combine with another numeral. They also show that treating numerals as predicates of type <e,t> faces the same problem; the semantic composition of numerals would fail in a complex numeral construction. This time, the problem is not about types, but predicate modification would result in incorrect truth-conditions. Namely, the NP *two hundred books* would denote the empty set since for no x it is the case that the set of atoms is equal to both two and hundred simultaneously.

On the other hand, in I&M's analysis complex numerals are derived fully compositionally, i.e. *hundred books* being of type <e,t> can be an argument to *two* that is of type <<e,t>, <e,t>>.

The crucial part of their claim is that they treat English *-s* in numeral constructions as number agreement (semantic concord) rather than being a genuine plural marker. They claim that true plurals cannot combine with numerals because a plural noun such as *books* denotes a set of individuals x, where each x is a plurality of books, and these pluralities do not necessarily have the same cardinality. In other words, *books* in *two books* has to be semantically singular, only denoting a set of atomic individuals.

There are two main approaches to Turkish numerals. One is I&M's (2006) view of numerals as sketched above. They claim that languages like Turkish, where numerals combine with singular forms of nouns, constitute evidence for the atomic requirement of numerals. Their claim is based on the assumption that Turkish bare singulars denote sets of atoms.

On the other hand, Bale et al. (2010) argue against this view and treat Turkish numerals as restrictive modifiers combining with nouns via subsective modification, following Link (1987). Namely, numerals in Turkish are considered as functions from number neutral sets to one of their subsets which consists of all and only the groups that are composed of n (number denoted by the numeral) non-overlapping (atomic) minimal parts. The idea is that Turkish bare singulars are number neutral, i.e. inclusive of atoms and their pluralities, instead of denoting sets of atoms. Their semantics of Turkish numerals is illustrated below (Bale et al. 2010: pg. 10):

(4) a. $[\![two]\!] = \lambda P_{pl}.\{x : x \in P_{pl} \;\&\; \exists Y\ [Y \in \text{PART}(x) \;\&\; |Y| = 2 \;\&$
$\forall z\ [z \in Y \rightarrow z \in \text{MIN}(P_{pl})]]\}$
b. A predicate Q is of type P_{pl} iff $\forall x, y \in Q\ [x \oplus y \in Q]$
c. $\text{MIN}(P)$ is defined iff
$\forall x, y\ [[x, y \in P \;\&\; \neg\exists z\ [z \in P \;\&\; [z < y \vee z < x]]] \rightarrow x \wedge y = 0]$.
When defined $\text{MIN}(P) = \{x : x \in P \;\&\; \neg\exists z\ [z < x]\}$.

In this paper, I aim at showing that I&M's analysis should be favored over Bale et al.'s. Adopting this view of numerals explains the core facts of Turkish numeral constructions if the following hold: (i) Turkish bare singulars are strict singulars denoting sets of atoms, (ii) Turkish numeral constructions lack plural agreement, and (iii) the classifier *tane* is a partial identity function defined only for atomic properties. Following I&M in that Turkish numeral constructions lack plural agreement unlike the English ones, I will motivate and justify the atomicity of bare singulars and the semantics of the classifier below.

3. Turkish Bare Singulars as Atomic Properties

Thanks to the seminal work of Link (1983), the mereological treatment of pluralities has become a well-established tradition in the semantic literature, where the domain of individuals (D_e) has been assumed to include atoms and their closure under the sum operator $\oplus$. For example, the complete atomic join semilattice with a, b, and c as singular individuals include the atoms a, b, c and the pluralities a $\oplus$ b, a $\oplus$ c, b $\oplus$ c, and a $\oplus$ b $\oplus$ c.

Bale et al. (2010) argue that Turkish bare singulars denote number neutral sets, inclusive of atoms and pluralities (see also Görgülü 2012). For example, if in a model a, b, and c are the books, the Turkish noun *kitap* 'book' denotes the set $\{a, b, c, a \oplus b, a \oplus c, b \oplus c, a \oplus b \oplus c\}$. Their claim is based on the neutral interpretation of bare singulars in the predicate position as in (5a). In addition, bare singulars in Turkish are also known as having number neutral interpretations in non-case marked direct object positions as exemplified in (5b).

(5) a. Ali ve Merve **çocuk**.
Ali and Merve child
'Ali and Merve are children.'

b. Ali **kitap** oku-du.
Ali book read-PAST
'Ali read a book/books.'

Despite what these cases seem to suggest, I argue that bare singulars in Turkish denote sets of atoms only, i.e. $[\![kitap]\!] = \{a, b, c\}$. My claim is based on their singularity in argument positions and their singular kind denotations. I will first illustrate the strict singularity of bare singulars and then explain the apparent number neutrality in the cases shown above, which I claim to follow from their singular kind denotations.

3.1. Strict singularity in argument positions

Bare singulars in Turkish are interpreted as strictly singular and definite in subject and case-marked object positions as shown in (6a) and (6b), respectively. This constitutes evidence for their atomicity. Namely, if they denoted number neutral sets inclusive of atoms and pluralities, we would expect to get number neutral interpretations in these examples.

(6) a. **Çocuk** ev-e koş-tu.
child home-DAT run-PAST
'The child ran home.'
Not: 'The children ran home.'

b. Ali **kitab-ı** oku-du.
Ali book-ACC read-PAST
'Ali read the book.'
Not: 'Ali read the books.'

One might wonder whether it is still possible to keep the number neutral analysis and derive the singular interpretations via a competition story. In line with this idea, Bale et al. (2010) claim that Turkish bare plurals are exclusive of atoms in denoting pluralities only (see also Görgülü 2012). Namely, the bare plural *kitaplar* 'books' denotes the set $\{a \oplus b, b \oplus c, a \oplus c, a \oplus b \oplus c\}$ in their view. Maintaining this analysis, one might argue that the competition between number neutral bare singulars and strict plurals results in the singular reading of bare singulars as in (6). However, bare plurals in Turkish are actually inclusive of atoms and their pluralities just as in English, i.e. $\{a, b, c, a \oplus b, a \oplus c, b \oplus c, a \oplus b \oplus c\}$, as I will show below.[3]

Krifka (2003), Sauerland et al. (2005), Spector (2007), and Zweig (2009) argue for a number neutral account of bare plurals in English. In these works, it has been observed that although bare plurals contain multiplicity as part of their denotation in positive contexts, they lose that requirement in downward entailing and question contexts. In other words, the 'more than one' meaning does not seem to be a strict requirement in their interpretation. It has been claimed that this is due to the number neutral denotation that they have, the multiplicity condition of which arises as a result of a conversational (scalar) implicature in positive contexts. So, a bare plural in English denotes a set of atomic individuals and pluralities.

This observation also holds for Turkish bare plurals as evidenced by the example in (7). If we had gone to the forest and come across one bear, it would be bizarre to respond to the question in (7) as 'no'. Because seeing one bear is an efficient answer to the question in (7), the denotation of the bare plural *ayılar* cannot be 'more than one' bear.

(7) Orman-da **ayı-lar-a** rastla-dı-nız mı?
forest-LOC bear-PL-DAT come.across-PAST-2PL Q
'Did you come across bears in the forest?

[3] See Renans et al. (2017) for an experimental study showing the number neutrality of Turkish plurals.

a. Evet, bir tane gör-dü-k.
yes, one CL see-PAST-1PL
'Yes, we saw one.

b. #Hayır, bir tane gör-dü-k.
no, one CL see-PAST-1PL
'No, we saw one.'

Now, consider (8b) where a bare plural appears in a negative context. In (8a), the scalar implicature surfaces since the 'more than one' interpretation is stronger than the 'one or more' interpretation. On the other hand, (8b) is felicitous when there are no children playing ball, but not if there is only one child playing, as would be predicted by a strictly plural account.

(8) a. **Çocuk-lar** sokak-ta top oynu-yor.
child-PL street-LOC ball play-PROG
'Children are playing ball on the street.'

b. **Çocuk-lar** sokak-ta top oyna-**mı**-yor.
child-PL street-LOC ball play-NEG-PROG
'Children aren't playing ball on the street.'

The 'one or more' reading of bare plurals is also available in other downward entailing contexts such as the antecedents of the conditionals as in (9a) and the restrictors of universal quantifiers as in (9b). In both cases, the bare plural *erkekler* 'men' is interpreted neutrally.[4]

(9) a. Eğer **erkek-ler** tarafından aldatıldıysan, sen de biz-e katıl-abil-ir-sin.
if man-PL by were.cheated you also we-DAT join-ABIL-AOR-2SG
'If you have been cheated by men, you can join us.' (one or more men)

b. **Erkek-ler** tarafından aldatılan herkes biz-e katıl-abil-ir.
man-PL by was.cheated everybody we-DAT join-ABIL-AOR.
'Everyone who has been cheated by men can join us.' (one or more men)

Therefore, in light of the argumentation for English bare plurals, I argue that Turkish bare plurals are also number neutral and the multiplicity condition in positive contexts arises as a result of a conversational implicature.

Bale et al. (2010) use the following sentences in (10) as evidence for their strict plural account of Turkish bare plurals (pg. 8). The reasoning is as follows: If plurals were inclusive of atoms, then they would be expected to be predicated of singular subjects as well as plural ones. The example in (10b) shows that plurals in Turkish cannot be predicated of singular subjects.

(10) a. John ve Brad **çocuk(-lar)**.
John and Brad child-PL
'John and Brad are children.'

b. *John **çocuk-lar**.
John child-PL
Intended: 'John is a child.'

However, *-lAr* in (10a) is not the genuine plural marker but the optional 3rd person plural agreement, which happens to be homophonous with the former. One way to distinguish the two is their stress pattern. The third person plural marker shifts the stress to the preceding syllable, whereas the genuine plural marker itself bears the stress (Göksel and Kerslake 2005). In (10a), the stress is on the syllable preceding *-lAr*, suggesting that it is the 3rd person plural agreement

[4]The bare plurals in (7), (8), and (9) can also be interpreted as definites. See Section 3.2.1 for details.

marker. Given that, the structure of (10a) can be roughly represented as the following:[5]

(11) [$_{TP}$ John ve Brad [$_{VP}$ [$_{NP}$ çocuk] COP] T+-*lar*]

We expect (10b) to be bad because the subject is not plural, so the 3rd person plural agreement is not realized on the predicate.

If (10a) is pronounced with the stress on *-lAr*, then the sentence means 'John and Brad are the children.', not 'John and Brad are children.', receiving an equative interpretation. We still expect (10b) to be bad since the equative reading requires a maximal unique plural individual to be equated with *the children*. The subject *John*, however, is an atomic individual. So, there is a number mismatch between the two entities that are equated.[6]

To wrap up, we have seen that bare singulars denote sets of atoms and bare plurals are number neutral, inclusive of atoms and pluralities.

3.2. Singularity in kinds

In this section, I show that besides denoting atomic properties, bare singulars can also have singular kind reference following Dayal's (2004) view on English definite singular kinds. This constitutes further evidence for their atomic property denotation. I will first discuss the properties of kinds by introducing plural kinds in Turkish and then return to singular kinds.

3.2.1. Overview of kind terms

We have seen that Turkish bare plurals are like English bare plurals in being number neutral. They are also equivalent in having the following primary readings: kind (12a), generic (12b), and existential (12c) (see Carlson 1977 and Chierchia 1998 for English bare plurals):

(12) a. **Dinazor-lar** 66 milyon 38 bin yıl önce yok ol-du.
dinosaur-PL 66 million 38 thousand year ago extinct be-PAST
'Dinosaurs became extinct 66 million 38 thousand years ago.'

b. **Ayı-lar** genelde saldırgan ol-ur.
bear-PL usually aggressive be-AOR
'Bears are generally aggressive.'

c. **Kedi-ler** dışarda çiftleş-iyor.
cat-PL outside mate-PROG
'Cats are mating outside.'/ 'The cats are mating outside.'

[5]Kornfilt (1996) and Kelepir (2003) claim that there is a null realization of the copula (COP) *-i* between the noun and the person agreement marker. The copula, being a clitic, shifts the stress to the preceding syllable.

[6]This is achieved by a competition with the singular definite denoted by the singular form due to Maximize Presupposition (MP, Heim 1991). Recall that bare singulars are interpreted as singular in definite readings.

I suggest following Chierchia (1998) and Dayal (2004) that bare plurals start as type <s,<e,t>> and become kind terms of type <s,e> via nominalization operation (*nom*), i.e. $^{\cap}$: $\lambda P_{<s,et>}\ \lambda s\ \iota x\ [P_s(x)]$. ($P_s$ is the extension of P at a situation s.) This implies that bare plurals can directly combine with kind-level predicates. When they combine with object-level predicates, further operations come into the picture (Chierchia, 1998). One is the inverse of *nom*, predicativization (*pred*), which takes the extension of the kind and returns the set of singular and plural entities that are the instantiations of the kind (in line with the neutrality of bare plurals), i.e. $^{\cup}$: $\lambda k_{<s,e>}\ \lambda x\ [x \leq \mathrm{k}_s]$. ($k_s$ is the plural individual consisting of atomic members of the kind.) In generic contexts, the Generic operator quantifies over these instantiations. The other is *Derived Kind Predication (DKP)*, which provides sort adjustment and introduces ∃-quantification over the instantiations of the kind provided by *pred* in a given situation in episodic contexts.

(13) DKP: If P applies to objects and k denotes a kind, then $P(k) = \exists x\ [^{\cup}k(x) \wedge P(x)]$

The application of DKP also results in narrow scope interpretation of bare plurals, as in English:

(14) a. **Köpek-ler** havla-mı-yor.
dog-PL bark-NEG-PROG
'Dogs aren't barking.'
b. $[\![$*Köpekler havlamıyor*$]\!]$ = $\neg bark\ (^{\cap}dogs) = DKP \Rightarrow \neg\ \exists x\ [^{\cup\cap}dogs(x) \wedge bark(x)]$

The fact that plural kinds are transparent to their instantiation sets is supported by the tests showing that access to the atomic level is necessary in object level readings (Schwarzschild, 1996). Below, among such tests the compatibility with *reciprocals* and the predicate *come from different areas* are applied.[7] The compatibility of bare plurals with these tests shows that plural kinds have a see-through relation with their instantiations, since the atomic level of a kind term is accessible only if its instantiations are grammatically available. (15a) and (15b) exemplify generic and episodic contexts, respectively.

(15) a. **Kedi-ler** birbiri-ne saldır-ır.
cat-PL each.other-DAT attack-AOR
'Cats attack each other.'
b. **Ayı-lar** bu hayvanat bahçesi-ne farklı bölge-ler-den gel-di.
bear-PL this zoo-DAT different area-PL-ABL come-PAST
'Bears came to this zoo from different areas.'

Differently from English ones, Turkish bare plurals can also have definite interpretations in object-level contexts besides narrow scope existential readings as is evident in the example (12c). This difference comes from the fact that Turkish lacks an overt definite article and we assume that the definite interpretations are achieved by covert type-shifting via *iota*. This makes bare plurals in Turkish ambiguous between narrow scope existential and definite readings.[8]

[7] Schwarzschild (1996) uses the incompatibility of collective/group-denoting nouns with reciprocals and the predicate *live in different cities* to show that collective nouns do not allow access to atoms.

[8] *Nom* and *iota* can freely apply in Turkish because there are no overt versions that would block them. This is a consequence of the Blocking Principle proposed in Chierchia (1998) which is represented below.

(i) *Blocking Principle*: For any type shifting operation ϕ and for any X: $*\phi(X)$ if there is a Determiner D

3.2.2. Singular kinds

What about bare singulars? Just like bare plurals, they can also combine with kind level and generic predicates as shown in (16a) and (16b). However, in episodic contexts, they are interpreted as strictly singular and definite as shown in (16c). This contrasts with bare plurals, which can receive narrow scope existential readings as in (12c).

(16) a. **Dinazor** 66 milyon 38 bin yıl önce yok ol-du.
dinosaur-PL 66 million 38 thousand year ago extinct be-PAST
'The dinosaur became extinct 66 million 38 thousand years ago.'

b. **Ayı** genelde saldırgan ol-ur.
bear usually aggressive be-AOR
'The bear is generally aggressive.'

c. **Kedi** dışarda çiftleş-iyor.
cat outside mate-PROG
'The cat is mating outside.' Not: '(The) Cats are mating outside.'

The lack of existential readings with bare singulars is further shown by their inability to take scope under negation as illustrated in (17), where the only interpretation available is singularity and definiteness. This behavior of bare singulars would not be expected if they were kind terms the way plural kinds are, hence if their instantiations included atoms and pluralities. Namely, like plural kinds they would be derived by *nom*, and in episodic contexts they would get number neutral existential readings by DKP. Given their singularity and definiteness in episodic contexts, how bare singulars can have kind denotations seems to be mysterious considering the view that kinds are inherently plural entities (Chierchia, 1998).

(17) **Kedi** dışarda çiftleş-mi-iyor.
cat outside mate-NEG-PROG
'The cat isn't mating outside.'

We can understand the behavior of bare singulars if we take them to be more like definite singular kinds in English (e.g. *The lion is extinct.*). Dayal claims that even though kinds (singular or plural) are conceptually plural, singular kinds are grammatically atomic. They are different from plural (and mass) kinds in not having a semantically transparent relation to their instantiations. Namely, they are impure atomic in the sense of Link (1983) and Landman (1989) behaving more like a collective noun. This means that *pred* or any similar operators like Carlson's (1977) Realization (R) relation are undefined for singular kinds. The latter constitutes the relation between kinds and their instantiations, i.e. $R(x,y)$ where y is a kind and x is an individual instantiated by that kind.[9] Hence, DKP is also unavailable for them.

such that for any set X in its domain, $D(X) = \phi(X)$.
In English, *iota* cannot freely apply to bare nouns since it is blocked by the overt definite marker *the*. Bare plurals in Turkish cannot get strong indefinite interpretations due to the Meaning Preservation which is proposed in Chierchia (1998), but revised in Dayal (2004). According to the Revised Meaning Preservation, *nom* and *iota* are ranked above the existential operator, hence nouns in Turkish can shift via the former but not the latter.
(ii) *Revised Meaning Preservation*: $\{^\cap, \iota\} > \exists$

[9] By abstracting over x, we would be able to get the instantiation set of a singular kind. This way they would not

Dayal's claim is based on the idea that common nouns systematically denote properties of ordinary individuals and properties of (sub-)kinds. Just like other determiners such as *every* and *a*, when the definite determiner combines with the latter it yields taxonomic readings. Namely, the definite singular kinds are derived compositionally from the regular definite determiner and a common noun denoting a taxonomic property, i.e. $\iota X\ [P(X)]$, X ranging over taxonomic entities. Based on that, *lion* in '*The lion is extinct*' denotes a singleton set containing the unique lion kind, i.e. $\{LION\}$, if the domain of quantification is the set of taxonomic entities as LION, WHALE, etc. (excluding types of lions). The definite, *the lion*, denotes its singleton element.

Singular definite kinds in English are not compatible with object-level contexts (episodic as well as generic) unless the statement is applicable to the whole species (e.g. *The rat reached Australia in 1770.*). In other words, they are impure atomic terms whose only instantiation set (if available at all) includes a singular representative or prototypical object.

The same facts hold for singular kind terms in Turkish.[10] Since Turkish lacks an overt definite marker, they are realized in bare form to which the covert *iota* operator applies.[11] I also provide further evidence with respect to their impure atomicity by applying the tests for the accessibility of the atomic level. Consider (18) where the bare singular *ayı* is used in an episodic context and is incompatible with the distributive predicate *come from different areas* (cf. with (15b)).

(18) ***Ayı** bu hayvanat bahçesi-ne farklı bölge-ler-den gel-di.
bear this zoo-DAT different area-PL-ABL come-PAST
Intended: 'Bears came to this zoo from different areas.'

The sentence in (18) shows that singular kinds do not allow distributive predication to entities we intuitively associate with them. Otherwise, they would be interpreted like plural kinds and yield grammatical results with these tests. Since singular kinds are impure atomic, the denotations of bare singulars in object-level contexts as in (16c) must be derived without reference to their kind denotations. More precisely, they denote atomic properties independent of being singular kinds. In cases like (16c), *iota* combines with the atomic property denotation of bare singulars to yield singular definite interpretations.[12] However, as in English, if a singular kind in Turkish refers to the totality of species as a prototypical object, it is compatible with object-level predicates as in (19).

(19) **Bilgisayar** bu ülke-ye çok geç gel-di.
computer this country-DAT very late come-PAST
'The computer reached this country very late.'

Similarly, in generic statements, singular kinds are acceptable again if they refer to the whole species as a prototypical object explaining their compatibility with genericity as in (16b). The fact that singular kinds block access to their instantiations also holds for generic contexts, as

be different from plural kinds.

[10]I consider singular kinds in Turkish to be names of kinds, so they have the same denotation in every situation, like proper names. See Section 3.3.2.

[11]This is also the case in languages like Russian and Hindi as shown in Dayal (2004).

[12]Strong indefinite readings are not available for bare singulars due to Revised Meaning Preservation.

evidenced by their incompatibility with reciprocals (cf. with (15a)).

(20) *__Kedi__ birbiri-ne saldır-ır.
cat each.other-DAT attack-AOR
Intended: 'Cats attack each other.'

To summarize, plurals are kinds and their object-level interpretations are derived via *pred* and DKP. On the other hand, bare singulars are ambiguous in being singular kinds and independently denoting atomic properties. In object-level contexts, their atomic property denotations are made use of unless a prototypical representation of the kind is meant. This is in line with the lack of narrow scope existential readings with them and their singular interpretations.

To wrap up the discussion so far, we have seen two types of evidence showing that bare singulars in Turkish denote sets of atoms. One was their singularity in argument positions and the other was their singular kind denotations.

3.3. Explaining neutrality

In this section, I will explain the apparent number neutrality of bare singulars in non-case marked direct object (21a) and predicate positions (21b), both of which stem from their singular kind denotations. The corresponding sentences in (5b) and (5a) are repeated below.

(21) a. Ali **kitap** oku-du.
Ali book read-PAST
'Ali did book-reading.'

b. Ali ve Merve **çocuk**.
Ali and Merve child
'Ali and Merve are children.'

3.3.1. Pseudo-incorpration

Öztürk (2005), following Massam (2001), claims that non-case marked bare singulars occupying a direct object position immediately preceding the verb undergo pseudo-noun incorporation (PI). The semantics of PI has been the focus of a number of accounts (e.g. van Geenhoven 1998, Farkas and De Swart 2003, and Dayal 2011, among others), all of which agree in that pseudo-incorporated (PI-ed) nouns are property denoting. Among them, Dayal (2011) claims that they simply modify the verb, the result of which denotes predicate of events- subtypes of the events.

Inspired by the analysis of the weak definites of English in Aguilar-Guevara and Zwarts (2010) (e.g. *Lola is reading the newspaper.*), I argue that Turkish PI-ed bare singulars take part in sub-event kinds in line with Dayal (2011), but as singular kind arguments instead of properties. Their number neutrality is an inference due to the conceptual plurality of singular kinds.

The claim that PI-ed bare singulars are arguments instead of modifiers comes from the fact that they block the occurrence of an extra object with the same thematic role as they bear. (This contrasts with Chamorro where theme-doubling is possible (Chung and Ladusaw, 2004).)

(22) *Ali Savaş ve Barış(-ı) **kitap** oku-du.
Ali war and peace-ACC book read-PAST
Intended: 'Ali did book-reading War and Peace.'

The claim that PI-ed bare singulars are singular kinds instead of properties is supported by the following facts. First of all, they are interpreted neutrally although we have previously seen that their property denotation is atomic.[13] Second, modification is incompatible with them, requiring indefinite or plural forms, unless it is meant to operate at the taxonomic domain, establishing sub-kinds.[14] Consider the following contrast:

(23) a. *Ali *eski* **kitap** oku-du.
Ali old book read-PAST
'Ali read an old book/old books.'

b. Ali *teknik* **kitap** oku-du.
Ali technical book read-PAST
'Ali did technical book-reading.'

This contrast stems from the fact that singular kinds are built on taxonomic properties, not the ones of ordinary objects. (23a) is bad because the adjective *old* can be considered as operating at the level of ordinary objects with a meaning like *worn-out* or *old* in terms of its publication date, whereas the adjective *technical* in (23b) defines a sub-kind of the book kind, hence it is compatible with the PI-ed singular kind.[15] Since singular kinds are impure atomic terms their instantiation sets are not available. Therefore, they cannot be type-shifted to sets of individuals suitable for modification by adjectives like *eski* 'old'.

Finally, PI-ed bare singulars are non-referential at the ordinary object level as shown in (24a) (Öztürk 2005: pg. 27), but reference to the kind itself is possible as shown in (24b). (Both examples are meant to follow (21a).) This is expected since PI-ed bare singulars are kind terms, so they introduce discourse referents at the level of kinds, not ordinary objects. DKP is also not available for singular kinds. Otherwise, they would be referential at the ordinary object level via ∃-quantification introduced by it.

(24) a. #Reng-i kırmızı-y-dı.
color-3POSS red-COP-PAST
'Its/Their color was red.'

b. Polisiye türü-y-dü.
crime kind-COP-PAST
'It (the book kind) was crime.'

In summary, based on their syntactic argument status and the facts given above, I claim that PI-ed bare singulars are singular kind arguments.

I follow the view that there are event kinds as well as event tokens in the ontology as pursued in Schäfer (2007) and Gehrke and Mcnally (2011) (and references therein). I assume that event

[13]Dayal (2011) argues that Hindi PI-ed bare singulars denote atomic properties, but number neutrality is achieved as a result of their interaction with atelicity. I have pursued this idea for Turkish previously as presented in the talk, but later realized that singularity is not necessitated in all telic contexts. For reasons of space, I will not discuss this issue.

[14]Taxonomic modification is usually available with adjectives rather than more complex structures like relative clauses. It is because adjectives are considered to be providing natural classification as opposed to the others which are mostly restricted to temporal, stage-level modications (Sadler and Arnold, 1994). However, depending on the context, relative clauses can also be taxonomic.

[15]The sentence can be acceptable if oldness defines a sub-kind of the book kind with a meaning like 'ancient/historical' kind of books. In addition, for some speakers (23a) is good but only with a singular interpretation.

kinds are derived via *nom* (by a mereological treatment of events). *Nom* is considered to be a general operator also applying to events as a function from event properties to situations, from situations to the maximal event satisfying that property in that situation, i.e. $\lambda P_{<s,vt>}\ \lambda s\ \iota e\ [P_s(e)]$ (*iota* yielding the largest plurality of events here). Similarly, *pred* applies to event kinds and returns sets of event tokens in a given situation, i.e. $\lambda k_{<s,v>}\ \lambda e\ [e \leq k_s]$.

For example, the reading event kind is given in (25a) which is derived by the application of *nom* to the reading event property $\lambda s\ \lambda e\ [READ_s(e)]$, and the reading event token is given in (25b) which is derived by the application of *pred* to the reading event kind.

(25) a. $[\![read^{kind}]\!] = {}^{\cap}\ \lambda s\ \lambda e\ [READ_s(e)] = \lambda s\ \iota e\ [READ_s(e)]$
b. $[\![read^{token}]\!] = {}^{\cup}\ \lambda s\ \iota e\ [READ_s(e)] = \lambda e'\ [e' \leq \iota e\ [READ_s(e)]]$

Nom can also apply to an event property of <s,<v,t>> type that has a singular kind as its theme, e.g. $\lambda s\ \lambda e\ [READ_s(e) \wedge Th_s(e) = \iota X\ [BOOK(X)]]$, and the result of this application will denote a sub-event kind as shown in (26).

(26) $[\![book\text{-}read^{kind}]\!] = {}^{\cap}\ \lambda s\ \lambda e\ [READ_s(e) \wedge Th_s(e) = \iota X\ [BOOK(X)]]$
$= \lambda s\ \iota e\ [READ_s(e) \wedge Th_s(e) = \iota X\ [BOOK(X)]]$

I argue that this sub-event kind forming process is PI. The singular kind *book* does not refer to any actual books, and its role is to restrict the denotation of the reading event kind by participating in it as a theme argument. This participation in return will yield a book-reading event kind, which is a sub-kind of the reading event kind. In other words, PI is a process where the taxonomy of event kinds is determined by thematic arguments.

Consecutively, the book-reading event kind will undergo *pred*, which results in a set of event tokens, as shown in (27a). Then, this set of event tokens will take an agent argument and be existentially closed as shown in (27b) (ignoring tense).

(27) a. $[\![book\text{-}read^{token}]\!] = {}^{\cup}\ \lambda s\ \iota e\ [READ_s(e) \wedge Th_s(e) = \iota X\ [BOOK(X)]]$
$= \lambda e'\ [e' \leq \iota e\ [READ_s(e) \wedge Th_s(e) = \iota X\ [BOOK(X)]]]$
b. $[\![Ali\ book\text{-}read^{token}]\!] = \exists e'\ [e' \leq \iota e\ [READ_s(e) \wedge Th_s(e) = \iota X\ [BOOK(X)]]$
$\wedge\ Ag(e') = Ali]$

Here, Ali is involved in an instance of the book-reading event kind. The assertion that at least one episodic event token of this event kind exists will correspond to the inference of reading one or more books which are the instantiations that the singular kind is conceptually associated with.[16] This explains the number neutral interpretation of PI-ed bare singulars.[17]

As a final remark, *nom* will be undefined for event properties with non-kind arguments. For

[16]Mithun (1984) shows that kind-referring nouns are normally incorporated in languages that make use of incorporation. Following Mithun, Krifka et al. (1995) argue that incorporated nouns refer to kinds, and noun incorporation is a syntactic device to stay in the kind-oriented mode.

[17] Additionally, subject PI is also available as shown by Öztürk (2005), e.g. *Ali-yi arı soktu* ‘Ali got bee-stung’. I will not go into the details here but I argue that they also fall into the same analysis proposed for object PI.

example, it will be hard to impute to a *reading this book* event a sufficiently regular behavior so that it can qualify as an event kind (see Chierchia 1998). Instead, such arguments are introduced within event tokens, and they do not participate in (sub-)event kind formation.[18]

In summary, the aim of this section has been to show that bare singulars occurring as non-case marked objects are singular kinds that participate in sub-event kind formation. Their number neutral interpretation is an inference due to the conceptual plurality of singular kinds.

3.3.2. The predicate position

Finally, I will discuss the number neutrality of bare singulars appearing in the predicate position. Analogous to the analysis of pseudo-incorporation, I claim that bare singulars in the predicate position can be singular kinds, and the apparent neutrality follows from that.

To recall, bare singulars can be predicated of plural subjects besides singular ones as exemplified in (21b), which seems to suggest that they denote number neutral sets. However, closer investigation reveals that this is not the case. Namely, when bare singulars in the predicate position are modified they are only compatible with singular subjects as shown in (28). Interestingly, though, if the adjectival modifier establishes a sub-kind/type of the noun that it modifies then the predication is also compatible with plural subjects as shown in (29).

(28) a. Ali yakışıklı **doktor**.
Ali handsome doctor
'Ali is a handsome doctor.'
b. *Ali ve Mehmet yakışıklı **doktor**.
Ali and Mehmet handsome doctor

(29) a. Ali pratisyen **doktor**.
Ali practitioner doctor
'Ali is a practitioner doctor.'
b. Ali ve Mehmet pratisyen **doktor**.
Ali and Mehmet practitioner doctor

The former case can be explained by the claim that bare singulars denote atomic properties, and they can be modified at the ordinary object level. Additionally, since they are atomic properties, they can only be predicated of singular subjects.

On the other hand, the latter case reminds us of the modification facts of PI. In parallel with this, the contrast given above can be attributed to the view that bare singulars can also appear as singular kinds in the predicate position, being only compatible with taxonomic modification.[19] However, how can singular kinds occur in the predicate position in the first place? We have previously discussed their impure atomicity which suggests that any type-shifting operation that would take a singular kind and return its instantiation set is not available. Therefore, predication is impossible in this way.

[18] Öztürk (2005) claims that case assignment is not achieved by verbs but higher functional heads. Unlike canonical arguments introduced by the latter, PI-ed bare singulars do not receive case since they are complements to verbs.

[19] Bare singulars in the predicate position can also be found in Romance and Germanic languages like Dutch, French, Spanish, and German, although their usage is more restricted compared to the ones in Turkish. See de Swart et al. (2007) for an account of them which is in similar lines with the analysis given here.

Instead, I propose that the usage of singular kinds in the predicate position is a process of naming the subject term with respect to a kind that it belongs to. This is achieved by the copula that plays the role of a null operator associating the two. The denotation that the copula has in such structures is given in (30a), and the logical form of the sentence *Ali çocuk* 'Ali is child' is represented in (30b). (k represents kinds, K represents singular kinds, R is Carlson's Realization relation, and $NAME$ is a relation constituting the relation between kinds and their names.) Informally, (30b) can stated as the following: There is a kind that Ali is a member of, and that kind is named as $\iota X\ [CHILD(X)]$ (the singular kind *child*).

(30) a. $[\![COP]\!] = \lambda x^K\ \lambda y\ \exists k\ [R(y,k) \wedge NAME\ (k, x^K)]$
b. $[\![Ali\ is\ child]\!] = \exists k\ [R(Ali,k) \wedge NAME\ (k, \iota X\ [CHILD(X)])]$

The motivation behind this claim is that singular kinds are names of kinds, as opposed to plural ones in Turkish. This is supported by the *dediğin* 'that you call' construction, with which you refer to the kind term by what you call it as exemplified below. It is only good with singular kinds, not with plural ones, suggesting that the kind-naming construction is only expected to be compatible with singular kinds.[20]

(31) **Bilgisayar(*-lar)** dediğin Charles Babbage tarafından icat ed-il-di.
computer-PL that.you.call Charles Babbage by invent-PASS-PAST
Literally: 'The kind that you call the computer was invented by Charles Babbage.'

The kind-naming specification can also be achieved if the subject is a plural term considering that sum individuals can also be members of kinds. This explains the compatibility of bare singulars with plural subjects in the predicate position. The logical form of (21b) is given below, which can be informally stated as the following: There is a kind that the plural individual Ali $\oplus$ Merve is a member of, and that kind is named as $\iota X\ [CHILD(X)]$.

(32) $[\![Ali\ and\ Merve\ are\ child]\!] = \exists k\ [R(Ali \oplus Merve,k) \wedge NAME\ (k, \iota X\ [CHILD(X)])]$

To wrap up, bare singulars in the predicate position can be singular kinds and their compatibility with plural subjects comes from the null kind-naming specification.

4. Back to Counting: The Semantics of the Classifier *tane*

So far, we have seen that the property denotation of bare singulars in Turkish is atomic, which is in line with I&M's view of numerals where they are argued to be modifiers of type <<e,t>,<e,t>> that combine with atomic properties.[21] This way we can explain the grammaticality of constructions where a numeral is followed by a bare singular, instead of a bare plural (e.g. *iki kitap* 'two book', **iki kitap-lar* 'two book-PL').[22] Let us now discuss the role of

[20]This seems to be a language specific property, as the *so called* construction in English which can be considered similar to the *dediğin* construction is fine with both singular and plural kinds as observed by Carlson (1977).
[21]In Turkish *çok* 'many/a lot of' and *bir kaç* 'a few' also combine with bare singulars rather than bare plurals. I suggest that they can also be considered to presuppose atomicity like numerals.
[22]Some numeral constructions of Turkish can have plural marking on them, e.g. *Nice 20 yil-lar-a!* 'To multiple 20 years! (Cheers!)', and *yedi cüce-ler* 'the seven dwarfs'. In the former, the plural marker pluralizes the denotation

the classifier *tane* in numeral constructions.

Classifiers are widely thought to be a means of mediating between the denotation of a noun and the numeral in obligatory classifier languages like Chinese. Krifka (1995) and Chierchia (1998) propose that classifiers are functions from kinds into sets of atoms constituted by the instantiations of the kind, i.e. $\lambda x^k \lambda y\ [^{\cup}x(y) \rightarrow AT(y)]$. Nouns in such languages uniformly denote kind terms of <s,e> type as they come out of the lexicon. Since kinds are inherently plural being equal to mass nouns in some sense, their atomic instances are not available for counting. Therefore, classifiers are required in order to reach the atomic level of the kind.

This view cannot be adopted for *tane*, though. Otherwise, it would be obligatorily attested with plural kinds, but plurals cannot occur in numeral constructions and *tane* is not compulsory. (Singular kinds would not be an option due to their impure atomic nature.) Instead, I propose that *tane* is a partial identity function which *triggers a presupposition* for atomic properties just like numerals.[23] I also treat it as taking numerals (represented by f) as one of its arguments[24].

(33) $[\![tane]\!] = \lambda P_{<et>}\ \lambda f_{<et,et>}: \forall x\ [P(x) \rightarrow AT(x)]\ .\ f(P)$

This account immediately explains the grammaticality of constructions with the classifier which combine with a bare singular, but not a bare plural (e.g. *iki tane kitap* 'two CL book', **iki tane kitap-lar* 'two CL book-PL'). The optionality of the classifier is a consequence of the fact that, besides numerals that can directly combine with atomic properties, the language has also a partial identity function that takes both numerals and atomic properties as its arguments.

As an optional element, the classifier seems to be redundant in the language. However, there are contexts in which it is obligatory. Contra English, ellipsis of the noun is impossible unless the numeral is accompanied by the classifier. This is also the case in partitive constructions.

(34) a. İki *(tane) ~~elma~~ verir mi-sin?
two CL ~~apple~~ give Q-2SG
'Can you give me two (apples)?'

b. Elma-lar-dan iki *(tane) ~~elma~~
apple-PL-ABL two CL ~~apple~~
'two of the apples'

Now let me discuss a possible hypothesis regarding the obligatoriness of the classifier in (34a) and (34b). I follow Lobeck (1995) (for (34a)) and Ionin et al. (2006) (for (34b)) in taking such structures to involve a null (deleted) noun which needs licensing by a head (proper head-government). I suggest that numerals in Turkish are in the specifier of the nominal projection as shown in (35) contra numerals in English which are claimed to take the NP as a complement in Lobeck (1995) and I&M as shown in (35c).[25] Due to their non-head status, the former cannot

of the numeral construction *20 yillar* '20 years' referring to more than one instance of 20 years. This means that it is still the genuine plural marker, rather than agreement. The latter is not a canonical numeral construction, and the numeral is just a modifier to the plural noun, denoting the most specific property of the dwarfs, i.e. being seven in number. Such structures are only possible with well-known groups (e.g. the three muskeeters).

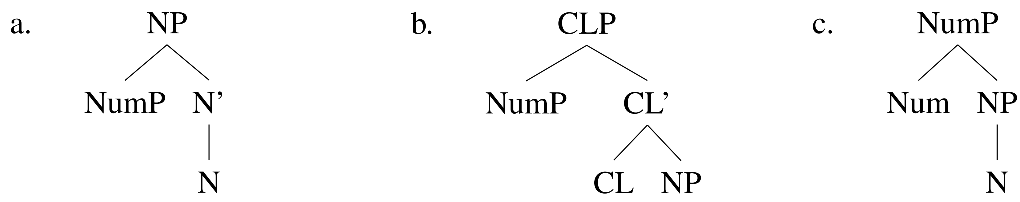
[23]Thanks to Veneeta Dayal for suggestions to explore this idea. Note that Bangla *-ra* is analyzed as a classifier that encodes a presupposition in Dayal (2014).

[24]We do not have strong evidence with regards to the order of the combination.

[25]In I&M, languages where numerals assign case to their nominal complements are argued to have the structure in (35c). Although English numerals do not pattern with this, they prefer to posit the same structure for them. The

license the elided NP. In the presence of the classifier the NP is extended by its projection as shown in (35b), so the elided noun is licensed by the classifier.[26]

(35)



The requirement for the classifier in ellipsis structures is also a property found in other optional classifier languages like Persian. This observation calls for further inquiry, but for now, it provides an interesting new dimension to our analysis of optionality in the Turkish classifier system.[27]

In summary, the classifier in Turkish is a partial identity function that presupposes atomic properties, which, combined with I&M's account of numerals, explains its optionality. The derivations of the numeral constructions are summarized below:

(36) a. $[\![\textit{2 book}]\!] = \lambda x\, \exists S\, [\prod (S)(x) \wedge |S| = 2 \wedge \forall s \in S\ \textit{book}(s)]$
b. $[\![\textit{2 tane book}]\!] = \lambda x{:}\ \forall x\, [P(x) \rightarrow AT(x)].\ \exists S\, [\prod (S)(x) \wedge |S| = 2 \wedge \forall s \in S\ \textit{book}(s)]$

5. Conclusion

In this paper, it has been argued that numerals in Turkish are modifiers of type <<e,t>,<e,t>>, the lexical complement of which has to be atomic (Ionin and Matushansky 2006), contrasting with the account where they are treated as restrictive modifiers (Bale et al. 2010). It has been shown that bare singulars denote sets of atoms, and the classifier *tane* is a partial identity function presupposing atomic properties.

This analysis establishes that the denotations of nouns in Turkish align with the denotations of nouns in English in that bare singulars are strict singulars and bare plurals are number neutral. However, the two languages differ in the absence/presence of number agreement in numeral constructions, which is interpreted as cross-linguistic variation.

As a concluding remark, in order to situate the findings for Turkish within a broader context and to appropriately draw out the implications for natural language generally, further research

one suggested here for Turkish is not discussed in their paper, but it does not conflict with their semantic account of the numerals. In addition, because Turkish numerals do not assign case to nouns it is safe to assume a structure where numerals are in the spec of the nominal projections.

[26]CL in (35b) is head-initial conflicting with the head-final property of Turkish. Instead, we can represent *tane* in the Spec, CLP assuming a null, head-final CL head. The crucial point is that NP is a part of CLP in the presence of CL, but it is not inside NumP.

[27]One can analyze the classifier as a semantically empty element having only a syntactic role. In such an analysis, the incompatibility of the classifier with plurals could be explained by the atomicity requirement of numerals. This approach is not adopted since they actually create a difference in meaning contributing an amount interpretation. The semantics of the classifier is still an ongoing project of mine and for present purposes, I want to preserve the role of the partial identity function for the classifier.

on relevant facts from other optional classifier languages like Western Armenian, Persian, and Hungarian is called for.

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The pa/wa of imperative alternatives[1]

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Abstract. This paper deals with topic markers interacting with discourse information in imperatives. It compares two topic markers from Slovenian (‘*pa*’) and Japanese (‘*-wa*’) and shows that while they mostly match in terms of the foci they associate with, their functions differ in imperatives: only *‘pa’* may yield a *concessive imperative* reading. It is shown that this reading can be derived while keeping a single entry for *‘pa’* by making attitudes of discourse participants part of the focus *‘pa’* associates with. The split between Slovenian and Japanese can then be attributed to minor differences in terms of which foci *‘pa’* and *‘-wa’* may associate with.

Keywords: imperatives, Slovenian, Japanese, alternative semantics, topic markers, focus, discourse particles, performative modality.

1. Introduction

Natural language semantics deals not only with what is said but also with what is not said. This is evident in work on information structure, where what must be accounted for is the relation between what is being said and what is already established due to context (Valduví, 2016). Similarly, the function of discourse particles is to relate to what is not being said. They usually do not contribute to the “core” propositional content of utterances. Rather, they convey information about the discourse participants (the speaker and the addressee of the utterance) (Zimmermann, 2011). Despite these similarities, the two domains are generally not explicitly connected in theoretical work. This paper takes a step in that direction with a case study of the function of topic particles from two languages—Slovenian and Japanese—specifically, their use in imperatives. As a baseline, topic particles in both Slovenian and Japanese are used to express *contrast*. In Slovenian, the particle is *‘pa’* and in Japanese *‘-wa’*:

(1) a. Zvitorepec **pa** je plesal. [Slovenian]
S.NOM PA AUX.3 danced.M
‘Slyboots was dancing (as opposed to doing something else).’

b. John-ga odori-**wa**-sita. [Japanese]
John-NOM dance-WA-did
‘John danced (as opposed to doing something else).’

In both examples, in addition to the propositional content of the sentence (i.e. *that Slyboots was dancing* in (1a), and *that John danced* in (1b)), the particles relate the predicate ‘dance’ (or the event of dancing), which is a part of the utterance, to other predicates (or events) that are merely contextually given. Roughly put, *‘pa’* and *‘-wa’* convey that the relevant individual is dancing, and not doing something else they could conceivably be doing. That is what we mean when we say that ‘dance’ is *contrasted*. However, despite their similarity in (1), the two particles differ

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when used in imperatives. Only *'pa'* has what appears to be a discourse particle use. That is, only *'pa'* can yield what we call a *concessive imperative*:

(2) a. A: *Don't eat that fish! It's poisonous.*
b. B: *I eat that kind of fish all the time, and I'm still alive.*
c. A (Slo.): **Pa** pojej jo! [✓concessive]
PA eat.IMP.(2) 3.F.ACC
'OK, eat it then!'
c'. A (Jpn.): #Tabe-**wa**-si-ro-yo! [✗ concessive]
eat-WA-do-IMP-SFP
'At least EAT it!' (⇐ can only mean)

What distinguishes a concessive imperative from a canonical one is that the former signals a disagreement between the speaker and addressee along the lines of (3).[2]

(3) *A canonical imperative P! commits the speaker to wanting the addressee to make P true. A* ***concessive imperative*** *⚐P! signals: (i) that the speaker wants the addressee to make ¬P true and (ii) that the speaker acknowledges the addressee wants to make P true.*

In this paper, we argue that the concessive use of *'pa'* can be captured without positing two homophonous versions of *'pa'*. Specifically, we claim that its "discourse particle" use is, in fact, identical to its function as a topic particle. We establish this by first closely comparing of the function of *'-wa'* and *'pa'* both outside imperatives (Section 2) and in imperatives (Section 3). We show that their behavior is parallel up to the point where we look at imperatives being contrasted with modals (Section 3.1) and more importantly concessive imperatives (Section 3.2), for which we establish that their core contribution in the discourse is to signal speaker-addressee disagreement to the point where this affects the speaker distancing ban characteristic of imperatives (Section 3.2.1). Based on this, we propose that concessive imperatives can be modeled in parallel with focus in an alternative semantics approach (Section 4); specifically, the disagreement conveyed by a concessive imperative is actually the result of a contrast between the attitudes of the speaker and addressee in the context. Finally, we discuss two analyses of what gives rise to the differences between *'pa'* and *'-wa'* in terms of licensing concessive imperatives.

2. Two languages, two particles, same foci?

The Japanese suffixal particle *'-wa'* has two main interpretations: it can mark a thematic topic (aboutness topic) or a contrastive topic (see Kuno, 1973; Heycock, 2008). These functions are exemplified in (4a) and (4b) respectively (CAPS on the stressed syllable indicate focus).

(4) a. John-**wa** ringo-o tabe-ta. [thematic topic]
John-WA apple-ACC eat-PAST
'As for John, he ate an apple.'

[2]We use the term concessive somewhat differently from its traditional use; see e.g. König (2009). We return to a more detailed discussion of what the concessive imperative reading exactly encodes in Section 3.2.

b. John-ga RINgo-**wa** tabe-ta. [contrastive topic]
John-NOM apple-WA eat-PAST
'John ate an apple (as opposed to something else).'

In (4a), '*-wa*' attaches to the constituent that the sentence is about (i.e. John)—the thematic topic or theme of the sentence. However, what we focus on in this paper are cases like (4b), where '*-wa*' marks a contrast between the constituent it attaches to (i.e. 'apple') and other constituents the speaker could have used in its place in the given context (e.g. a different fruit). Constituents to which this contrastive '*-wa*' attaches get focal stress, so in (4b) '*ringo*' is stressed.[3] In general, contrastive '*-wa*' can attach to a number of phrases of different categories: NPs (cf. (4b)), VPs (cf. (5a)),[4] PPs (cf. (5b)), and APs (cf. (5c)). As indicated in the corresponding translations, the contrastive topic marker '*-wa*' consistently marks contrast between the word or phrase it attaches to (its "host") and other elements of the same category (or semantic type).

(5) a. John-ga oDORI-**wa**-sita. [VP]
John-NOM dance-WA-did
'John danced (as opposed to doing something else).'

b. Tokyo-E-**wa** gakusei-ga i-tta-ga, Tokyo-KARA-**wa** ko-naka-tta. [PP]
Tokyo-to-WA student-NOM go-PAST-but Tokyo-from-WA come-NEG-PAST
'Students went to Tokyo, but didn't come from Tokyo.'

c. YaWARAKAku-**wa**-aru-kedo atatakaku-nai buranketto [AP]
soft-WA-is-but warm-NEG blanket
'The blanket which is soft, but not warm'

In Slovenian, similar constructions to those just discussed are expressed using the '*pa*' particle.[5] Like '*-wa*', '*pa*' can mark sentence topics by following them. This includes thematic topics, as in (6), as well as contrastive topics, as in (7). On other words, '*pa*' in in (6) marks what the sentence is about (cf. '*-wa*' in (4a)), and in (7) it signals contrast (cf. '*-wa*' in (4b)); e.g. in (7a) 'studied' is contrasted with 'eat'. Like with Japanese, we will focus on this later use.

(6) a. A: *You already know Hungerpot and Thickhead, did you maybe have the chance to meet Slyboots?*

b. B: Zvitorepca **pa** še nisem spoznal. [thematic topic]
S.GEN PA yet not.AUX.1 met.M.3
"As for Slyboots, I did not meet him yet."

(7) a. Lakotnik je jedel, Trdonja **pa** se je uČIL. [contrastive topic]
H.NOM AUX.2 ate.M T.NOM PA REFL.ACC AUX.3 studied.M
'Hungerpot was eating whereas Thickhead was studying.'

[3] '*-wa*' itself can also be stressed; e.g. *ringo-wa* in (4b) can surface as *ringo-WA*. Furthermore, both '*-wa*' and the constituent can get focal stress, as in *RINgo-WA*. See Tomioka (2010a) for relevant discussion.

[4] The verb form in (5a) is called *renyookei* in traditional grammars and is sometimes seen as a nominalized verb. The exact category of the form is not relevant to the discussion here. See Tagawa (2008) for relevant discussion.

[5] The particle has many other use beyond those that we discuss here (see Marušič et al. 2011, 2015 for discussion). Most notably, there is a conjunction '*pa*'. But it is probably a distinct element; it does not have the same form across different varieties of Slovenian, and differs from other instances of '*pa*' in that it is not a 2nd position clitic.

b. Lakotniku je všeč meso, Trdonji **pa** (je všeč) soLAta.
H.DAT AUX.3 like meat.NOM T.DAT PA (AUX.3 like) salad.NOM
'Hungerpot likes meat, whereas Thickhead likes salad.'

It should be noted that despite their semantic/pragmatic similarities (as thematic/contrastive topic) markers, *'pa'* and *'-wa'* differ in their morpho-syntactic distribution. Recall that *'-wa'* is a suffix, but *'pa'* is a 2nd position clitic. Note here that the 2nd position requirement applies to the whole clitic cluster (see Franks and King, 2000; Bošković, 2001), and *'pa'* specifically can appear either before or after any other clitics in the cluster, as shown by the sentences in (8).[6]

(8) a. Lakotnik **pa** se ji je opraVIčil.
H.NOM PA REFL.ACC 3.F.DAT AUX.3 apologized.M
b. Lakotnik se ji je **pa** opraVIčil.
H.NOM REFL.ACC 3.F.DAT AUX.3 PA apologized.M
'As for Hungerpot, he apologized to her.'

As reported by Marušič et al. (2011), *'pa'* can even appear within the clitic cluster itself, but only if the following clitic(s) are focused, as illustrated in (9).[7]

(9) Lakotnik mu jo je vzel, Trdonja mu **pa** GA je vzel.
H.NOM 3.M.DAT 3.F.ACC AUX.3 took.M T.NOM 3.M.DAT PA 3.M.ACC AUX.3 took.M
'Hungerpot took her from him, whereas Thickhead took HIM/IT from him.'

This property of *'pa'* is very telling with respect to its role as a topic marker. As shown further in (10a) and (10b), only elements below/to the right of *'pa'* in a clause can bear focus.[8]

(10) a. Rekel sem, da Zvitorepca bom **pa** JAZ poklical.
said.M AUX.1 that S.ACC will.1 PA I call.M
'I said that I (as opposed to someone else) will call Slyboots.'
b. Rekel sem, da Lakotnika bom **pa** (jaz) poKLIcal.
said.M AUX.1 that H.ACC will.1 PA I call.M
'I said that I will call (as opposed to invite/hug/pat ...) Hungerpot.'

Crucially, in contrast to (10a) and (10b), nothing higher than/to the left of *'pa'* can be focused. Thus, in (11a), the subject pronoun, which is higher than *'pa'*, cannot be focused. In the same way, the focus on the verb results in ungrammaticality in (11b).[9]

[6] Marušič et al. (2011) do not report any differences between the two sentences in (8), but (8a) is more natural with a contrastive topic interpretation, accompanied by stress on the relevant focused element to the right of *'pa'*.
[7] Slovenian clitic pronouns are exceptional in their ability to be stressed (Bošković, 2001).
[8] The *'bo(m)'* and *'pa'* clitic cluster is technically in the 3rd position here, as the topic *'Slyboots'* appears right after the complementizer. Slovenian is more flexible with the 2nd position requirement than other languages in its family (Franks and King, 2000; Bošković, 2001; Sheppard and Golden, 2002), which we return to in Section 5.
[9] Both examples in (11) are grammatical if the word preceding *'pa'* is not focused, just like the examples in (10) are (see footnote 8 regarding the exceptional 3rd position placement of the clitic cluster in such examples).

(11) a. *Rekel sem, da JAZ <u>bom</u> **pa** poklical Lakotnika.
said.M AUX.1 that I will.1 PA call.M H.ACC
int.: 'I said that I (as opposed to someone else) will call Hungerpot.'

b. *Rekel sem, da poKLIcal <u>bom</u> **pa** (jaz) Lakotnika.
said.M AUX.1 that call.M will.1 PA I H.ACC
int.: 'I said that I will call (as opposed to invite/hug/pat . . .) Hungerpot.'

These examples show that *'pa'* is indeed a topic marker—in that it must immediately follow the topic—foci can only appear to its right. Furthermore, the placement of *'pa'* is restricted with respect to other focus sensitive particles like the clitic *'že'* ("already"), which cannot precede *'pa'*, as seen in (12), showing that even elements that only associate with focus must follow *'pa'*.

(12) a. *Lakotnik <u>se</u> <u>ji</u> <u>je</u> <u>že</u> **pa** opravičil.
H.NOM REFL.ACC 3.F.DAT AUX.3 already PA apologized.M

b. Lakotnik <u>se</u> <u>ji</u> <u>je</u> **pa** <u>že</u> opravičil.
H.NOM REFL.ACC 3.F.DAT AUX.3 PA already apologized.M
'As for Hungerpot, he already apologized to her.'

The placement of *'pa'* is sensitive to information structure; topics (thematic or contrastive) always occur to its left, whereas foci and other focus sensitive particles may only occur to its right. Similarly, contrastive *'-wa'* in Japanese marks the focus by attaching to it. In that sense, the information structure status of the constituents in a sentence can be "read off" the two particles in their respective languages by looking at their placement.

3. Imperatives with *'pa/wa'*

The focus of our paper is the behavior of the two particles in imperatives, and at first glance *'pa'* and *'-wa'* have the same semantic contribution in imperatives as in the plain declaratives seen above. As seen in (13) and (14), the use of *'pa'* and *'-wa'* marks contrast on "salmon".[10]

(13) a. <u>A:</u> *I'm at the store, and they don't have tuna, eel, or mackerel.*

b. <u>B:</u> Kupi **pa** LOsos-a. [Slovenian]
buy.IMP.(2) PA salmon-ACC
'Buy salmon then.'

(14) a. <u>A:</u> *To open a sushi bar, we have to buy lots of different kinds of fish. But we don't have enough money to do so.*

b. <u>B:</u> SAke-**wa** ka-e-yo! [Japanese]
salmon-WA buy-IMP-SFP
'Buy at least salmon!' (cf. Hara, 2006; Tomioka, 2010a)

[10]Notice that the contexts in (13) and (14) are slightly adjusted for each language due to the "at least" reading that arises with *'-wa'*, which is also available outside of imperatives; see 4.2).

3.1. Contrasting imperatives with modals

The special status of imperatives becomes apparent when they are contrasted with a modalized declarative. In the Slovenian example (15a), a contrast is made between the imperative roughly equivalent to *You should go to school* (marked by *'pa'*) and *You need to go to school* (explicitly negated in the first clause). The imperative is being contrasted with a modal clause, just like modals can be contrasted with other modals, as in (15b), where *need* and *can* are contrasted.[11]

(15) a. Ni ti treba it v šolo, vseeno **pa** POJdi!
not 3.DAT need go.INF in school.ACC anyway PA go.IMP.(2)
'You don't have to go to school, but you should go anyway!'

b. Ni ti treba it v šolo, vseeno **pa** lahKO greš.
not 3.DAT need go.INF in school.ACC anyway PA can go.2
'You don't have to go to school, but you can go anyway!'

Examples like (15a) cannot be replicated in Japanese, but this seems to be independent from any differences in the imperatives themselves. That is, the use of *'-wa'* to contrast different modals like in (15b) is limited to begin with. There are cases where *'-wa'* can attach to modal elements, like (16), but it is not entirely clear if their function is parallel to that of (15b).

(16) John-ga gakoo-ni iku-koto-ga-DEKI-**wa**-suru-ga, (koosoku-zyoo) ika-naku-temoii
John-NOM school-to go-thing-NOM-can-WA-do-but school.regulation-on go-NEG-may
'John can go to school, but he does not have to go (given the school regulations).'

It might be that this difference is because of the "at least" reading of *'-wa'*, which we return to in Section 5. If the split between Japanese and Slovenian seen here is real, it already indicates that despite the functions of *'-wa'* and *'pa'* being largely parallel as topic markers (as we saw above, there are differences in terms of the kinds of foci they may associate with). This will be important as we move on to our discussion of the asymmetry with concessive imperatives.[12]

3.2. Concessive imperatives

Recall that in Slovenian, but crucially not in Japanese, a topic particle may yield a concessive reading of an imperative. This asymmetry is illustrated again in (17).[13]

[11] One may here wonder whether examples like (15a) contrast different speech acts. However, we will argue that another reading, namely the concessive reading, involves contrast at the speech act level.

[12] But see Tomioka (2010a) who argues that *'-wa'* operates on speech acts. It should be noted that speech acts in Tomioka (2010a) differ from what we will treat as speech act alternatives in the text below.

[13] We do not claim that Japanese lacks concessive imperatives. What we show here is that concessive imperatives with a contrasitve topic marker are impossible. In fact, Japanese employs an alternative strategy to form concessive imperatives, shown in (i), where the conditional marker *'nara'* is employed to convey the speaker's concession.

(17) a. A: *Don't eat that fish! It's poisonous.*
b. B: *I eat that kind of fish all the time, and I'm still alive.*
c. A (Slo.): **Pa** pojej jo!
PA eat.IMP.(2) 3.F.ACC
'OK, eat it then!'
c'. A (Jpn.): #Tabe-**wa**-si-ro-yo!
eat-WA-do-IMP-SFP
'At least eat it!'

In order to better understand what exactly is encoded in a concessive imperative, we can compare it with a couple of other non-canonical imperative functions, which at first glance appear to be similar. These are so called *acquiescence* and *indifference* readings (see von Fintel and Iatridou, 2017). The hallmark of the former is that they signal that the speaker does not have a problem with the addressee carrying out the action described by the imperative (e.g. *'Sure. Go ahead. Open the window!'*), but they do not function as commands and do not seem to impose an obligation on the addressee. Similarly, an indifference imperative (as the name suggests) signals that the speaker has no opinion about whether the addressee should or should not act in accordance with the imperative (e.g. *'Open the window! Don't open the window! I don't care.'*).

The similarity between concessive imperatives and the two other readings just discussed is the lack of the speaker imposing an obligation on the addressee, but crucially concessive readings cannot just be reduced to either acquiescence or indifference readings—they give rise to an additional inference: that the speaker and addressee disagree over the imperative. This is best illustrated by the infelicity of the Slovenian examples in (18) and (19), where *'pa'*-imperatives are respectively forced into an acquiescence and indifference context.

(18) a. A: *It's getting warm. Can I open the window?* [✗ acquiescence]
b. B: Seveda. #**Pa** odpri ga!
sure PA open.IMP.(2) 3.M.ACC
int.: 'Sure. Open it!'

(19) a. A: *It's getting warm. Should I open the window?* [✗ indifference]
b. B: #**Pa** odpri ga ali ne odpri ga! Mene ne briga.
PA open.IMP.(2) 3.M.ACC or NEG open.IMP.(2) 3.M.ACC me.ACC NEG care
int.: 'Open it or don't open it! I don't care.'

(18) only works if the speaker wants to convey reluctance about letting the addressee open the window, whereas (19) is infelicitous even out of the blue. We argue that this is because concessive imperatives do in fact convey the speaker's preferences, albeit indirectly; concession

(i) Nara, ik-e!
If go-IMP
'Well, go then!'

Interestingly, in Slovenian, a *'pa'*-concessive imperative may be preceded by a conditional clause, as in (ii), but due to reasons of space we leave the exploration of a potential parallelism between the two for future work.

(ii) Če tako misliš, (potem) **pa** pojdi!
if this think.2, then PA go.IMP.(2)
'If you think that's the case, then go!'

involves the speaker expressing the addressee's preferences in contradistinction with their own preferences. Concession crucially does not express speaker indifference, nor does it express that the speaker has no problem with the addressee carrying out the action described in the imperative—disagreement is actually the key. And as we show next, the addressee's preferences actually have a privileged status in concessive imperatives.

3.2.1. Speaker distancing in concessive imperatives

When a canonical imperative is uttered, the speaker cannot also explicitly state a preference for the negation of the propositional content of that imperative, as shown in (20a) for English (Kaufmann, 2012; Condoravdi and Lauer, 2012). Follow-ups that have this effect, like *'… but I don't want you to'*, can be seen as cases of *distancing* by the speaker (Stegovec and Kaufmann, 2015). The observation carries over to Slovenian and Japanese, as seen in (20b) and (20c).

(20) a. #Buy salmon! But I don't want you to buy it.
b. #Kupi lososa! Ampak nočem, da ga kupiš!
buy.IMP.(2) salmon.ACC but not.want.1 that 3.M.ACC buy.2
'Buy salmon! But I don't want you to buy it.'
c. #Sake-o ka-e! Demo watasi-wa kimi-ni soo-site-hosiku-nai.
salmon-ACC buy-IMP but I-TOP you-DAT so-do-want-NEG
'Buy salmon! But I don't want you to do so.'

Crucially, distancing by the speaker is constrained differently in concessive imperatives. In a *'pa'*-concessive, the speaker may felicitously express a preference for the negation of the propositional content of the imperative, as in (21a).[14] Note that this is not possible when *'-wa'* is used with an imperative in Japanese as in (21b), highlighting the asymmetry between the two.

(21) a. ?**Pa** kupi lososa! Ampak (jaz) nočem, da ga kupiš!
PA buy.IMP.(2) salmon.ACC but I not.want.1 that 3.M.ACC buy.2
'Well, buy salmon then! But *I* don't want you to buy it.'
b. #Sake-**wa** ka-e! Demo watasi-wa kimi-ni soo-site-hosiku-nai.
salmon-WA buy-IMP but I-TOP you-DAT so-do-want-NEG
'Buy at least salmon! But I don't want you to do so.'

In contrast to (21a), if the speaker of a concessive imperative tries to follow it up by attributing the preference for the negation of the imperative's propositional content to the addressee, this yields infelicity. This is shown in (22a) with a Slovenian *'pa'*-concessive, contrastied again with a Japanese example in (22b)—showing that the latter is not a concessive imperative.

[14]The degradation in (21a) is due to the follow up feeling redundant—it essentially conveys what the concessive imperative already conveys on its own. It should also be noted that the distancing facts are more intricate than we have space to discuss here; see Condoravdi and Lauer (2012); Kaufmann (2014) for discussion. The key point remains: although the speaker appears to concede to the addressees preferences in a concessive imperative, the speaker's original preferences do not entirely disappear—which is what we try to capture with our analysis below.

(22) a. **#Pa** kupi lososa! Ampak vem da ga nočeš kupit!
PA buy.IMP.(2) salmon.ACC but know.1 that 3.M.ACC not.want.2 buy.INF
'Well, buy salmon then! But I know you don't want to buy it.'

b. Sake-**wa** ka-e! Kimi-wa soo-si-taku-nai-no-o sitteru-kedo.
salmon-WA buy-IMP you-TOP so-do-want-NEG-C-Acc know-though
'Buy at least a salmon! I know you don't want to do so, though.'

Therefore, while uttering a canonical imperative publicly commits the speaker to the imperative, uttering a concessive imperative makes the speaker publicly acknowledge that the imperative is in line with the addressee's preferences. An analysis of concessive imperatives must therefore capture that: (i) given a canonical imperative P!, where P is a proposition that resolves a decision problem (a set of propositions), a concessive imperative ⚐P! commits the speaker to believing $\neg P$ is the optimal solution, and (ii) the speaker of ⚐P! simultaneously acknowledges that the addressee entertains P as the optimal solution. We propose that although the solutions to the decision problem in (i) and (ii) are in direct conflict, they can both be expressed by a single imperative—a concessive imperative—if we model speaker and addressee commitments/attitudes as focus alternatives. The intuition is that when *'pa'* yields a concessive imperative in Slovenian, *'pa'* is associating with a "focused" representation of speech act participant commitments the same way as it associates with focused predicates in examples like (1a). We proceed to outline our analysis in the following section, providing first the necessary assumptions regarding the semantics of focus alternatives and the semantics of imperatives.

4. Analysis: Hidden alternatives

We propose that all the readings that *'pa'* and *'-wa'* can yield in imperatives—including, crucially, the concessive one—arise from the particles associating with different elements in the narrow focus of the sentence. The contribution of *'pa'* or *'-wa'* to the meaning (and function) of a sentence depends on which element is the narrow focus. The main upshot of the analysis is that a single lexical entry can be given for *'pa'*, without having to posit a special status for *'pa'* in its discourse related use. We adopt the core ideas of *alternative semantics* approaches to focus (Karttunen, 1976; Karttunen and Peters, 1979; Rooth, 1985, 1992; Büring, 1997), namely: focus invokes a set of alternative propositions, which constitutes the *focus value* of a sentence ($[\![S]\!]^{f,c}$). In (23a), where *'salmon'* is the focus, the focus value of the sentence is a set of propositions of the form *Slyboots bought x*, where the focus is replaced by a variable of the same type as the focused element.[15] The variable can correspond to any element of the right type that is salient in the given context (c); we represent this semi-formally, for ease of exposition, as in (23b).

(23)

a. Slyboots bought SALmon.

b. $$[\![S]\!]^{f,c} = \textit{Slyboots bought} \left\{ \begin{array}{l} \textit{salmon} \\ \textit{tuna} \\ \textit{eel} \\ \textit{mackerel} \\ \ldots \end{array} \right\}$$

[15]Minimally, the variable must have the same semantic type, but it may be further (contextually) constrained; e.g. in (23a) we may want to constrain the variable to kinds of fish. We abstract away from this in our discussion.

This focus value of a sentence is in contradistinction to its *ordinary value* ($[\![\text{S}]\!]^{o,c}$), which is the proposition that is actually overtly expressed by the sentence in question:

(24) a. Slyboots bought SALmon. b. $[\![\text{S}]\!]^{o,c} =$ *Slyboots bought salmon*

The shorthand we will be using for the meaning of sentences with focus is illustrated in (25a); text in bold marks what is present in both the ordinary value and the focus value of the sentence.

(25) a. Slyboots bought SALmon. b. $[\![\text{S}]\!]^{c} = \textit{Slyboots bought} \left\{ \begin{array}{l} \textbf{\textit{salmon}} \\ \textit{tuna} \\ \textit{eel} \\ \textit{mackerel} \\ \ldots \end{array} \right\}$

Having established the basics of how focus can be interpreted in plain declarative sentences, we can now move on to imperatives. We will be following Kaufmann's (2012) approach to the semantics of imperatives, where their characteristic semantics is attributed to a modal operator—which is at its at-issue level a necessity modal, but equipped with presuppositions that ensure the imperative can only be used performatively. We use represent this modal with 'Imp' with its meaning given in (26); following standard assumptions we treat it as a quantifier over possible worlds whose meaning depends on *conversational backgrounds*—functions from worlds to sets of propositions (Kratzer, 1981, 1991, 2012). These are the *modal base* (f), which yields a (necessarily consistent) body of information, and the *ordering source* (g), which induces an ordering among the worlds that comply with f (and is possibly inconsistent). Given this, we semi-formally represent the meaning of imperatives as illustrated in (27).

(26) $[\![\text{Imp}]\!]^{c} = \lambda f \,.\, \lambda g \,.\, \lambda p \,.\, \lambda w \,.\, (\forall v \in O(w,f,g))[p(v)]$
($O(w,f,g)$ is defined as the set of worlds conforming to f at w (i.e., in $\bigcap f(w)$) that are best according to g at w)

(27) $[\![\text{Buy salmon!}]\!]^{c} =$ Imp *you buy salmon*

The advantage of taking this approach to imperatives may not be that evident at first. This approach does allow us to treat some imperatives with *'pa'* and *'-wa'* as straightforwardly as their declarative counterparts. Since the two elements are focus sensitive particles, imperatives where they associate with a focused direct object as in (28) can both be analyzed as having the meaning in (29), where (29a) is a rough paraphrase and (29b) the semi-formal representation.

(28) a. Kupi **pa** LOsos-a.
buy.imp.(2) pa salmon-acc
b. SAke-**wa** ka-e-yo!
salmon-wa buy-imp-sfp

(29) a. *Buy SALmon! [not tuna, eel, mackerel, . . .]*

b. $\text{I\scriptsize MP}$ *you buy* $\left\{\begin{array}{l} \textbf{\textit{salmon}} \\ \textit{tuna} \\ \textit{eel} \\ \textit{mackerel} \\ \ldots \end{array}\right\}$

The move to treat IMP as a modal also pays off in that we can explain examples where imperatives are being contrasted with modal verbs like in the Slovenian example in (30).

(30) Ni ti treba it v šolo, vseeno **pa** POJdi!
not 3.DAT need go.INF in school.ACC anyway PA go.IMP.(2)
'You don't have to go to school, but you should go anyway!'

In the alternative semantics approach, the variable representing the focused element in the focus value of the sentence is type-restricted, the imperative being contrastively focused against a modal verb implies that the two are of the same relevant type.[16] This follows immediately from a modal analysis of imperatives. Thus, the meaning of the second clause in (30) can be analyzed as in (31)—as the contrast is explicit in this case, the set of propositions in the focus value is contextually narrowed down to the two containing *'need'* and IMP (cf. (31b)).

(31) a. *[You don't need to, but] GO to school anyway!*

b. $\left\{\begin{array}{c} \textbf{IMP} \\ \textit{need} \end{array}\right\}$ *you go to school*

This brings us to the concessive reading. On an intuitive level, a concessive imperative expresses at least two things: (i) an imperative (≈ *you should P*) and (ii) a disagreement between the speaker and addressee concerning the optimal solution to a *decision problem* (≈ *I think you should ¬P* vs. *You think you should P*; see below for a definition). In order to capture these two layers of meaning, we suggest that the two can be thought of as its ordinary value and its focus value respectively, and crucially the ordinary value is tied to addressee preferences and public commitments, as we saw with the asymmetries in speaker distancing above.

A decision problem, following Kaufmann (2012), is a contextually given set of propositions describing future courses of events that jointly exhaust the context set.[17] The prejacent of IMP presents one solution to it, and is therefore one of the elements in the set. What is odd about concessions compared to most other imperatives is that the prejacent of the imperative does not match the speaker's solution to the decision problem, and the speaker in fact appears to have a preference for the addressee not to act on it (as Kaufmann 2012: 160 admits, this is somewhat problematic for her account). We propose that the speaker/addressee disagreement can be modeled the same way as contrast in information structure terms. The general idea is that

[16] As noted previously, contrast seems to be needed to make modal alternatives salient with imperatives. We do not have a ready explanation for this fact, so we leave this question open for further study.

[17] Note that decision problems could also be modelled in terms of question sets (cf. Roberts, 1996).

concessive imperatives are special in that they primarily express what the speaker thinks are the addressee's preferences—unlike a canonical imperative, which primarily expresses the speaker's preferences. We suggest that this is why *'pa'* appears in concessive imperatives in Slovenian; as a contrastive topic marker, *'pa'* must range over focus alternatives that in this case include (along with the imperative) the equivalent of an embedding attitude verb ($\approx$ 'A *thinks that'* vs. 'B *thinks that'*). Pending our discussion of how and where this is encoded, this can be thought of along the lines of Ross's (1970) *Performative Hypothesis* as a literal—albeit silent—attitude verb dominating the matrix clause, and we express it as such in our derivation in (32).[18]

(32) a. Speaker: *Eat the fish then!*

b. $\left\{ \begin{array}{l} \textbf{\textit{You think that}} \\ \textit{I think that} \end{array} \right\}$ IMP *you eat the fish*

In (32b), the two "attitude alternatives" are both part of the focus value of the sentence, but only the addressee's is part of the ordinary value. The speaker's attitude is still present though, as part of the focus value—which is meant to capture that the speaker's preferences do not completely disappear with concessives. The imperative component and the prejacent stay constant as *'Eat the fish!'*, as they are shared by the ordinary and focus values of the sentence. At first glance, this seems at odds with the idea that the two attitudes include two mutually exclusive solutions to the decision problem (P/$\neg P$), however we argue that the two opposing propositions actually arise analogously to *Neg Raising*, that is: *'I don't think that P'* having the meaning of *'I think that not P'*. Consider P! as the imperative in (32), where the ordinary value of the entire construction is *You think* P!. Note that by virtue of the latter being the ordinary value, we can infer that $\neg$ *I think* P! (i.e. of the two alternatives *I think* P! is the excluded one). From this, we can derive *I think* $\neg P$! following analyses of *Neg Raising* in terms of the *excluded middle* (Bartsch, 1973; Heim, 2000; Gajewski, 2005) and the notion of *Opinionated Speaker*: a speaker is opinionated about α if it holds that 'the speaker is certain that α' $\vee$ 'the speaker is certain that $\neg\alpha$' (Soames, 1982; Sauerland, 2004; Fox, 2007). The derivation is given in (33).

(33)

$\neg$ *I think* P!	(*I think* P! is the denied alternative)
I think P! $\vee$ *I think* $\neg P$!	(*Opinionated Speaker*; excluded middle)
$\therefore$ *I think* $\neg P$!	

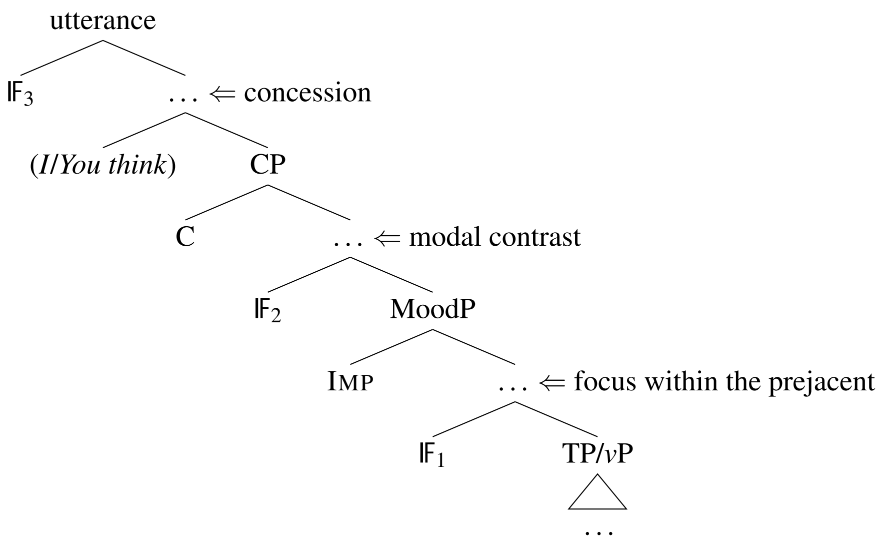
For our purposes, we assume that *Opinionated Speaker* is a pragmatic presupposition, and as such survives negation. Therefore, because $\neg$ *I think* P! and *I think* P! result in a contradiction, (32) also infers *I think that* $\neg P$!. The consequence of this is that (32) can indirectly signal the speaker's disagreement, which we argued is a key component in concession. Thus, if the information about "speaker/addressee attitudes" is encoded at some level where *'pa'* may be associated with it, we can derive the concessive reading of *'pa'*-imperatives in conjunction with two independently needed assumptions concerning *Neg Raising* and the *Opinionated Speaker*.

The question now remains as to where these "speaker/addressee attitudes" are encoded. Recall

[18]It may seem odd, given that focus marking is often directly tied to prosody, to talk about covert elements being in the focus. But see e.g. Heim (1992) and Ippolito (2007) for an unrelated use of focus on covert elements.

that both *'pa'* and *'-wa'* are sensitive to syntax in terms of the way the associate with focus. The former must precede the focus it associates with and follow backgrounded material, whereas the latter attaches to the focused constituent. A fairly standard way to approach the syntactic sensitivity of such particles is to assume that the different kinds of narrow focus correspond to different segments of syntactic structure.[19] We can then think of focus sensitive particles like *'pa'* and *'-wa'* (represented as $\mathbb{F}$) as needing to syntactically scope over the narrow focus. The rough syntactic representation of a matrix imperative in (34) can then be divided into three parts corresponding to the three main readings we discussed: (i) readings matching those in regular declaratives ($\mathbb{F}_1$ level), (ii) modal contrast ($\mathbb{F}_2$ level), and finally (iii) concession—contrast at the level of the "performative projection", where speaker/addressee attitudes are encoded ($\mathbb{F}_3$ level).

(34)



But is the performative projection actually present in the syntax? There is evidence from the behavior of concessive imperatives in Slovenian suggesting that it is. Slovenian allows imperatives to be embedded in indirect speech reports (Sheppard and Golden, 2002; Stegovec and Kaufmann, 2015), as in (35). Note that this example also contains *'pa'*, which is in second position in the embedded clause, preceding everything but the complementizer. Crucially, such imperatives can only get a non-concessive interpretation.[20] This means that the embedded clause cannot be interpreted as conceding to the addressee neither from the perspective of the original speaker—"Slyboots", nor from the perspective of the actual speaker in the given context.

(35) Zvitorepec je rekel, da **pa** kupi lososa.
S.NOM AUX.3 said.M that PA buy.IMP.(2) salmon.ACC
i. 'Slyboots said that you should buy salmon instead.' [✓contrastive object]
ii. *'Slyboots said that you should buy salmon then.' [✗ concessive]

The lack of the concessive reading in embedded imperatives can be straightforwardly derived assuming that the performative projection is present only in matrix clauses, as in embedded

[19] See e.g. Katzir (2007) for a specific implementation in terms of *structural focus alternatives*.
[20] Apart from focus on *'salmon'* (in the translation), other non-concessive readings are also available.

imperatives like the one in (35) the matrix attitude verb serves the same purpose (see Stegovec and Kaufmann, 2015; Stegovec, 2016). Note that *'pa'* can only precede the imperative verb and its arguments as it must immediately follow the complementizer—and therefore the matrix clause. Since *'pa'* can only associate with foci to its right and no performative projection is present in the embedded clause, our account correctly predicts the lack of a concessive reading.

What is the performative projection? Ross's (1970) original performative hypothesis is riddled with problems (for discussion, see Speas and Tenny, 2003) and has largely been abandoned. However, there have been more recent revivals of similar ideas, such as Speas and Tenny's (2003) Speech Act Participant projection, where the speaker and addressee are directly encoded into the syntax, or Pearson's (2012) use of attitudinal operators, where the speaker or addressee are encoded as attitude holders via presuppositions. In both cases, these special syntactic means of encoding speaker or addressee attitudes are assumed to be absent in most embedded clauses, which fits our explanation for the lack of embedded concessive imperatives. In fact, Pearson's approach is also adopted in Stegovec (2016, 2018) to account for independent asymmetries between matrix and embedded imperatives attested in Slovenian. There is thus converging evidence pointing towards the need to encode speaker and addressee attitudes in the syntax and our discussion of concessive imperatives confirms this further.

To conclude, we have shown that one can maintain a unified lexical entry for *'pa'* in Slovenian and still explain both its regular function as a topic marker as well as its discourse particle function. In addition, this account also suggests that the characteristic semantic function of imperatives is the result of both a modal operator IMP (Kaufmann, 2012; Stegovec, 2016) and a syntactic encoding of the speakers attitudes—introduced by a silent performative projection in matrix clauses and the embedding attitude verb in embedded imperatives. This last split crucially allows for an analysis where the modal contrast reading is derived independently from the concessive imperative reading. It is not entirely clear alternative more "minimal" analyses of imperatives (e.g. in terms of *To-Do Lists*; Portner, 2007) would capture the same facts.

5. How are *'pa'* and *'wa'* different?

We have shown thus far how the different readings *'pa'* and *'-wa'* may yield can be derived. But recall that not all the readings *'pa'* can yield are available with *'-wa'*. Most notably, *'-wa'* does not give rise to concessive readings—unlike *'pa'* in Slovenian. Although we do not offer a conclusive answer to this issue, we present two tentative solutions that will hopefully help to shed light on the language independent factors at play here. Assuming our analysis of concessive imperatives is on the right track, the concessive reading should be derivable in the same way in both languages—by invoking focus alternatives where speaker's and addressee's attitudes are contrasted. The two particles play a rather minimal role here, as they are only required to associate with the focus; they must scope over it. Based on this, then the lack of a concessive reading with Japanese *'-wa'* should result from an independent point of variation between the two which prohibits it to scope over the performative projection.[21]

A promising split to examine is the fact that *'-wa'*—but crucially not *'pa'*—also has an "at least"

[21] A point of variation we do not consider is the ability of *'-wa'* to yield hanging topics, which *'pa'* cannot do:

reading associated with it (this can be seen as resulting from a scalar implicature triggered by *'-wa'* or contrastive topics themselves; cf. Jackendoff 1972; Hara 2006; Tomioka 2010b). This effect is shown in relation to numerals bearing *'-wa'* in (36).

(36) Taro-wa doitu-ni tooka(-kan)-**wa** taizaisimasi-ta.
Taro-TOP Germany-in ten-day-for-WA stay-PAST
'Taro stayed in Germany for at least ten days.' (Schwarz and Shimoyama, 2011: 403)

This reading requires some notion of a scale or ordering between alternatives so that the focused expression can be "ranked" with respect to the other alternatives. It is not clear in contrast, how the focused speaker and addressee attitudes required for the concessive reading could be placed on a scale (at least if *I think* and *You think* exhaust all the options). Therefore, if the "at least" reading is an inherent property of *'-wa'*, when it associates with focus (cf. (2c') vs. (1b,4b,5)), this could be sufficient to prevent it from scoping over the performative projection and therefore blocking it from occurring with concessive imperatives.

A more straightforward solution would be to tie the split directly to the morpho-syntactic status of *'pa'* and *'-wa'*. Assuming that syntax maps directly to semantics (cf. (34)), restricting the syntactic positions the particles can occupy should also restrict their scope in semantics. Recall that *'pa'* is a 2nd position clitic and *'-wa'* (in imperatives) is a suffix placed above the verb stem and below the IMP morpheme (see (39b) below). Its morpho-syntactic distribution is even further restricted, as it can only attach to select "hosts" (e.g. it cannot attach to tense markers). *'Pa'* also differs in a crucial way from other clitics in Slovenian with respect to clitic placement. For instance, Slovenian allows 2nd position clitics to occur in 1st position in some matrix clauses:

(37) a. Podal mu je svoj-o sablj-o.
passed 3.M.DAT AUX.3 self's-ACC sword-ACC
'He passed him his sword.'

b. Mu je podal svoj-o sablj-o.
3.M.DAT AUX.3 passed self's-ACC sword-ACC
'He passed him his sword.'

This exceptional placement is not possible in imperatives when the verb is the first non-clitic (cf. (38a,b)) (Sheppard and Golden, 2002). The only exception to this is *'pa'*, as shown in (38c).

(i) a. Kudamono-**wa** John-ga ringo-o tabe-ta
fruit-WA John-NOM apple-ACC eat-PAST
'As for the fruits, John ate an apple.'

b. *Hrana/o **pa**, Lakotnik ljubi klobase.
food.NOM/ACC PA Hungerpot loves sausages.ACC
'As for food, Hungerpot loves sausages.'

There is no reason to think the hanging topic construction is comparable to the sort of constructions we took for the basis of our analysis of concessive imperatives, where focus plays the main role.

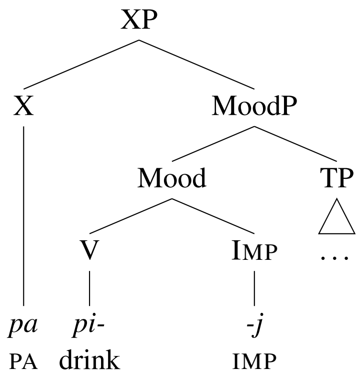
(38) a. Poda-j mu svoj-o sablj-o!
pass-IMP.(2) 3.M.DAT self's-ACC sword-ACC
'Pass him your sword!'

b. *Mu poda-j svoj-o sablj-o!
3.M.DAT pass-IMP.(2) self's-ACC sword-ACC
int. 'Pass him your sword!'

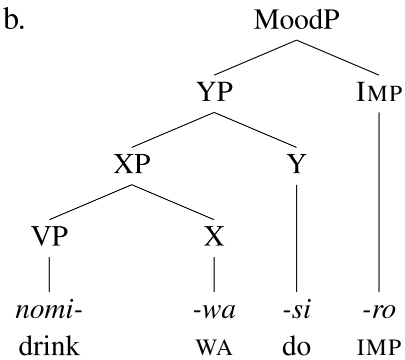
c. **Pa** podaj mu svoj-o sablj-o!
PA pass-IMP.(2) 3.M.DAT self's-ACC sword-ACC
'Well, pass him your sword then!'

This may be why *'pa'* occurs with concessive imperatives—it can occur exceptionally high in matrix clauses, above all overt material (cf. (39a)). We suggest, then, that in matrix clauses this allows *'pa'* to associate with focus in the performative projection. On the other hand, *'-wa'* attaches to the verb (cf. (39b)), so it may scope over the verb and anything in its extended projection, but not anything outside it—thus excluding the performative projection.[22]

(39) a.



b.



This approach may explain why there are some concessive imperatives in Japanese which can be analyzed as employing *'-wa'*. These cases have a sentence-initial host to which *'-wa'* can attach (as oposed to the verb) and the concessive reading becomes available in this case, as shown in (40) (the phonological string *'de-wa'* is often contracted into *'zyaa'* in Japanese).

(40) de-**wa**(/zyaa), ik-e!
Cop-WA go-IMP
'Well, go then!'

If in (40) the "high" *'-wa'*, like *'pa'*, occurs sufficiently high in the syntax to scope over the performative projection in the semantics, this would be expected from our analysis. But due to space limitations, we postpone a detailed analysis of such examples until future work.

[22]Note that we are somewhat vague about how affixes take scope outside the word (and we are not alone in doing this). In simple terms, one can think of it analogously to how affixal negation works: if NEG is an affix on the verb, it does not only scope over the verb itself, but also the arguments the verb takes, etc. Crucially, it does not scope over elements outside the extended projection of the verb—such as what we assume the performative projection to be (and possibly MoodP). In this sense, *'pa'* behaves like sentential negation, and *'-wa'* like verbal negation.

6. Conclusion

In this paper, we hope to have shown the advantage of not treating information structure marking and discourse particles as separate entities at least with respect to concessive imperatives. We have shown, based on a careful comparison of Slovenian and Japanese, that the two domains do not have to be distinguished. The Slovenian topic particle *'pa'*, which also licenses concessive imperatives, does not have to be treated differently in terms of its contribution to the meaning of the sentence; both when it delineates the sentence topic from its focus and when it introduces a concessive imperative, it is merely associating with focus alternatives. The difference is only in the type of the elements that are in the sentence focus. Our discussion hopefully also contributes to the understanding of the fundamental semantic properties of imperatives. In particular, by looking at the meaning and function of concessive imperatives and exploring, more generally, which aspects of imperatives may be contrasted in the discourse. Of course, there are several questions that remain open. To what extent are similar strategies employed cross-linguistically? Can other discourse particles be modeled in the same way? These are important questions that warrant further study as we move forward with this project.

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The similarity approach strikes back: Negation in counterfactuals[1]

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Abstract. The meaning of counterfactual conditionals is standardly described using the similarity approach (Stalnaker, 1968; Lewis, 1973). This approach has recently been challenged by Ciardelli et al. (2018). They argue that the similarity approach is in principle unable to account for the meaning of counterfactuals with an antecedent consisting of a conjunction embedded under a negation ($\neg(p \wedge q)$). Ciardelli et al. (2018) dismiss the approach on these grounds and offer an alternative. The main goal of the present paper is to defend the similarity approach against this attack. I will argue that the problem that underlies the observations in Ciardelli et al. 2018 is more general and not solved by the solution they offer. I will furthermore argue, against Ciardelli et al. (2018), that the cause of the problem is not the similarity approach, but the interaction of negation with the meaning of counterfactual conditionals. The paper will conclude with a first outline of a solution for the problem, which still uses the similarity approach, but combines it with an alternative semantics for negation.

Keywords: counterfactuals, negation, similarity approach, causality.

1. Introducing the main players and the storyline

How should we approach the semantics of counterfactual conditionals? If you look at the literature on this topic over the last 50 years, you will see that there is one particular approach that clearly dominates the field: the similarity approach of Stalnaker (1968) and Lewis (1973). We teach it to our students the first time they encounter the problem of counterfactual sentences and they grow up under the impression that this is the only way one should think about them. It became a paradigm, an empire in the vast field of the literature on counterfactuals. But paradigms come with a serious drawback: they can make us blind. We start to mistake theory for reality and, consequently, don't question it anymore. That also seemed to happen in the case of the similarity approach. Even though at the beginning the approach was challenged from various angles, the criticism dried out as the approach became more and more established.

However, in a recent paper by Ciardelli et al. (2018) the similarity approach was called into question again. A team of Skywalkers stepped forward and challenged the empire. They put forward an argument that targets the very core of the approach and claim that this argument convincingly shows that we need to give up our paradigm, dismiss the similarity approach. In this paper we will take the side of the empire and pick up the glove that has been thrown at its feet. We will argue that even though the argument of Ciardelli et al. (2018) is extremely valuable, it does not succeed in eliminating the similarity approach. There is a way to account for the observations they make without giving up the paradigm.

We will start in Section 2 with a short introduction to the similarity approach and premise semantics for counterfactuals. In Section 3 we will have a look at the recent challenge brought

[1]I would like to thank Ivano Ciardelli, Luca Champollion and the audience at Sinn und Bedeutung 22 for feedback and discussion. Special thanks to Jonathan Pesetsky for proof-reading the manuscript.

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forward by Ciardelli et al. (2018). We will discuss their evidence against the similarity approach and the alternative approach they propose. In Section 4 we will present our evidence against their proposal. We will argue that this evidence points actually to a more general problem concerning the interpretation of negation in conditionals. An alternative solution for the problem is sketched in Section 5. Section 6, contains conclusions and an outlook on future work.

2. The galactic empire

2.1. The similarity approach

From the perspective of possible worlds, the central question any approach to the meaning of counterfactual conditionals has to answer is the question of the selection function. A counterfactual is true if in a selected set of possible worlds that make the antecedent true, the consequent is true as well.[2] But which situations should be selected? As Goodman (1955) has shown, it cannot be the set of all possible worlds that make the antecedent true. The conditional (1) seems intuitively to be true. But the consequent of the counterfactual doesn't hold in all possibilities that make the antecedent true. What, for instance, if the match had been soaked in water overnight? This example shows that when we evaluate a counterfactual, we consider only a particular subset of the antecedent worlds. But how to select the right worlds?

(1) If I scratched this match, it would light.

The core idea of the similarity approach is that we select the possible worlds in which the antecedent is true and which in other respects differ minimally from the evaluation world w_0 of the counterfactual. This idea can be made precise using an order over possible worlds that, given the actual world, compares all other worlds with respect to their similarity to the actual world. This order is at least assumed to be a weak total order that centers around the actual world w_0 (the actual world is a smallest element of the order). A counterfactual with antecedent A and consequent C is now said to be true in case the consequent holds in all possible worlds that make the antecedent true and are minimal with respect to the order.[3]

There exist various refinements of this theory, imposing all kinds of extra conditions on the order. The argument against the similarity approach that will be discussed in the next section targets the basic core of the theory, which is what we outlined here.

2.2. Premise semantics

We can also take an inferential perspective on the truth conditions of counterfactuals. Then we could say that a counterfactual is true in case we can infer the consequent from the antecedent. From the inferential perspective, the question of the selection function discussed above becomes the questions of the premise function. It is not possible to infer the consequent just from

[2]This set can consist of one or more worlds, depending on the theory.
[3]For the purpose of this paper we follow Stalnaker (1968) and adopt the Limit Assumption.

the antecedent. Certain facts of the evaluation world are used as additional premisses of this inference. To infer the consequent of (1) from its antecedent, we need to take into account the laws governing the behaviour of matches. We also assume (because this is true for the match in front of me) that the match wasn't soaked in water overnight. In premise semantics this is spelled out in terms of the *premise set P*. P is the set of true facts of the evaluation world that matter for the truth of a counterfactual. A counterfactual is said to be true in case the consequent can be inferred from the antecedent together with the laws and any maximal subset of the premise set consistent with the antecedent. Choosing maximal subsets consistent with the antecedent makes sure that we take as many premises into account as possible, without running into a contradiction. Let Π be a set of sentences. We define $Max_{\Pi}(\phi)$ as the set of maximal subsets of Π consistent with ϕ. Then we can define the truth conditions of a counterfactual $A \rightsquigarrow C$ according to premise semantics as in A (Veltman, 1976; Kratzer, 1981b, a).

$$A \rightsquigarrow C \text{ iff } \forall S \in Max_P(A) : S \cup \{A\} \models C. \tag{A}$$

Suppose, for instance, the premise set P consists of the sentences p, q, and r and we want to evaluate a counterfactual with the antecedent $\neg p$. The unique maximal subset of P consistent with the antecedent would be the set $\{q, r\}$. A counterfactual with the antecedent $\neg p$ is true, in case the consequent follows from $\neg p$ together with q and r (and the relevant laws). It might happen that there are multiple equally maximal subsets of the premises that are consistent in the antecedent. In this case Clause A demands that the consequent has to follow from each of them together with the antecedent. Consider, for instance, a counterfactual with the antecedent $\neg p \vee \neg q$ using the same premise set. In this case there are two equally maximal subsets of P that are consistent with the antecedent: $\{p, r\}$ and $\{q, r\}$. Rule A now demands that both of these sets together with the laws and the antecedent entail the consequent.

2.3. The relation between similarity approach and premise semantics

If you think about it, premise semantics is actually not that different from the similarity approach discussed before. The premises that together with the antecedent have to entail the consequent characterise the relevant antecedent worlds that we need to check for the truth of the consequent. Also in case of premise semantics, we want these selected worlds to be as close as possible to the actual world; we want to keep as many of the premises as possible. We can define an order on possible worlds that compares them with respect to the premises they make true: given the premises P we say that a world w_1 is more similar to the actual world w_0 than a world w_2 in case the subset of P true in w_2 is a subset of the subset of P true in w_1. Based on this order the similarity approach will make the same predictions as Rule A.[4] Going back to our example with the premise set $\{p, q, r\}$, this set would induce the order on possible worlds given in the left diagram of Figure 1 (for each world only those premises are given that are true in this world, false premises are left out). The worlds w_3, w_5, w_6 and w_7 all make the antecedent

[4]For the formal details see Lewis 1981. If restrict ourselves to similarity relations that are strict partial orders, the equivalency also holds the other way around: given a similarity order, one can define a premise set P such that Rule A counts the same counterfactuals true. We can, thus easily switch from one perspective to the other.

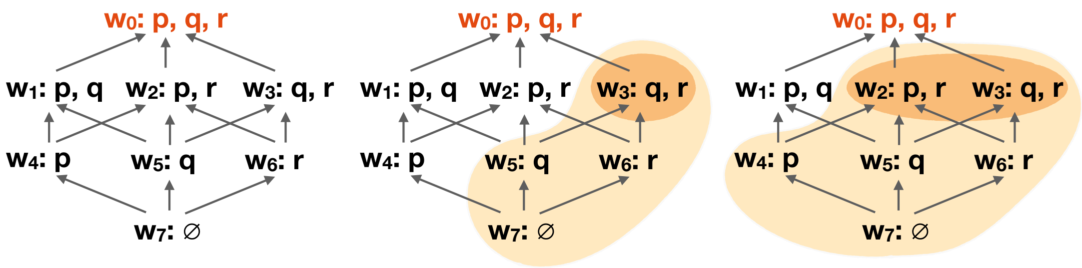

Figure 1: Evaluating counterfactuals given the premise set $\{p, q, r\}$.

If $\neg p$ *had been the case* true. Among these, w_3 is the world most similar to the actual world w_0 (dark orange in the second diagram of Figure 1). This is also the world where the maximal subset of the premises consistent with the antecedent is true. A conditional with antecedent $\neg p \vee \neg q$ is true in the worlds w_2, w_3, w_4, w_5, w_6 and w_4. The worlds most similar to the actual world are w_2 and w_3 (dark orange in the right diagram of Figure 1). They correspond to the two maximal subsets of the premises consistent with the antecedent that we calculated before.

This finishes our short presentation of the current paradigm for how to approach the meaning of conditional sentences. This is the empire in our story. Both perspectives, the similarity approach and premise semantics, will play a role in the discussion below. The attack of Ciardelli et al. (2018) is directed against the formulation using a similarity order, but for their alternative approach Ciardelli et al. (2018) build on premise semantics.

3. The empire under attack

3.1. Earlier strikes at the empire

We mentioned already at the beginning that the similarity approach has been attacked before. However, it is quite hard to really falsify the proposal. The reason is its generality. The argument has to work for any possible similarity order. It has to hit the very idea of approaching the meaning of counterfactuals using an order relation on possible worlds.

One way to truly hit the approach is by targeting its logic. The semantics of the similarity approach can be axiomatized (Lewis, 1973). The axioms capture the meaning of counterfactuals in terms of the inferences you are allowed to draw with them. One could attack the approach by arguing that the axioms the similarity approach give rise to are not the right ones: important properties of counterfactuals are not covered or some of the predicted inferences are in fact not valid for counterfactuals. An example for such an attack is the discussion concerning the law *Simplification of Disjunctive Antecedents* (SDA), see formula B. This law is not valid according to the logic of the similarity approach. In other words, SDA is not entailed by the axiomatisation. However, the principle seems to be intuitively valid, not only for counterfactuals (2a), but for conditionals in general (2b). Therefore, it has been argued, B should be a law of any adequate theory of the meaning of counterfactuals. The similarity approach doesn't tick this box, hence, the argument continues, we need a different approach.

$$(SDA) \quad [(\phi \vee \psi) \rightsquigarrow \chi] \rightarrow [(\phi \rightsquigarrow \chi) \wedge (\psi \rightsquigarrow \chi)] \tag{B}$$

(2) a. If Mary or Sue had been at the party, it would have been a lot more fun.
b. If it's sunny tomorrow or aliens invade Amsterdam overnight, I will eat breakfast outside.
c. If Spain had fought with the Axis or the Allies, she would have fought with the Axis.

This line of attack is not without problems. Some authors have argued that, while (SDA) holds for the normal resolution of similarity, it is not generally valid. See, for instance, examples as in (2c): from this counterfactual one cannot infer that if Spain had fought with the Allies, it would have fought with the Axis. But this wouldn't get the similarity approach completely off the hook; one would still need an account of the normal resolution of similarity. A different way to counter this attack is by replying that it only shows that the logic of the similarity approach needs to be strengthened. In other words, we need to put extra conditions on the similarity relation. However, there is an extra complication here. One can prove that no compositional account of the meaning of counterfactuals based on classical logic can validate (SDA) without validating *Antecedent Strengthening* (AS), given in formula C.

$$(AS) \quad [\phi \rightsquigarrow \chi] \rightarrow [(\phi \wedge \psi) \rightsquigarrow \chi] \tag{C}$$

Now, we certainly don't want (AS) to hold for the meaning of counterfactuals. This was the point of example (1): from *If I scratched this match, it would light* it doesn't follow *If the match was soaked in water overnight and I scratched it, it would light*. On the one hand, this sounds like bad news for the similarity approach. It clearly shows that we cannot account for (SDA) by strengthening the logic.[5] But you could also take this to be good news. The result shows that the validity of (SDA) is not a particular problem of the similarity approach. It is a problem of any approach to the meaning of counterfactuals that involves classical logic. This weakens the power of (SDA) as an argument against the similarity approach in particular. But if we want to adopt the similarity approach, we still need to explain why (SDA) seems intuitively valid.

So far we have been focusing exclusively on the conditional connective as an operator occurring in B. We implicitly assumed that it is the logic of this operator that needs to account for the critical observation. But there is another operator present in the relevant counterfactual: disjunction. Maybe the semantics assumed for the conditional connective is not the problem, but the semantics we assumed for disjunction. There are various other contexts in which the classical approach to disjunction is known to be problematic (Free Choice phenomena, exhaustive interpretation). This is also the angle from which Ciardelli et al. (2018) approach the problem of (SDA).[6] To deal with the semantics of disjunction properly, they propose that we need to work with a more fine-grained semantic framework: inquisitive semantics (Ciardelli et al., 2018). Most importantly, in this framework, the meaning of a sentence is not equated with the

[5] At least not without giving up basic logical principles, like the substitution of logical equivalencies.
[6] They are not the first to do so, see in particular Alonso-Ovalle 2009; Fine 2012; Schulz 2011 for related proposals.

set of worlds in which the sentence is true, but with a set of such sets, representing the maximal information states that would support the sentences. In most cases this set of sets just contains the set of worlds that make the sentence true. But the support condition for disjunctions introduce non-trivial alternatives: for each disjunct the set of worlds that make this disjunct true.[7] The counterfactual operator $\rightsquigarrow$ is then proposed to quantify over the alternatives the antecedent gives raise to, see D below. For the definition of the connective $\mapsto$ you can then pick your favourite notion of counterfactual entailment. It could be a similarity approach, the proposal of Ciardelli et al. (2018), or something else. Whatever you choose, the inference (SDA) will now be valid for $\rightsquigarrow$.

$$\phi \rightsquigarrow \psi \Leftrightarrow \forall p \in Alt(\phi) \exists q \in Alt(\psi) : p \mapsto q \tag{D}$$

Thus, at least in the case of (SDA), what started out as a challenge for the similarity approach eventually led to the development of a more advanced semantics of other operators involved in the critical observation. The similarity approach itself remained relatively unaffected.

3.2. The recent challenge by Ciardelli et al. (2018)

We will now turn to the challenge posed by Ciardelli et al. (2018) for the similarity approach. They also target the logic of the similarity approach. But the critical inference that they address is not one that is invalid according to the similarity approach, but should be valid according to our intuition. In the case of Ciardelli et al. 2018 we are dealing with an inference that is valid according to the logic, but is intuitively invalid according to Ciardelli et al. (2018): the inference in E.

$$[(\neg\phi \rightsquigarrow \chi) \wedge (\neg\psi \rightsquigarrow \chi)] \rightarrow [\neg(\phi \wedge \psi) \rightsquigarrow \chi] \tag{E}$$

Ciardelli et al. (2018) empirically tested the intuitive validity of the inference. They conducted an online experiment in which they asked participants to judge the truth or falsity of the counterfactuals given in (3) in the scenario depicted in Figure 2. In this scenario a circuit connects two switches to a lamp. The wiring is such that the light is on if and only if the switches are in the same position. In the depicted scenario both switches, A and B, are up and the lamp is on.

(3) a. If switch A was down, the light would be off.
    b. If switch B was down, the light would be off.
    c. If switch A or switch B was down, the light would be off.
    d. If switch A and switch B were not both up, the light would be off.

The results of their study are given in Table 1. The important observation is that even though the majority of the participants judged the conditionals (3a) and (3b) to be true, only 22% took

[7] Ciardelli et al. (2018) propose as the support condition of a disjunction $s \models \phi \vee \psi$ iff $s \models \phi$ or $s \models \psi$.

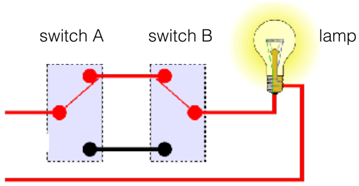

Figure 2: The circuit example of Ciardelli et al. (2018).

sentences	number	true	%	false	%	indet.	%
$\neg A \rightsquigarrow Off$	256	169	66,02%	6	2,34%	81	31,64%
$\neg B \rightsquigarrow Off$	235	153	65,11%	7	2,98%	75	31,91%
$(\neg A \vee \neg B) \rightsquigarrow Off$	362	251	69,33%	14	3,87%	97	26,80%
$\neg(A \wedge B) \rightsquigarrow Off$	372	82	22,04%	136	36,56%	154	41,40%

Table 1: Results of the empirical study.

(3d) to be true as well. However, according to E, if (3a) and (3b) are considered to be true, then (3d) should be true as well. This is a serious problem for the similarity approach. The inference in E is valid for the logic of the similarity approach. That means it holds no matter what similarity relation you choose. Ciardelli et al. (2018) conclude from this that the approach is doomed to fail. The empire falls.

Let us take a closer look at what the problem seems to be. Using the terminology of premise semantics, if (3a) is true, this tells us that the fact that switch B is up is part of the premises of the evaluation world. For the counterfactual to be true, the position of the second switch needs to be kept constant. In the same way the truth of (3b) allows us to conclude that the fact that switch A is up is part of the premises. There might be also other facts that count as premises. We will just consider one other fact, q.[8] The premise set $\{A, B, q\}$ results in the order over possible worlds described in Figure 3, first diagram. The sentence $\neg(A \wedge B)$ is true in the worlds w_1, w_3, w_4, w_5, w_6 and w_7, the area shaded bright orange in Figure 3, second diagram. According to the similarity approach, the most similar worlds are w_1 and w_2 (dark orange in Figure 3, second diagram). In both of these worlds the light is off. Hence, the counterfactual in (3d) is predicted to be true – contra to the results of the empirical study.

The problem seems to be that interpreters of (3d) also consider a world like w_5 where both switches are down. In this world the light is on and, hence, the counterfactual is judged to be false. So, the set that should be selected as the set of relevant antecedent worlds should be the set $\{w_1, w_3, w_5\}$, see the dark orange area in the last diagram of Figure 3. Thus, also worlds not optimal according to the order need to be selected as relevant antecedent worlds.

[8]The reader might wonder why we do not consider the possibility that the state of the lamp is part of the premises. According to Ciardelli et al. (2018) (and many other authors) the reason is that this is a fact causally dependent on the antecedent. Such facts are deselected as possible premisses. But this issue and the way Ciardelli et al. (2018) account for it is completely orthogonal to the topic of this paper. We simply assume that this is taken care of.

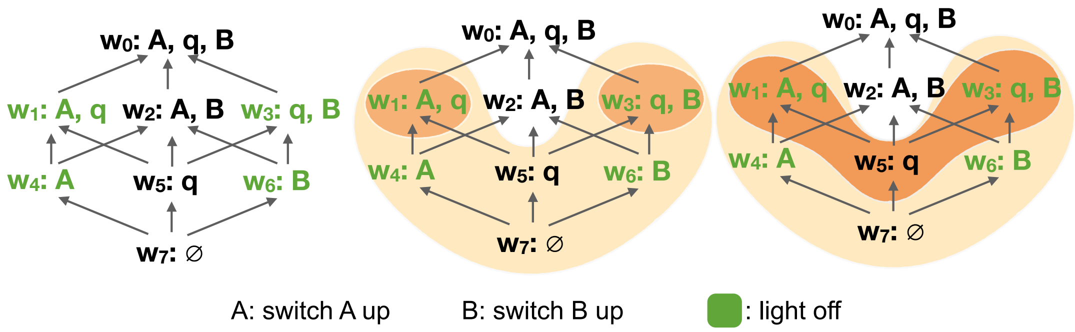

Figure 3: The worlds selected by the similarity approach for the antecedent of Example (3d) (center) and the worlds that should be selected for this antecedent (right).

3.3. The alternative approach of Ciardelli et al. 2018: Cautious retraction

Based on the criticism discussed in the last subsection, Ciardelli et al. (2018) dismiss the similarity approach. They conclude that we need to select the relevant antecedent worlds in a different way. The alternative they propose is spelled out in terms of premise semantics. Recall the interpretation Rule A of standard premise semantics, repeated here as F. According to this rule a counterfactual is true in case all maximal subsets of the premises consistent with the antecedent together with the antecedent entail the consequent.

$$A \mapsto C \text{ iff } \forall S \in Max_P(A) : S \cup \{A\} \models C. \tag{F}$$

Ciardelli et al. (2018) propose to replace this rule with Rule G. According to this rule, a counterfactual is true in case the intersection of all maximal subsets of the premises that are consistent with the antecedent together with the antecedent entail the consequent. They choose to err on the side of caution and only allow fact to be kept constant in case they are part of all maximal subsets consistent with the antecedent.[9] Thus, they predict a smaller subset of the premises to be carried over to the hypothetical scenario considered by the counterfactual, and, as a consequence, less counterfactuals to be true.

$$A \mapsto C \text{ iff } \bigcap Max_P(A) : S \cup \{A\} \models C. \tag{G}$$

With this interpretation rule they can account for observations concerning the critical example (3d). If we assume that the position of the switches, A and B, are part of the premises (together with other facts q), then there are two maximal subsets of the premises consistent with the antecedent $\neg(A \wedge B)$: the sets $\{A, q\}$ and $\{B, q\}$. The intersection only contains q; the positions of both switches in the actual world needs to be given up, because together they contradict the antecedent. We get the correct prediction that the consequent has to be true not only in the worlds w_1 and w_3, but also in w_5. The light isn't off in all of these worlds (not in w_5). Hence, the counterfactual comes out as false, as intended. For the counterfactuals (3a) and (3b)

[9]In fact, they propose that this set sets an upper limit for the premises kept. We will come back to this later.

Ciardelli et al. (2018) make exactly the same predictions as the similarity approach. In these cases there is only one maximal subset of premises that is consistent with the antecedent.

Because the interpretation rule given in G only takes into account the truth-conditions of the antecedent, it predicts identical truth-conditions for counterfactuals with logically equivalent antecedents. Therefore, one might think that this proposal makes wrong predictions for (3c), which has an antecedent that is logically equivalent to the antecedent of (3d). The counterfactual (3c) we do want to come out as true. However, Rule G is combined with Rule D, assuming inquisitive semantics for the treatment of disjunction. From the perspective of inquisitive semantics, while the antecedents of (3c) and (3d) are truth-conditional equivalent, they are not semantically equivalent. Because Rule D is sensible to this semantic difference, we get different truth conditions for the counterfactuals. The counterfactual in (3c) is still predicted to be true. The rule D checks whether each disjunct of the antecedent counterfactually entails the consequent. Whether we define counterfactual entailment using Rule F or Rule G, we obtain that the truth of the consequent is in w_1 and w_3. In these worlds the consequent is true. Hence, the counterfactual is predicted to be true.

4. The empire strikes back–part 1

The empirical results of Ciardelli et al. (2018) seem to be rather devastating for the similarity approach. No matter how the similarity order is defined, there is no way the approach will predict that (3a) and (3b) are true, while (3d) is false. Does this mean that we have to dismiss the approach; give up on the empire? In this section I will argue that this conclusion would be too hasty. First, I will make a more conceptual point and show that the proposal of Ciardelli et al. (2018) can still be seen as an order-based approach. The solution Ciardelli et al. (2018) propose is more a variation of than an alternative to the similarity approach. Secondly, I will claim that the empirical results of Ciardelli et al. (2018) hint at a more general semantic problem. While Ciardelli et al. (2018) are able to account for one particular realisation of this problem, they fail to account for other instantiations. Thus, their solution strategy – targeting the similarity approach – does not seem to work.

4.1. Cautious retraction as cautious similarity

As the authors admit, their proposal comes in spirit very close to premise semantics. But still it is not a standard premise semantics approach. Conceptually, Ciardelli et al. (2018) consider their approach different in that they do not incorporate what they call the minimal change requirement. The central idea is not to keep as many facts of the premises as the antecedent allows, but "... rather, whenever we are faced with a counterfactual assumption, we determine a background of facts which are not at stake, and we hold all these facts fixed." (Ciardelli et al. 2018: 35). The only restriction on the background is that it has to be a subset of $\bigcap Max_P(A)$.[10]

This sounds as if they completely do away with the idea of optimisation in the meaning of counterfactuals. The context fixes some set of background facts, to those facts we add the

[10] See also footonote 8.

antecedent and then we check whether the consequent follows. But that is not a very faithful picture of what is going on here. Looking at their formal apparatus we see two differences from standard premise semantics: (i) the background, the facts relevant for the meaning of a counterfactual, can be a subset of the filtered premisses, and (ii) the condition for how to filter or retract premises has changed. To the first difference a defender of standard premise semantics could reply that premise semantics captures this by making the premise function context dependent.[11] Ciardelli et al. (2018) do not show that their way to incorporate context dependence gives better results. The second difference is more substantial. Ciardelli et al. (2018) could have proposed that the upper limit of the background is the filtered premise set of standard premise semantics: $Max_P(A)$. They opt for being more cautious and choose $\bigcap Max_P(A)$ instead. However, the resulting truth conditions for counterfactuals can still be understood as result of an order-based optimisation process. In other words, and contra to what they seem to say, optimisation still plays a role in the semantics of counterfactuals. We will argue for this by showing that, just as for standard premise semantics, the truth conditions they predict for counterfactuals can be produced by selecting optional worlds based on a similarity order. You only have to be a bit more generous in what you count as an optimal world.

Assume, again, that P is our finite set of premises, the facts of the evaluation word that matter for the truth of a counterfactual.[12] As before, we use P to define a strict partial order on possible worlds: $w_1 \leq_P w_2$ iff $\{\varphi \in P \mid w_2 \models \varphi\} \subseteq \{\varphi \in P \mid w_1 \models \varphi\}$. Let $M_P^+(\varphi)$ be the $<_P$-maxima in the set of worlds that satisfy $\bigcap Max_P(\varphi) \cup \{\varphi\}$. Because P is finite, this set is non-empty. We use $M_P^+(\varphi)$ to define truth conditions for counterfactuals as in A.

$$A \mapsto C \text{ iff } \forall w' : \; [w' \models A \wedge \exists w \in M_P^+(A)(w' \leq_P w)] \rightarrow w' \models C. \tag{H}$$

It can now be shown that the conditions in G and H are equivalent. Thus, to check the truth of a counterfactual, we don't just look at the most similar antecedent worlds, but at all worlds smaller or equal to a certain limit, described by $M_P^+(A)$. Ciardelli et al. (2018) don't give up on similarity, they just relax a bit the order-based selection criterium.

Proof. The result follows from $\{w \mid w \models A \wedge \exists w \in M_P^+(A)(w' \leq_P w)\} = \{w \mid w \models \bigcap Max_P(A) \cup \{A\}\}$. So, we prove this equation.
$\Rightarrow$ Assume $u \in \{w \mid w \models A \wedge \exists w \in M_P^+(A)(w' \leq_P w)\}$. Thus, there exists a world $w \in M_P^+(A)$ such that $v \leq_P w$. Because of the definition of $M_P^+(A)$, it follows that $w \models \bigcap Max_P(\varphi) \cup \{\varphi\}$. Because $v \leq_P w$, it follows $v \models \bigcap Max_P(\varphi)$. We also know that $v \models A$. Thus, $v \in \{w \mid w \models \bigcap Max_P(A) \cup \{A\}\}$.
$\Leftarrow$ Assume $v \in \{w \mid w \models \bigcap Max_P(A) \cup \{A\}\}$. From this it follows $v \models A$. Because P is finite, it follows that there is a maximal w with $v \leq_P w$ and $w \models \bigcap Max_P(A) \cup \{A\}$. Hence, $v \in \{w \mid w \models A \wedge \exists w \in M_P^+(A)(w' \leq_P w)\}$.

[11] Ciardelli et al. (2018) choose for a framework where the premises function is fixed as the set of facts (Ciardelli et al. 2018: 25). Then, context dependence has to be build in at a different place and they choose they notion of background as the right place.

[12] We work with a finite set of premises, because this is also what Ciardelli et al. (2018) do. Additionally, they work with premise sets that consist only of atomic sentences. We don't adopt this restriction here.

4.2. Cautious similarity under scrutiny

We now turn to potential limitations of the alternative proposal of Ciardelli et al. (2018). As noticed before, the interpretation rule that according to Ciardelli et al. (2018) should take over the place of the similarity approach only takes the truth conditions of its arguments into account.[13] Consequently, the approach makes the same predictions for logically equivalent antecedents. It is not that clear that this prediction is actually correct. Take, for instance the antecedent $\neg A$: *"Switch A is down"*. $\neg A$ is logically equivalent to stating that switch A is down and that it is not the case that both switches are up, $\neg A \wedge \neg(A \wedge B)$. We can now compare the truth values assigned to counterfactuals with these two logically equivalent antecedents, see (4a) and (4b). In the scenario in Figure 2 the first counterfactual is dominantly judged to be true (see Table 1). But what about (4b)? Is this counterfactual also intuitively true in the described context? That seems at least questionable. Hence, there appears to be a difference in interpretation of (4a) and (4b). The redundant information $\neg(A \wedge B)$ cannot just be ignored, contra to what the similarity approach and also cautious similarity tell us.

(4) a. If switch A was down, the light would be off.
    b. If switch A and switch B were not both up and switch A were down, the light would be off.

One could counter that this is not a particular strong argument against the proposal. Assume that we were to empirically test (4a) and (4b) and observed a significant difference between the truth-judgements of both counterfactuals. It would still be hard to say what caused the difference. Maybe the observed difference is due to pragmatic reasons: the sentence (4b) is reinterpreted because of the redundancies in the antecedent. In other words, we could get rid of the problematic example by moving it to the pragmatic waste basket.

4.3. The limits of cautious similarity–an empirical study

Let's try to make the argument stronger. We also saw that the proposal of Ciardelli et al. (2018) doesn't deviate a lot from the similarity approach. Again, it operates using a set of selected facts of the actual world (premises) that need to be kept true in the selected antecedent worlds. The proposal also tries to keep as many of the premises as possible. The only difference is that Ciardelli et al. (2018) are a bit more cautions about when to keep a premise: only in case this premise is an element of each maximal subset of the premises consistent with the antecedent. So, basically, this is still an approach based on minimisation of differences from the actual world. But if the minimisation forces you to make a choice between two premises, the approach refuses to choose and gives up both.[14] If no such choice needs to be made, the approach makes exactly the same predictions as the similarity approach/premise semantics.

Assume now, I add to my counterfactual antecedent a formula expressing information about the

[13] In case this is not clear already, this holds also for the similarity approach.

[14] Just to compare, standard premise semantics/similarity approach demands that you check the consequent for both choices.

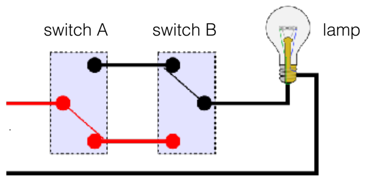

Figure 4: A new scenario with one switch down and no electricity.

premises that is true in the evaluation world. As long as the premises occurring in this formula do not contradict other parts of the antecedent, they will be in each maximal consistent set. Hence, the approach will try to keep them true in the considered counterfactual scenario. Consider, for instance, the counterfactuals in (5) in the scenario described in Figure 4. The wiring is as in the previous scenario of Figure 2, but now the position of the switches is different and we add as an additional fact of the evaluation world that there is no electricity at the moment.

(5) a. If the electricity was working, then then light would be on.
b. If the electricity was working and switch A was up, then the light would be on.
c. If the electricity was working and switch A and switch B were not both up, then the light would (still) be off.

As before, we use A and B to shorten *switch A is up* and *switch B is up* respectively. Additionally, we use E to shorten the claim that the electricity is working. As before, we can use examples like (5a) and (5b) to establish that E, $\neg A$ and B should be among the premises for the scenario presented in Figure 4. Given this premise set, what would Ciardelli et al. (2018) predict for the truth conditions of (5c)? In the first diagram of Figure 5 the different possibilities with respect to this premise set are described (w_0 is, again, the actual world). In the green worlds the light is off. The antecedent of (5c) is true in the worlds w_3, w_5 and w_7. The unique maximal subset of the premises consistent with the antecedent is $\{\neg A, B\}$. Because there is only one maximal subset with the antecedent, the approach makes the same predictions as the similarity approach: w_3 is selected as the world where the consequent needs to be true, marked dark orange in the first diagram of Figure 5. In w_3 the light is off. Thus, the approach predicts the counterfactual to be true.

However, this is not the interpretation that we observe. I conducted an experiment using an online questionnaire, designed with Qualtrics and distributed using Prolifix. The study duplicated the setting of the studies conducted in Ciardelli et al. 2018, only changing the example. Participants were asked to judge the truth/falsity of the counterfactuals given in (5) using a slider bar (see Figure 6). The slider bar allowed for five positions that were in the evaluation translated into the numbers $0-4$. The questionnaire was filled in by 51 native speakers of English, who received 1 Pound as payment. The results are given in Table 2.[15] The first two examples were interpreted in agreement with the predictions of Ciardelli et al. (2018) (and the similarity approach). This also confirms the premise set used to calculate the predictions. However, the

[15]Some of the responses can be questioned, because the participant either answered the fillers incorrectly or finished the study within a few seconds. In row 4 of Table 2 the corrected results are given. They are nearly identical to the unfiltered results.

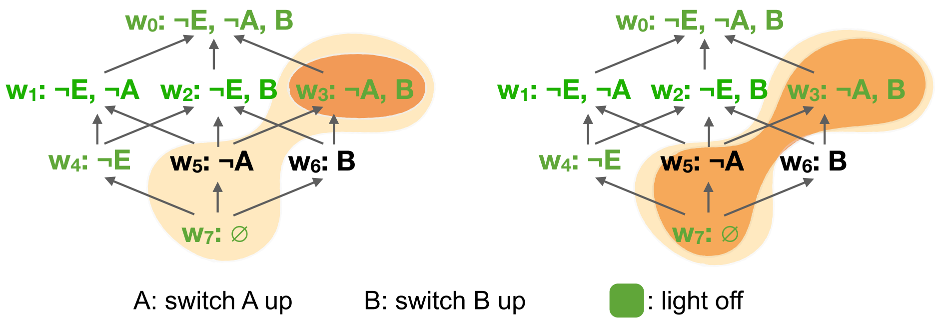

Figure 5: The worlds selected by Ciardelli et al. 2018 for the antecedent of (5c) (left) and the worlds that should be selected for this antecedent (right).

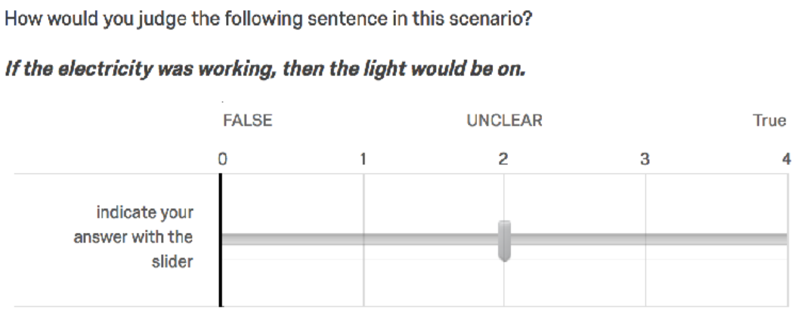

Figure 6: A screenshot from the online questionnaire.

counterfactual (5c) is by the majority of the participants judged to be false. The reason seems to be that the fact that switch B is up and switch A is down in the evaluation world shouldn't be kept constant in the hypothetical scenario introduced by the antecedent. These facts need to be given up. This would give you as the set of antecedent worlds $\{w_3, w_5, w_7\}$, marked dark orange in the second diagram of Figure 5. Then the counterfactual (5c) would correctly be predicted to be false.[16]

There are a couple of options for how Ciardelli et al. (2018) could defend their approach against the results presented here. One way would be to use the same move made in the last subsection and submit the observations to the pragmatic waste basket. In the end, also in this case the antecedent of the critical counterfactual (5c) contains information that is redundant. The only difference is that now the redundancy is context dependent, while before contextual information didn't matter. This is an easy move to be made, but only convincing in case one can back it up with a solid pragmatic story. One would probably want to turn to Grice's maxims of conversation: the speaker must have a reason to include redundant information; this reason is to signal to the speaker that A, and B shouldn't end up in the premise set, etc. However, making this argumentation explicit won't be easy. There are many possible reasons the speaker might have to mention redundant information. One would still need to explain how the hearer knows

[16]The problem that we noticed here is a problem that approaches to the meaning of counterfactuals based on the similarity approach share. Any approach that allows for substitution of logical equivalents will have trouble accounting for the observations made here.

sentences	true	%	false	%	indet.	%
$E \rightsquigarrow On$	8	16%	42	82%	1	2%
$(E \wedge A) \rightsquigarrow On$	43	84%	5	10%	2	4%
$[E \wedge \neg(A \wedge B)] \rightsquigarrow On$	14	27%	27	53%	8	16%
$[E \wedge \neg(A \wedge B)] \rightsquigarrow On^*$	9	26%	20	59%	5	15%

Table 2: Results of the empirical study.

that excluding *A* and *B* from the premise set is the only viable option here. Furthermore, one would have to explain how Gricean reasoning can interact with the operation of a semantic operator (the conditional connective).

4.4. Intermediate conclusions

In this section we explored the limits of the proposal of Ciardelli et al. (2018). We discussed at least one concrete example which the approach cannot immediately account for. We also outlined a possible pragmatic escape route for the approach, but observed that this route needs to be worked out. However, evaluating the proposal of Ciardelli et al. (2018) is not our goal. The purpose of this paper is to defend the similarity approach against the attack of Ciardelli et al. (2018). To some extend we did that in Subsection 4.1 when I argued that the alternative Ciardelli et al. (2018) propose is still an order-based approach and not really giving up on similarity. But also the results of the study conducted can be used to that purpose. They point to a different possible explanation of the data of Ciardelli et al. (2018), in particular one that leaves the similarity approach unaffected.

The antecedent of (5c) is very similar to that of the critical example (3d). Both antecedents involve a complex negation $\neg(A \wedge B)$. In both cases we observe that if we apply minimisation, we lose too many possibilities. In both cases we want to keep – in a certain sense– all logical possibilities that the negation allows. In the next section we want to explore an alternative explanation of the observations made in this paper; one that takes the negation to be responsible instead of the semantics proposed for the conditional. Though, we will not argue here that this solution should be preferred to the proposal of Ciardelli et al. (2018), the fact that this is a plausible alternative explanation of the data shows that we do not need to give up the similarity approach and the empire is safe for now.

5. The empire strikes back–part 2

5.1. ... by blaming negation

In this section I will develop an alternative explanation for the critical data of Ciardelli et al. (2018), one that at the same time can explain the observations made in Section 4. The structure of this solution employs the same strategy that we saw in Section 3.1 in reaction to the observation that the law (SDA) (simplification of disjunctive antecedents) seems intuitively valid for counterfactuals. There, we ended up blaming the disjunction in the antecedent for the validity of the inference. Following Alonso-Ovalle (2009); Fine (2012); Schulz (2011); Ciardelli et al. (2018) we proposed that the disjunction introduces alternatives for each of its disjuncts. The conditional is then said to quantify over these alternatives, see rule D, repeated here as I. The connective $\mapsto$ that the rule builds on can still be interpreted according to the similarity approach. From a more general point, we analysed the intuitive validity of (SDA) as evidence that we need a richer semantic framework than just basic truth conditions, in particular with respect to the semantic treatment of disjunction.

$$s \models \phi \rightsquigarrow \psi \Leftrightarrow \forall p \in Alt(\phi) \exists q \in Alt(\psi) : p \mapsto q \tag{I}$$

The same solution will be now proposed with respect to the observations of Ciardelli et al. (2018) and Section 4. Again, we take the examples to show that we need a richer semantic framework. In particular, we need to respect the alternatives that expressions might introduce. But in addition to the earlier proposal that disjunction introduces alternatives, we will argue here that this also applies to negation.

5.2. A counterproposal

At the core of the present proposal lies the idea that negation, just as disjunction, introduces alternatives. We already need the semantics of the connective $\rightsquigarrow$ to quantify over alternatives in order to account for disjunctive antecedents. The alternatives that negation gives raise to will be treated the same way. We will argue that this is sufficient to account for the critical observations.

We adopt the framework of inquisitive semantics that Ciardelli et al. (2018) work with.[17] The only thing we need to change is the support condition for negation. The solution we propose is inspired by standard approaches to truthmakers of negations. A truth maker of a formula $\neg\phi$ is standardly taken to be a formula χ that contradicts the formula ϕ in question ($\chi \perp \phi$). We additionally restrict truth makers of negations to relevant sentences/propositions that contradict ϕ. This means we need a notion of relevance here, a question that we want to see answered. As we are concerned with semantics here, we use a notion of relevance that is context independent and relies on the sentence itself. Assuming a propositional language we define $\mathscr{L}(\phi)$ as the set of atomic formula occurring in ϕ. To be relevant according to ϕ is to know the truth value of all elements in $\mathscr{L}(\phi)$. In other words, the question capturing what is relevant according to a sentence ϕ is $Q(\phi)$, the partition introduced by $\mathscr{L}(\phi)$ (i.e. the set of sets of possible worlds that assign the same truth value to all elements in $\mathscr{L}(\phi)$). For example, if $\phi = A \wedge B$, then $\mathscr{L}(\phi) = \{A, B\}$ and $Q(\phi) = \{AB, A\bar{B}, \bar{A}B, \bar{A}\bar{B}\}$.[18] Any formula using the same vocabulary gives rise to the same issue. We extend support to issues in the standard way: an information state s supports an issue I ($s \models I$) in case s completely answers I, i.e. $\exists i \in I : s \subseteq i$. The new interpretation rule for negation is given in J. It states that a situation supports $\neg\phi$ in case it's a complete answer to the issue raised by ϕ and contradicts ϕ.

[17] We could as well have used truthmakers semantics.

[18] To simplify notation we write $A\bar{B}$ to refer to the set of worlds where A is true and B is false.

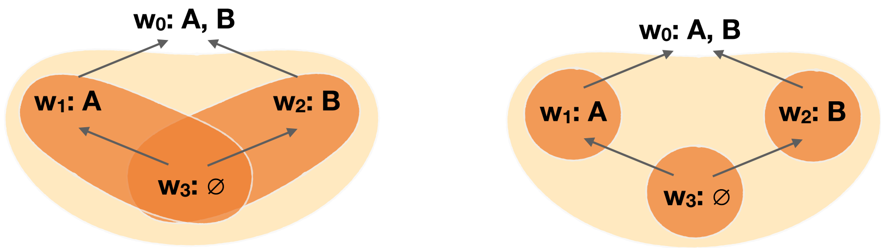

Figure 7: The alternatives predicted for the antecedents of (6a) (left) and of (6b) (right).

$$s \models \neg\phi \text{ iff } s \models Q(\phi) \text{ and } s \bot \phi. \tag{J}$$

According to this rule, the semantic value of the sentences $\neg A \vee \neg B$ and $\neg(A \wedge B)$ differ: $Alt(\neg A \vee \neg B) = \{\bar{A}, \bar{B}\}$ (see the left diagram in Figure 7), but $Alt(\neg(A \wedge B)) = \{\bar{A}B, A\bar{B}, \bar{A}\bar{B}\}$ (see. Crucially, the sentence $\neg(A \wedge B)$ contains an additional alternative, $\bar{A}\bar{B}$. When this sentence occurs as antecedent of a counterfactual, also this alternative needs to counterfactually entail the consequent.

Let us see how this accounts for our examples. First we take a look at the critical examples of Ciardelli et al. (2018). As discussed before, we assume the premises in this case to include the positions of the switches. This gives the order of worlds displayed in Figure 7. The antecedent of (3c), repeated here as (6a) is true in w_1, w_2 and w_3, marked bright orange in the left diagram of Figure 7. The antecedent is disjunctive: $\neg A \vee \neg B$, hence, the counterfactual is predicted to be true if each disjunct separately counterfactually entails the consequent. We employ the similarity approach to compute counterfactual entailment. So, we predict that the counterfactual is true if the consequent is true in world w_1 and w_2 (left diagram of Figure 8). In these two worlds the light is off. Hence, (3c) is correctly predicted to be true.

(6) a. If switch A or switch B was down, the light would be off.
  b. If switch A and switch B were not both up, the light would be off.
  c. If the electricity was working and switch A and switch B were not both up, then the light would (still) be off.

The negation in the antecedent of (3d), repeated here as (6b), introduces the alternative set given in the right diagram of Figure 7. For each of these alternatives we have to check whether they counterfactually entail the consequent. In this case, this is not true. The alternative set $\{w_3\}$ does not counterfactually entail that the light is off. Hence, the approach correctly predicts that the counterfactual in (6b) is false. Finally the example (6c) in the scenario described in Figure 4. In this case the order over possible worlds looks a bit different, because the facts change, see Figure 9. The alternatives the antecedent gives rise to are $\{w_3\}$, $\{w_5\}$ and $\{w_7\}$. If we now check for each of these alternatives whether it counterfactually entails the consequent, we see that this is not the case. There is one alternative, $\{w_5\}$, that makes the consequent false.

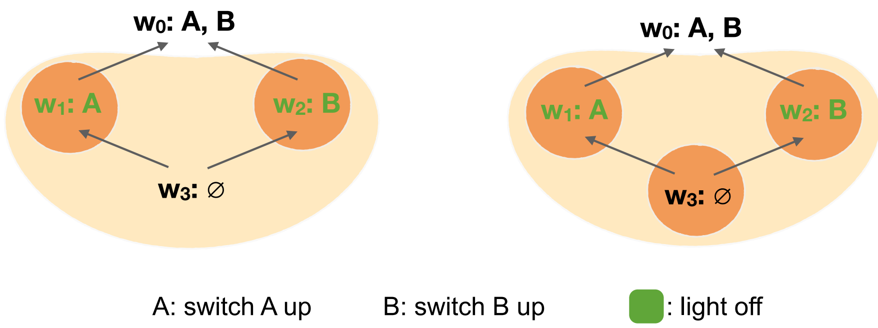

Figure 8: The most similar worlds selected for the antecedents of (6a) (left) and of (6b) (right) assuming rule I and the similarity approach to counterfactual entailment.

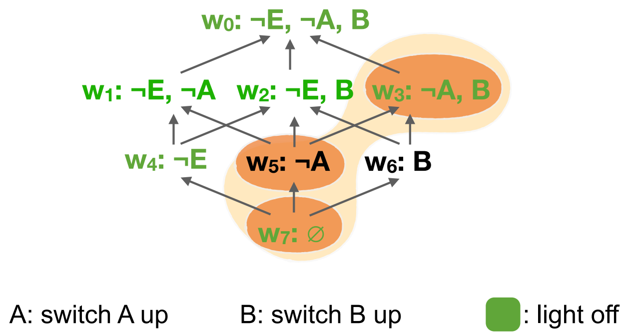

Figure 9: Alternatives predicted for (6c) in the scenario of Figure 4.

Hence, the counterfactual (6c) is predicted to be false, just as intended.

6. Conclusions: The empire is still alive and kicking!

This paper addressed a recent challenge put forward by Ciardelli et al. (2018) against the similarity approach of Stalnaker (1968) and Lewis (1973), the standard approach towards the meaning of counterfactual conditionals nowadays. We have argued that the evidence that Ciardelli et al. (2018) put forward against the similarity approach is not conclusive. Our argument proceeded in two steps. First, we have shown that in certain scenarios also the counter-proposal of Ciardelli et al. (2018) runs into trouble. While their approach can possibly be saved using a pragmatic story, we have sketched an alternative analysis that provides a unified solution for these and the original examples of Ciardelli et al. (2018). This alternative is still compatible with the similarity approach. Hence, the similarity approach is not defeated, yet. The empire is safe.

The solution proposed here builds on inquisitive semantics. We proposed that not only disjunction, but also negation introduces alternatives. The conditional quantifies over these alternatives and checks for each of them separately whether they counterfactually entail the consequent of the counterfactual. We are, then, free to choose our favourite approach to defining this notion of entailment. Nothing stops us from choosing a similarity approach here. As we discussed in the last section, at least for all examples discussed in this manuscript a similarity approach makes adequate predictions.

Proposing that negation introduces non-trivial alternatives is a big step to take. This step needs to be supported by more evidence, preferably coming from the same sources that motivate the inquisitive treatment of disjunction. The good news is that there is a lot of literature on disjunction that we can build on. But this is work that still needs to be done. Some preliminary independent evidence for the semantics for negation proposed here comes from the exhaustive interpretation of answers. Here it has been observed that negative answers cancel or restrict an exhaustive interpretation. Also exhaustive interpretation is standardly modelled as selecting models that are minimal with respect to some order. Another interesting fact is that many languages develop question markers out of their markers of negation.[19] Something similar has been observed for disjunction as well.

Negation is a very exciting topic that hasn't received sufficient attention, yet. But this seems to be changing. There are a number of interesting projects, also in the philosophical literature, that are concerned with the linguistic and logical properties of negations at the moment. This manuscript is just another example of this change.

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[19] Thanks to Andreas Haida for pointing this out to me.

Decomposing universal projection in questions[1]

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Abstract. Revising a proposal by Guerzoni (2003), we propose to derive universal projection of presuppositions in wh-questions, where attested, from a family of three felicity conditions on question use. Assuming that these felicity conditions can be violated under certain conditions, this proposal predicts a typology of contexts where universal projection can exceptionally be unattested. We propose that this prediction is correct, presenting a family of scenarios where the expected absence of universal projection is observed.

Keywords: wh-questions, universal presupposition projection, felicity conditions, bridge principles.

1. Introduction

Presuppositions have been said to project universally from under wh-phrases in wh-questions (e.g., Schlenker 2008, 2009; Abrusán 2011, 2014; Nicolae 2015). We can state this generalization as in (1), where π maps an expression to its presuppositional content, and R and S are the wh-phrase's property denoting restrictor and scope, respectively.

(1) **universal projection generalization**
$\pi(\text{wh R S}) = \lambda w.\ \forall x[[\![\text{R}]\!](x)(w) \rightarrow \pi(\text{S})(x)(w)]$

For example, as stated in (3), R in (2) expresses the property of being one of those ten boys, and due to the factivity of *regret*, π(S) is the property of having been invited by Bill. According to the generalization in (1), then, (2) presupposes that Bill invited each of those ten boys.

(2) Who [$_{\text{R}}$ among those ten boys] [$_{\text{S}}$ does Mary regret that Bill invited __]?

(3) a. $[\![\text{R}]\!](x)(w) \Leftrightarrow$ x is one of those ten boys
b. $\pi(\text{S})(x)(w) \Leftrightarrow$ Bill invited x in w

We will review two existing approaches to the presupposition projection behaviour of unembedded wh-questions: the *local context* approach, due to Schlenker (2008, 2009), and the *pragmatic bridge* approach, due to Guerzoni (2003). Under the local context approach, the same calculus drives projection from under wh-phrases that also drives projection from under universals and other quantificational phrases in declaratives. The pragmatic bridge approach, in contrast, divorces projection in wh-questions from projection from under quantificational phrases in declaratives, and instead credits presupposition projection in wh-questions to pragmatic con-

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straints on the use of questions.

We will propose a development of Guerzoni's (2003) pragmatic bridge approach by positing a family of three pragmatic bridge principles. We propose that this development is motivated by certain instances of non-universal projection in wh-questions, which do not seem to have been observed previously. We propose that non-projection in those cases can be understood in terms of the suspendability of the pragmatic principles that we posit.

2. Two approaches to presupposition projection in wh-questions

2.1. Local context account

Schlenker (2008, 2009) assumes that presuppositions project universally both from under quantificational determiner phrases and from under wh-phrases. For example, consider (4) on a reading where *him* is anaphoric to the matrix subject; under Schlenker's assumption, this example, like (1) above, presupposes that Bill invited each of those ten boys.

(4) None [$_R$ of those ten boys] [$_S$ regrets that Bill invited him].

Schlenker proposes a calculus that indeed applies to (1) and (4) in the same way. Here we sketch Schlenker's (2009) rendition of the proposal, which we dub the *local context* account. The account requires, in a nutshell, that a presupposition be entailed by its so-called local context. With S understood as above, the local context is the strongest property P such that restricting S with P is globally vacuous in the context set (in the sense of Stalnaker 1978), i.e., does not alter the interpretation of the structure as a whole relative to the context set. In cases like (1) and (4), the local context is as shown in (5), the conjunction of the context set c with the restrictor property, i.e., the property given by R.

(5) **local context**
$\lambda x.\lambda w.\ c(w) \wedge [\![R]\!](x)(w)$

The fact that the local context of S in both (1) and (4) entails the restrictor property is due to the fact that both *no* and *wh* participate in an inferential pattern known as *conservativity* (Barwise and Cooper 1981; Keenan and Stavi 1986): both of the equivalences in (6) are supported by intuitions, as exemplified by the intuited equivalences stated in (7).[2]

(6) **conservativity**
a. $no\ R\ S \equiv no\ R\ R{\wedge}S$
b. $wh\ R\ S \equiv wh\ R\ R{\wedge}S$

[2]We extrapolate slightly from Schlenker's (2009) brief discussion of wh-questions, which does not explicate the role of conservativity in the wh-question case.

(7) a. No boy complained $\equiv$ No boy is a boy who complained
b. Which boy complained? $\equiv$ Which boy is a boy who complained?

As detailed in Schlenker (2009), given conservativity, the requirement that the local context entail π(S) in cases like (1) and (4) derives universal projection as a pragmatic condition (Stalnaker 1973). It does this in virtue of deriving (8), requiring that the universal presupposition be entailed by the context set.

(8) **universal projection derived**
$[\![$no R S$]\!]/[\![$wh R S$]\!]$ is felicitous in c only if
$c \subseteq \{w\colon \forall x[[\![R]\!](x)(w) \rightarrow \pi(S)(x)(w)]\}$

As intended, this derives parallel universal projection from under quantificational determiners like *no* (Schlenker 2008, 2009; Chemla 2009), and for wh-questions (Schlenker 2008, 2009; Abrusán 2011, 2014; Nicolae 2015).

2.2. A pragmatic bridge approach

The second approach to presupposition projection in wh-questions exploits natural conditions on the felicitous use of (unembedded) questions. Guerzoni (2003: p. 50, 91) proposes a felicity condition worded as in (9).

(9) **question bridge principle**
A question is felicitous ONLY IF it can be felicitously answered (i.e. only in contexts where at least one answer is defined)

It will be useful to spell out this principle in some greater detail, under Guerzoni's own assumptions about presuppositions and the semantics of questions, listed in (10).

(10) a. **Frege-Strawson view of presupposition**
$\pi(\phi) = \text{dom}([\![\phi]\!])$
b. **Stalnaker's assertion bridge principle**
ϕ is felicitous in c only if $c \subseteq \text{dom}([\![\phi]\!])$
c. **Hamblin-Karttunen semantics**
$[\![\text{wh R S}]\!] = \lambda w.\{[\![S]\!](x) \mid [\![R]\!](x)(w)\}$

As stated in (10a), the proposed elaboration assumes, in the Frege-Strawson tradition, that the semantic presupposition carried by a sentence is encoded as a definedness condition: construing propositions as functions from possible worlds to truth values, the presupposition is given by the set of possible worlds that serves as that function's domain; (10a) feeds the bridge principle for assertions in (10b), due to Stalnaker (1973): for an assertion to be felicitous, the domain of the relevant proposition must be entailed by the context set; (10c) states the familiar Hamblin-Karttunen semantics for wh-questions (Hamblin 1973; Karttunen 1977).

Given these assumptions, and pretending for ease of exposition that Stalnaker's assertion bridge principle exhausts the felicity conditions on assertions, we can reconstruct Guerzoni's question bridge principle as in (11), requiring that in some context set world, the question extension contain a Hamblin-Karttunen answer whose domain is entailed by the context set.

(11) **question bridge principle**
Q is felicitous in c only if
$\exists$w,p[w$\in$c $\wedge$ p$\in$Q(w) $\wedge$ c$\subseteq$dom(p)]

We will start evaluating Guerzoni's account in the next subsection, in the context of a preliminary comparison of the two approaches.

2.3. Preliminary comparison of the approaches

We submit that both approaches reviewed above have considerable conceptual appeal. The local context approach is attractive in virtue of it providing a general and predictive account of presupposition projection. The assumptions about conservativity it relies on are independently established and hence do not incur any theoretical cost. The pragmatic bridge account, too, we take to enjoy independent conceptual motivation. The question bridge principle is surely a condition that is expected to be observed at least in prototypical uses of questions. After all, it seems plausible that a question that necessarily lacks any felicitous answer fails to serve a proper purpose in conversation and is therefore itself infelicitous. To this rationale, we add that the question bridge principle is a central (implicit or explicit) ingredient of existing analyses of certain island effects in wh-questions (Oshima 2007; Simonenko 2016; Schwarz and Simonenko 2016), which therefore provide potential independent motivation.

However, as developed so far, the two approaches are not on a par with regard to empirical predictions. The difference that is the most relevant in the present context, and perhaps also the most obvious, is that the Schlenker's account derives universal projection in wh-questions while Guerzoni's merely derives existential projection. For example, Guerzoni's account merely predicts (2) to presuppose that Bill invited some of those ten boys, not that he invited each of them. As matters stand, then, to the extent that the universal projection generalization for wh-questions is correct, the local context account emerges as the more adequate of the two.

We will argue below that the universal projection generalization is in fact less robust than it has been made out to be. We will then formulate a version of the pragmatic bridge account in terms of a family of three felicity condition on questions that does derive universal projection. We further propose that the violability of those principles predicts a typology of non-universal projection cases that is indeed attested.

3. A first case of non-universal projection

While the universal projection generalization for wh-questions seems consistent with the relevant examples discussed in the literature, we take it to be clear that universal projection is not always attested. Here we provide a first set of illustrations. The unembellished universal projection generalization predicts B's question in (12) below to presuppose that every member is female.

(12) A: Some member nominated herself.
B: Which [$_R$ member] ([$_S$ nominated herself])?

This is so, at least, if the feminine gender marking on the reflexive pronoun *herself* is analyzed as a presupposition trigger (Cooper 1983), so that S carries the presupposition content specified in (13). However, this prediction appears incorrect. The question in (12) may presuppose that some member is female or perhaps, more specifically, that the discourse referent introduced by A's statement is female, but surely not that all members are female.

(13) $\pi(S)(x)(w) \Leftrightarrow$ x is female in w

Analogous observations hold for the discourses in (14) and (16). In these cases, the wh-phrase's scope carries the presuppositional content specified in (15) and (17), triggered by the definiteness of *their* and the factivity of *know*, respectively. The universal projection generalization accordingly leads one to expect that B's question presupposes that each of the colleagues has Australian relatives and that each of those 50 runners will be disqualified. Once again we take those predictions to be incorrect. In each case, the attested presupposition seems, again, to be existential, or, perhaps, more specifically a presupposition about the discourse referent introduced by A's existential statement.

(14) A: Some of the colleagues brought their Australian relatives to the meeting.
B: Which [$_R$ of the colleagues] ([$_S$ brought their Australian relatives])?

(15) $\pi(S)(x)(w) \Leftrightarrow$ x has Australian relatives in w

(16) A: Some of those 50 runners know that they will be disqualified.
B: Which [$_R$ of those 50 runners] ([$_S$ know that they will be disqualified])?

(17) $\pi(S)(x)(w) \Leftrightarrow$ x will be disqualified in w

What are the implications of these observations for the local context account, which is designed to deliver the universal projection generalization? The account can conceivably be reconciled with the data above by appealing either to tacit restriction of the wh-phrase's domain (e.g. George 2011) or to local accommodation in the sense of Heim (1983). Tacit domain restriction could strengthen the restrictor property of the question in (12), so that the universally projected presupposition would merely entail that certain members are female, not that all members are. Likewise for the questions in (14) and (16). Alternatively, local accommodation could be posited to obviate projection, thereby also accounting for the absence of the problematic universal presuppositions in the relevant examples.

We doubt, however, that either tacit domain restriction or local accommodation is part of the correct analysis of the non-projection data presented above. In alignment with experimental findings reported in Chemla (2009) and Geurts and van Tiel (2016), it seems to us that tacit domain restriction is hard or impossible in cases where *which* combines with a partitive of the form *of Def Num NP* (where Def is a definite or demonstrative determiner, Num is a numeral, and NP is a noun phrase). Example (16) illustrates that non-universal projection is found in particular in cases of this form, suggesting that tacit domain restriction is at least insufficient to capture the observed absence of universal projection. With regard to local accommodation, we note that this process, if posited in wh-questions, must be tightly constrained. One reason is that the unavailability of local accommodation is an implicit premise of current analyses of the so-called factive island effect illustrated by (18), from Oshima (2007).

(18) *Who does Max know that Alice got married to on June 1st?

Oshima (2007) and Abrusán (2011) propose two different analyses on which factive island questions suffer from certain pathologies of meaning. We will not review these analyses here, but we note that under both accounts, the intended meaning pathology would be obviated by local accommodation of the factive presupposition. If either Oshima's and Abrusán's account is correct, then, local accommodation can be unavailable in wh-questions even if projection yields a pathological meaning. It would therefore be surprising if local accommodation were available in cases like those above, where there seems to be less pressure for universal projection to apply, given that it would not result in a comparable pathology.

Motivated in part by these doubts about the local context account, we will in the following explore an alternative approach to the presence and absence of universal projection in wh-questions, an approach whose central ingredient is a family of pragmatic question bridge principles.

4. Universal projection from three bridge principles

We propose to revise Guerzoni's (2003) proposal by replacing the question bridge principle in (11) with a family of three pragmatic bridge principles: informally, the *No Accommodation* condition requires that a questioner avoid the need for accommodation of the presupposition of a possible answer, hence that answer presuppositions be either satisfied by common knowledge or else incompatible with it; the *Restrictor Economy* condition obligates the questioner to avoid possible answers whose presuppositions are incompatible with common knowledge; and the *Restrictor Homogeneity* condition demands that the questioner aims for the set of possible answers to be fully determined by common knowledge.

Maintaining the assumptions catalogued in (19a) and (19b), which repeat (10a) and (10b), and still assuming that question meanings map worlds to sets of propositions, these bridge principles can be explicated as the felicity conditions listed in (20). For wh-questions of the form *wh R S*, under the Hamblin-Karttunen semantics in (10c), repeated in (19c), these conditions amount to those listed in (21).

(19) a. **Frege-Strawson view of presupposition**
$\pi(\phi) = \text{dom}([\![\phi]\!])$
b. **Stalnaker's assertion bridge principle**
ϕ is felicitous in c only if $c \subseteq \text{dom}([\![\phi]\!])$
c. **Hamblin-Karttunen semantics**
$[\![\text{wh R S}]\!] = \lambda w.\{[\![S]\!](x) \mid [\![R]\!](x)(w)\}$

(20) Q is felicitous in c only if
i. **No Accommodation**
$\forall p[\ c \subseteq \{w: p \in Q(w)\} \rightarrow c \subseteq \text{dom}(p) \vee c \cap \text{dom}(p) = \emptyset]$
ii. **Restrictor Economy**
$\forall p[\ c \subseteq \{w: p \in Q(w)\} \rightarrow c \cap \text{dom}(p) \neq \emptyset]$
iii. **Restrictor Homogeneity**
$\forall w,w'[w,w' \in c \rightarrow Q(w)=Q(w')]$

(21) $[\![\text{wh R S}]\!]$ is felicitous in c only if
i. **No Accommodation**
$\forall x[\ c \subseteq [\![R]\!](x) \rightarrow c \subseteq \text{dom}([\![S]\!](x)) \vee c \cap \text{dom}(([\![S]\!])(x)) = \emptyset]$
ii. **Restrictor Economy**
$\forall x[\ c \subseteq [\![R]\!](x) \rightarrow c \cap \text{dom}([\![S]\!](x)) \neq \emptyset]$
iii. **Restrictor Homogeneity**
$\forall w,w'[w,w' \in c \rightarrow \{x: [\![R]\!](x)(w)\} = \{x: [\![R]\!](x)(w')\}]$

Our central observation about these felicity conditions, established in detail in the Appendix, is that for wh-questions, under the Hamblin-Karttunen semantics assumed, the three bridge principles taken together have the consequence (22). Those principles, taken together, derive universal projection.

(22) **universal projection derived**
$[\![\text{wh R S}]\!]$ is felicitous in c only if
$c \subseteq \{w: \forall x[[\![R]\!](x)(w) \rightarrow w \in \text{dom}([\![S]\!](x))]\}$

Before building on this result in the remainder of the paper, we note that, while we cannot offer a general theory of felicity conditions in which the particular bridge principles posited here can be embedded, these principles strike us as plausible conditions on prototypical question-answer exchanges. We take it to be natural that a questioner will strive to avoid the need to accommodate the presupposition of a possible answer (No Accommodation) and to restrict the answer space to only those propositions that are still live options in the conversation (Restrictor Economy).

As for Restrictor Homogeneity, we suggest that it provides a possible way of interpreting the familiar notion of D-linking introduced in Pesetsky (1987). Pesetsky notes: "When a speaker asks a question like *which book did you read?*, the range of felicitous answers is limited by a set of books both speaker and hearer have in mind. If the hearer is ignorant of the context assumed by the speaker, a *which*-question is odd". Echoing related remarks in George (2011) in a different context, we propose that Pesetsky's observation can be understood as follows. It is very unlikely for the full extension of the bare noun *book* to be invariable throughout a context set. Hence it may at first seem unlikely for the question *Which book did you read?* to satisfy the Restrictor Homogeneity condition. However, this condition could well be met if the wh-phrase's domain is tacitly understood by the interlocutors as restricted to a particular set of books, say the set of books on this shelf that the interlocutors are attending to. What we propose, then, is that D-linking is tacit restriction of the wh-phrase's domain that is driven by the pressure to meet Restrictor Homogeneity. The question left open under this line of thought, though, is what to make of Pesetsky's proposal that D-linking is restricted to *which*-questions, excluding wh-questions with bare *who* or *what*. We return to this issue in section 5.3 below.

5. A typology of non-universal projection

While universal projection follows from the three proposed bridge principles taken together, it can be shown (as the reader is invited to confirm) that no two of these principles are sufficient to derive universal projection. We now note that while felicity conditions provide listeners with a guide to the speaker's assumptions, the listener might under certain conditions take the speaker to act in violation of one of the felicity conditions. The assumption that one of the three felicity conditions in (20) is violated would result in the obviation of the inference of a universally projected presupposition. Below, we present data that we interpret as showing that, indeed, each of the three conditions in (20) is suspendable and that the suspension of any one of the three principles results in the expected absence of universal projection.

5.1. The No Accommodation condition suspended

We begin by revisiting the examples presented in section 3 above. We submit that the attested absence of universal projection in all of those cases has the same source, viz. a violation of the No Accommodation condition stated in (20)i. For illustration, we focus here on the question in (14)B, repeated below as (23). The restrictor property and the presupposition are as shown in (24) (where (b) repeats (15)).

(23) Which $[_R$ of the colleagues$]$ $[_S$ brought their Australian relatives$]$?

(24) a. $[\![R]\!](x)(w) \Leftrightarrow$ x is one of the colleagues in w
b. $\pi(S)(x)(w) \Leftrightarrow$ x has Australian relatives in w

Consider now the type of scenario described in (25). Relative to this scenario, the question (23) would satisfy Restrictor Homogeneity (20)iii and Restrictor Economy (20)ii, but not No Accommodation (20)i.

(25) **Type 1 scenario**
it is common knowledge that the colleagues are $r_1, \ldots, r_n$; for each of $r_1, \ldots, r_n$, the questioner lacks an opinion about whether they have Australian relatives

It would satisfy Restrictor Homogeneity because common knowledge fully determines the set of colleagues. It would satisfy Restrictor Economy because for each member x of that set, the speaker's belief's, and hence common knowledge, is compatible with x having Australian relatives. But it would violate No Accommodation because for some (in fact, every) member x of that set, the speaker's beliefs, and hence common knowledge, fails to entail that x has Australian relatives.

We believe that the question (23) indeed has acceptable uses in such a scenario. In fact, we take the discourse in (14) above, repeated here as (26), to make that point, since it is easy to imagine B's question in (26) as occurring in a type 1 scenario (where common knowledge is now the common knowledge of A and B).

(26) A: Some of the colleagues brought their Australian relatives to the meeting.
B: Which [$_R$ of the colleagues] [$_S$ brought their Australian relatives]?

On our analysis, this demonstrates that suspension of the No Accommodation condition is a possible source of the absence of universal presupposition projection in wh-questions.

5.2. Restrictor Economy suspended

We will present an observation suggesting that Restrictor Economy, too, can be suspended. We will make this case with respect to the question in (27), where the restrictor property is as in (28a), and the presupposition property, due to the factivity of *know*, is as shown in (28b).

(27) Which [$_R$ of our players] [$_S$ does Fred know _ scored in the last game]?

(28) a. $[\![R]\!](x)(w) \Leftrightarrow$ x is one of our players in w
b. $\pi(S)(x)(w) \Leftrightarrow$ x scored in the last game in w

Consider now the type of scenario described in (29). Relative to this scenario, the question (27) would satisfy Restrictor Homogeneity (20)iii and No Accommodation (20)i, but not Restrictor Economy (20)ii.

(29) **Type 2 scenario**
it is common knowledge that our players are $r_1, \ldots, r_n$ ($n>3$); for r_1, r_2, r_3, it is common knowledge that they scored; for $r_4, \ldots, r_n$, it is common knowledge that they did not score

The question would satisfy Restrictor Homogeneity because common knowledge fully determines the set of players. It would satisfy No Accommodation because for each member x of that set, either common knowledge entails that they scored in the last game, or it entails that they did not. But it would violate Restrictor Economy precisely because for some members x of the set, common knowledge entails that they did not score.

We suggest that the question in (27) is indeed usable in this type of scenario. To illustrate, it seems clear that (30) below can be a successful exchange embedded in type 2 scenario.

(30) A: Crazy Fred is turning into a real problem. Whenever he finds out that one of our players scored a goal in a league game, within a week or two he sends that player a threatening text message.

B: We need to protect our players! Which [$_R$ of them] [$_S$ does Fred know _ scored in the last game]?

Since common knowledge in the type 2 scenario is inconsistent with the potential universal presupposition, the mere acceptability of (30) is indicative of the absence of universal projection. We conclude that the suspension of Restrictor Economy is a second possible source of the absence of universal projection.[3]

5.3. Restrictor Homogeneity suspended

Finally, we submit that Restrictor Homogeneity, too, is subject to acceptable suspension, and that such suspension goes along with the expected absence of universal projection. We propose that "quiz show questions" routinely violate the Restrictor Economy condition. For eample, we take it to be obvious that (31) could be appropriately posed by a TV show host to a candidate even when common knowledge fails to determine the set of Japanese nobel prize winners. In particular, it seems clear that (31) would be usable in a quiz show setting that instantiates the type 3 scenario in (32).

(31) Which [$_R$ Japanese Nobel Prize winner] [$_S$ died last month]?

(32) **Type 3 scenario**
it is common knowledge that there are some Japanese Nobel Prize winners, but there is no x such that it is common knowledge that x is a Japanese Nobel Prize winner

In this scenario, not only does common knowledge fail to determine the set of Japanese Nobel Prize winners, in violation of Restrictor Homogeneity (20)iii, but common knowledge even fails to determine this set partially, as it fails to identify any individual as a Japanese Nobel Prize winner. It is because of that property of the scenario that No Accommodation (20)i and Restrictor Economy (20)ii are satisfied vacuously, as the universal quantification (20)i and (20)ii ranges over the empty set of propositions.

[3] It seems plausible to us that acceptable violations of Restrictor Economy can arise when speakers aim to satisfy a competing constraint that is incompatible with Restrictor Economy. In the analysis of (30) the competing constraint that comes to mind is Gricean brevity. The speaker could have avoided the violation of Restrictor Economy by using a restrictor like *of the players who scored a goal in the last game* instead of *of them*, but refrained from doing so in order to reduce utterance length or syntactic complexity. Cummins et al. (2013: 204) make a related observation that a speaker may choose to use a presupposition trigger and later explicitly deny the presupposition if the alternative to the trigger involves a circumlocution.

Consider now the variant of (31) shown in (33). Given the restrictor and the presupposition properties shown in (34), universal projection would yield the presupposition that every Japanese Nobel Prize winner has Australian collaborators.

(33) Which [$_R$ Japanese Nobel Prize winner] [$_S$ accused one of his Australian collaborators of plagiarism last month]?

(34) a. $[\![\text{R}]\!](\text{x})(\text{w}) \Leftrightarrow$ x is a Japanese Nobel prize winner in w
b. $\pi(\text{S})(\text{x})(\text{w}) \Leftrightarrow$ x has Australian collaborators in w

It seems obvious that (33) in fact need not carry such a universal presupposition. As announced above, we propose attributing the absence of universal projection in this case to the suspension of Restrictor Economy.

Recall also our proposal from above that Pesetsky's (1987) notion of D-linking can be understood as tacit restriction of a wh-phrase's domain driven by the pressure to meet the homogeneity requirement. The question we left open is why obligatory D-linking would be restricted to *which*-questions, as Pesetsky proposed. The question is, in particular, why questions with bare wh-phrases *who* and *what* need not be D-linked. We cannot offer an explanatory answer to this question, but we note that under our interpretation, this restriction might indicate that Restrictor Homogeneity is not in fact a general condition on question use, but merely, for reasons that remain to be elucidated, a condition on the use of *which*-questions.[4]

If so, it is predicted that universal projection is systematically absent in wh-questions with bare *who* or *what*. It turns out that this prediction is compatible with judgments reported in the literature – simply because the cases used to illustrate universal projection in wh-questions happen to not include any questions with bare *who* or *what* (Schlenker 2008, 2009, Abrusán 2011, 2014, Nicolae 2015) . Consider, then, the question in (36), a variant of (2) above, which is repeated here as (35).

(35) Who [$_R$ among those ten boys] [$_S$ does Mary regret that Bill invited _]?

(36) Who does Mary regret that Bill invited _?

We take it that judgments regarding universal projection are less clear for (36) than they are for (35). Under analyses that derive, or presuppose, the unqualified universal projection generalization (Schlenker 2008, 2009, Abrusán 2011, 2014), a natural interpretation of this finding is that,

[4] Typologically, the English contrast between D-linked *which* and non-D-linked *what/who* seems to be replicated in several different ways. For instance, French has been reported by Baunaz (2011: 203) to employ a special prosodic contour (slight fall rise accent) on wh-words to signal specificity, that is, that "the speaker has a very good idea that the interlocutor has a specific referent in mind". Languages which have morphological markers triggering D-linking, such as Turkish on the account of Enç (1991), may use or not use those on wh-words depending on contextual factors (e.g. Kornfilt 2013). It remains to be seen if these contrasts translate into different behaviours with respect to presupposition projection.

while universal projection is actually present in (36), uncertainty about the wh-phrase's domain renders the universal presupposition hard to detect. That is, proponents of these accounts could point out that it is expectedly hard to confirm whether (36) presupposes that Bill invited everyone, simply because it is unclear what individuals the universal quantification ranges over. In contrast, our own analysis leads us to propose that the uncertainty about the wh-phrase's domain, via suspension of Restrictor Homogeneity, does not merely render universal projection hard to detect, but in fact preempts universal projection from taking place in the first place, in virtue of removing one of the premises that we consider necessary to derive it.

6. Conclusions

Building on Guerzoni (2003), we have attributed the universal projection of presuppositions in wh-questions, where observed, to the conspiracy of three question bridge principles. If, like other felicity conditions, these principles are violable under certain conditions, they predict a typology of possible instances of non-universal projection. For each principle, we have presented instances of non-universal projection that we attribute to the principle's suspension.

This proposal leaves many questions unanswered. First, while we have offered instances of violations of each of the three felicity conditions, we have said little about what it is about the examples presented that allows for those violations, hence we have not pinpointed the ultimate source of the absence of universal projection in the relevant cases.

Second, the analysis is subject to an important limitation. Since it is based on felicity conditions on asking questions, in its present form it is not applicable to embedded questions. But presupposition projections can of course be observed to project from embedded questions as well. To illustrate, (38) embeds (2), repeated again as (37), under *know*.

(37) Who [$_R$ among those ten boys] [$_S$ does Mary regret that Bill invited __]?

(38) Ann knows [who [$_R$ among those ten boys] [$_S$ Mary regrets that Bill invited __]].

It seems clear that, to the extent that (37) is intuited to presuppose that Bill invited each of those ten boys, so is (38). For the pragmatic bridge account to capture this parallel, or any projection of presuppositions from embedded questions, it would need to be suitably generalized. The prospects for that project remain to be assessed.[5]

Finally, we can pose an updated version of a question formulated at the end of section 3. There we asked how Schlenker's (2008; 2009) local context account, which is designed to derive the universal projection generalization, could be rendered compatible with cases of non-universal projection. We noted that the effects of this theory could conceivably be weakened by appealing to tacit restriction of the wh-phrase's domain (George 2011) or local accommodation (Heim 1983). In section 3, we already voiced doubts about the prospects of this approach. In addition,

[5]We thank Philippe Schlenker (personal communication) for pressing us on this point.

we now note that tacit domain restriction or local accommodation would need to selectively apply in the three type of scenarios that we have identified as supporting the suspension of one of the three question bridge principles. Under the local context account, the question that arises is why domain restriction or local accommodation would apply under just those circumstances.

Appendix

In this appendix, we wish to confirm that the three bridge principles posited in section 4 derive universal projection. Assuming a non-empty context set c, we first show that the conditions in (20), repeated in (39), jointly entail (40).

(39) Q is felicitous in c only if
i. **No Accommodation**
$\forall p[\ c \subseteq \{w\text{: } p \in Q(w)\} \rightarrow c \subseteq dom(p) \vee c \cap dom(p) = \emptyset]$
ii. **Restrictor Economy**
$\forall p[\ c \subseteq \{w\text{: } p \in Q(w)\} \rightarrow c \cap dom(p) \neq \emptyset]$
iii. **Restrictor Homogeneity**
$\forall w,w'[w,w' \in c \rightarrow Q(w) = Q(w')]$

(40) Q is felicitous in c only if
$c \subseteq \{w\text{: } \forall p[p \in Q(w) \rightarrow w \in dom(p)]\}$

Proof: The statements in (i) and (ii) entail (A). Given (iii), and given that c is non-empty, $\forall w[w \in c \rightarrow p \in Q(w)]$ and $\exists w[w \in c\ \&\ p \in Q(w)]$ are equivalent for any p, so (A) and (B) are equivalent. Since w does not occur on the right-hand side of the material implication in (B), (B) is equivalent to (C), which in turn is equivalent to (D). Since for any $w \in c$, $c \subseteq dom(p)$ entails $w \in dom(p)$, (D) entails (E), and hence (F). QED

(A) $\forall p[\ c \subseteq \{w\text{: } p \in Q(w)\} \rightarrow c \subseteq dom(p)]$
(B) $\forall p[\ \exists w[w \in c\ \&\ p \in Q(w)] \rightarrow c \subseteq dom(p)]$
(C) $\forall p,w[w \in c\ \&\ p \in Q(w) \rightarrow c \subseteq dom(p)]$
(D) $\forall w[w \in c \rightarrow \forall p[p \in Q(w) \rightarrow c \subseteq dom(p)]\ ]$
(E) $\forall w[w \in c \rightarrow \forall p[p \in Q(w) \rightarrow w \in dom(p)]\ ]$
(F) $c \subseteq \{w\text{: } \forall p[p \in Q(w) \rightarrow w \in dom(p)]\}$

For wh-questions, under the Hamblin-Karttunen semantics, (40) amounts to (41) as intended, deriving universal projection.

(41) $[\![\text{wh R S}]\!]$ is felicitous in c only if
$c \subseteq \{w\text{: } \forall x[[\![R]\!](x)(w) \rightarrow w \in dom([\![S]\!](x))]\}$

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Ever free relatives crosslinguistically[1]

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Abstract. Based on a sample of seven languages, I show that the so-called modal inferences in ever free relatives (ignorance and indifference) are not universally available. The primary reading of ever free relatives crosslinguistically turns out to be a "non-modal" one, which is available to all languages under investigation. The implication is that if there is a modal inference triggered by the use of the ever-morpheme in FRs, the inference is likely to have a source external to the ever free relative (Lauer, 2009; Condoravdi, 2015; Hirsch, 2016). In line with this conclusion, I propose to generalize Hirsch's (2016) analysis of ignorance ever free relatives, suggesting that all ever free relatives, no matter how they are ultimately interpreted, are instances of (un)conditionals + donkey-anaphoric definite descriptions.

Keywords: ever free relatives, (un)conditionals, definite descriptions, modal inferences, crosslinguistic semantics

1. Introduction

This paper aims to contribute to our understanding of the semantics of EVER FREE RELATIVES, illustrated by the examples in (1).

(1) a. **Whoever brought the cake** is exceptionally talented.
b. Sue was so hungry that she ate immediately **whatever they served her**.
c. Dave always goes **to whatever party Lisa goes**.

Ever free relatives (henceforth eFRs) have attracted a lot of attention by semanticists thanks to the intriguing interpretive effects caused by the presence of the ever-morpheme. It is commonly assumed that the primary function of the ever-morpheme is to convey a so-called modal inference, particularly the inference that the speaker or some other agent does not know or care about the identity of the eFR referent, dubbed ignorance and indifference, respectively (Dayal, 1997; von Fintel, 2000; Tredinnick, 2005). Only some researchers (e.g. Lauer, 2009; Condoravdi, 2015) have entertained the idea that eFRs, particularly the so-called universal or free choice eFRs, can be genuinely "non-modal". It is more common to assume that these eFRs are in fact a subspecies of indifference eFRs.

After I provide some background to the modal inferences of eFRs (§2), I turn to novel crosslinguistic evidence that challenges the common assumption that eFRs are *primarily* or even *always* modal (§3). Based on a small-scale crosslinguistic empirical survey involving seven languages, I demonstrate that what can be considered non-modal eFRs are available in all of them, but the so-called modal eFRs only in a proper subset of them. This result supports the recent trend of treating eFRs essentially as non-modal; whenever modality is conveyed, its source is external to the eFR (Lauer, 2009; Hirsch, 2016). I further provide some new arguments in favor of treat-

[1] This paper is partly based on a small-scale empirical study. I'm very grateful to all the translators and participants (a comprehensive list can be found at https://osf.io/kq3ag).

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ing eFRs as subkinds of (un)conditionals (following Hirsch 2016, who in turn is building on Rawlins 2013) and show that there are reasons to believe that *all kinds of eFRs* (not just ignorance eFRs) should receive this treatment (§4). An explicit analysis, closely following Hirsch's (2016) proposal is also provided.

2. Background on the modal inferences of ever free relatives

Much semantic literature on eFRs converges on the idea that their *raison d'être* is to convey some modal inference (Dayal, 1997; von Fintel, 2000; Tredinnick, 2005).[2] The so-called IGNORANCE INFERENCE is probably the best-known and most studied type of inference; consider the classical example (2), which conveys that the speaker does not know (is "ignorant" about) which movie is now playing at the Avon. In fact, the interpretation is even stronger—the speaker has *no settled belief* about the identity of the movie. This intuition is captured by the inference in (3): there are worlds in the speaker's doxastic state that differ in the identity of the movie currently played at the Avon.[3] The varying identity of the eFR referent is referred to—ever since Dayal's (1997) seminal paper—as the VARIATION REQUIREMENT.

(2) Whichever movie is now playing at the Avon is making a lot of money. (Dayal, 1997: 101)

(3) $\exists w,w'[w,w' \in \mathsf{DOX}(w_0)(\mathsf{SPEAKER}) \wedge \iota x\,\textsc{playing at the Avon}(w)(x) \neq \iota x\,\textsc{playing at the Avon}(w')(x)]$

As noted by Lauer (2009) and Condoravdi (2015), there is a subspecies of the ignorance inference, namely the IRRELEVANCE INFERENCE. This inference arises in cases where discourse participants fail to agree on the identity of the eFR referent but agree that the identity is irrelevant—can remain unsettled—for the purpose of the current discourse. In this case, the variation requirement is satisfied not with respect to the doxastic state of a single individual (both A and B can stick to their respective beliefs about the deadline), but with respect to the union of more doxastic states (or, more specifically, the context set). From now on, when I speak about ignorance, I silently assume ignorance or irrelevance.[4]

(4) A: The deadline at the end of March is binding.
B: But the deadline is at the end of April!
A: Well, I think it's March, but it doesn't really matter now—whatever deadline is written on the syllabus is binding. (adapted from Lauer, 2009: 39)

(5) $\exists w,w'[w,w' \in [\mathsf{DOX}(w_0)(\mathsf{SPEAKER}) \cup \mathsf{DOX}(w_0)(\mathsf{HEARER})] \wedge \iota x\,\textsc{deadline on syllabus}(w)(x) \neq \iota x\,\textsc{deadline on syllabus}(w')(x)]$

[2]The choice of the neutral term "inference" is intentional. The issue of the intended kind of inference will be addressed shortly.

[3]Ignorance is not strong enough because the speaker cannot follow up with ... *the movie is the Arrival* even if she is wrong about that (if her belief is false). Another way of capturing the intuition is to say that the speaker knows that she doesn't know. Despite these complications, I stick to the term ignorance.

[4]I have not encountered a language that would distinguish between the two formally or that would allow one but not the other reading.

Another type of well-studied inference is the INDIFFERENCE INFERENCE. Consider example (6), which implies that Zack voted indifferently—he did not care about the identity of the person that was at the top of the ballot. According to the influential proposal of von Fintel (2000), this inference is captured well by a counterfactual condition of the form 'had there been somebody else (than in actuality) at the top of the ballot, Zack would have voted for him/her anyway', expressed slightly more formally in (7). In this case, the variation requirement is satisfied with respect to counterfactual worlds.

(6) Zack simply voted for whoever was at the top of the ballot (namely Clinton).
(von Fintel, 2000: 32)

(7) $\forall w[w \in \mathsf{BEST}(w_0) \wedge \iota x\,\textsc{at top of ballot}(w)(x) \neq \iota x\,\textsc{at top of ballot}(w_0)(x)$
$\rightarrow \textsc{voted}(w)(\iota x\,\textsc{at top of ballot}(w)(x))(\textsc{Zack})$

An example of what is sometimes considered a non-modal eFR is provided in (8). Lauer (2009) argues that this type of eFR carries no conventional modal inference (whether ignorance or indifference) and that it is sufficient if (i) Parker wrote at least two different things in those days (9a) and (ii) that all the things that he wrote in those days were violent (9b).[5]

(8) In those days, whatever Parker wrote was (always) violent. (Lauer, 2009: 7)

(9) a. $\exists s, s'[s, s' < \textsc{those days} \wedge$
$\iota x\,\textsc{wrote}(s)(x)(\textsc{Parker}) \neq \iota x\,\textsc{wrote}(s')(x)(\textsc{Parker})]$

b. $\forall s[s < \textsc{those days} \wedge \exists x[\textsc{wrote}(s)(x)(\textsc{Parker})]$
$\rightarrow \textsc{violent}(s)(\iota y\,\textsc{wrote}(s)(y)(\textsc{Parker}))]$

3. Modal inferences crosslinguistically

3.1. Existing evidence

The existing literature on eFRs has a record of more or less episodic observations to the effect that modal inferences in various languages are not as freely available as they are in English. Von Fintel 2000: 38 reports Anna Szabolcsi's (p.c.) observation that Hungarian eFRs lack ignorance and indifference eFRs altogether (and only have the "universal" (non-modal) ones).[6] Giannakidou and Cheng (2006) report that Greek eFRs lack the ignorance reading, but do have

[5] The formalization in (9) is simplified and will be made more precise in section 4.

[6] Anna Szabolcsi (p.c.) informs me that eFRs in Hungarian are formed by the addition of *csak* lit. 'only' after the relative wh-word; see (i).

(i) Meghívtam **akit** **csak** láttam.
invited.1SG REL.who.ACC only saw.1SG
'I invited whoever (≈ everyone) I saw.'

Hungarian cannot form ever wh-words in eFRs by using the free choice morpheme *bár-/akár-,* which can only attach to the interrogative wh-word (*bárki/akárki* 'anyone'), but not the relative one (**báraki/*akáraki*). (Cf. Halm 2016, who shows that *bárki* can participate in the formation of unconditionals.) For discussion of these and related facts I'm grateful to Anna Szabolcsi, Julia Bacskai-Atkari, Aniko Csirmaz, Éva Dékány, and Beáta Gyuris.

the non-modal one (they are silent on the indifference reading).

(10) *Greek* (Giannakidou and Cheng, 2006: 166/169)
a. ?#Opjadhipote jineka ine i arxisindaktria aftou to periodikou, pire
which:EVER woman is the editor this:GEN the:GEN magazine:GEN got
ena vravio xthes vradi. **ignorance**
a prize last night
Intended: 'Whichever (≈ The) woman (who) is the editor of this magazine got a prize last night.'
b. Opjosdhipote irthe sto parti, efxaristithike. **non-modal**
who:EVER came:3SG to.the party was.happy:3SG
'Whoever (≈ Everyone who) came to the party had a good time.'

Eilam (2007) says about Hebrew eFRs that "examples [involving indifference] are easier to find and given a null context, the indifference reading will be the one preferred by speakers, *if the ignorance reading is available at all.* However, it is not the case that the latter is entirely impossible [. . .]" (my emphasis). Caponigro and Fălăuş (2017) demonstrate that Italian and Romanian eFRs also lack the standard ignorance and indifference readings, but do have the non-modal one, as illustrated for Romanian below.[7]

(11) *Romanian* (Caponigro and Fălăuş, 2017: ex. (47c), (51c), (48c))
a. *Este usturoi în orice mâncare găteşte Bianca acum. **ignorance**
is garlic in EVER.what dish cooks Bianca now
Intended: 'There's garlic in whatever dish Bianca is cooking now.'
b. *În acel moment, am luat orice unealtă îmi era la îndemână,
in that moment have.1SG grabbed EVER.what tool me.DAT was at hand
care s-a nimerit să fie un ciocan. **indifference**
REL REFL-has happened SUBJ be a hammer
Intended: 'In that moment, I grabbed whatever tool was handy, which happened to be a hammer.'
c. Este usturoi în orice mâncare găteşte Bianca. **non-modal**
is garlic in EVER.what dish cooks Bianca
'There's garlic in whatever (≈ every) dish Bianca cooks.'

Balusu (2017) observes that Telugu utilizes three different morphemes, reserved for ignorance, indifference, and non-modal readings, respectively. It might be of significance that only the last type (called "quantificational" by the author) appears to form a genuine FR (the other two are correlatives/unconditionals).

Based on the data and claims above, one could gain the impression that these languages (perhaps with the exception of Hebrew) simply have no definite eFRs, but only eFRs that are

[7] Caponigro and Fălăuş (2017) argue that Italian and Romanian eFRs—what they call "free choice FRs" (a term also used by Giannakidou and Cheng 2006, but in the sense of (non-modal) eFRs), are semantically more akin to subtrigged free choice items than to eFRs. In other words, they are claimed not to be definite descriptions, but rather quantificational expressions. For the purpose of this paper, I take Romanian eFRs to be standard eFRs, i.e., definites, see below.

genuine universal quantifiers.[8] It turns out, however, that a definite construal is available in languages without ignorance and indifference eFRs. Consider the minimal pair in (12), where the minimal difference concerns tense—past in (12a) and future in (12b). Future tense appears to license the eFR, which receives an uncontroversial definite construal.

(12) *Romanian* (SURVEY)

a. *Ieri la ora 8, David s-**a** **uitat** la orice era pe HBO.
yesterday at hour 8 D. REFL-has looked at EVER.what was on HBO
'Yesterday at 8, David was watching whatever they were showing on HBO.'

b. Diseara la 8, David se **va** **uita** la orice va fi pe HBO.
Tonight at 8, D. REFL will look at EVER.what will be on HBO
'Tonight at 8, David will be watching whatever (≈ the thing) they will be showing on HBO.'

Upon closer examination, we discover that even eFRs in simple present contexts turn out to have a definite reading. In the absence of the adverbial quantifier *întotdeauna* 'always', one might be under the impression that the eFR has a universal reading; however, this impression disappears in the presence of the adverbial, which, intuitively, "takes over" the universality, quantifying over situations such that in each of the situations, David eats the thing(s) that his girlfriend cooks for him. Therefore, there is empirical motivation to adopt Tredinnick's (2005) proposal that quasi-universal eFRs in non-modal contexts are in fact definites in the scope of covert generic or iterative operators.

(13) *Romanian* (SURVEY)
La cină, David mănâncă (întotdeauna) orice îi găteste prietena lui.
at dinner D. eats always EVER.what him cooks girlfriend his
'For dinner, David (always) eats whatever his girlfriend cooks for him.'

3.2. Crosslinguistic empirical survey

In order to have a more reliable overview of the crosslinguistic situation, I have conducted a small-scale crosslinguistic survey of seven languages, testing the acceptability and interpretation of eFRs in the following four contexts: a. habitual present, b. simple past, c. temporally punctual future, and d. temporally punctual past, illustrated in (14). The former two lend themselves to iterative / quasi-universal readings; the latter two do not.[9]

(14) a. Mark (always) eats whatever his girlfriend cooks.
b. Last week, Mark ate whatever his girlfriend cooked.

[8] The hypothesis that at least some eFRs are genuine universal quantifiers used to be quite popular, if not standard (see e.g. Cooper 1983; Larson 1987; Tredinnick 1995; Iatridou and Varlokosta 1998). Ever since Jacobson's (1995) seminal paper on the semantics of free relatives, however, the field has been dominated by the assumption that all FRs, including eFRs, are definite descriptions (see esp. the arguments in Tredinnick 2005).

[9] More contexts were tested, but only these are systematically reported here. More detailed information on the survey (including the list of all participants, who were mostly linguists), blank as well as filled out questionnaires, and a spreadsheet summarizing the results can be found at https://osf.io/kq3ag.

c. Tonight at 8pm, Mark will watch whatever they'll be showing on HBO.
d. Yesterday at 8pm, Mark watched whatever they were showing on HBO.

Table 1 provides the median ratings per context and language (Likert scale from 1/unacceptable to 5/acceptable; *n* indicating the number of participants). The results show that eFRs are universally accepted in contexts allowing for iterative/quasi-universal interpretations (a, b). In context (b), which in principle allowed a single event or an iterative reading, the preferred reading (and in some languages the only one) was the iterative one, i.e. multiple instances of cooking–eating. eFRs are further generally accepted in the punctual future context. This suggests that despite the fact that the preferred/only reading in the simple past context is iterative (quasi-universal), the definite reading is generally available in the future context. In other words, all languages behave as Romanian as exemplified in (12b). The most interesting observation is that all the languages exhibit a decrease in acceptability in the punctual past context, as compared to the punctual future context. (The number of participants is too small for any statistical analysis to be meaningful.) This decrease is very slight (not greater than 1 point on the Likert scale + absolute rating above 3) in three of the investigated languages, namely Serbian, Polish, and Hebrew, while it is clearly pronounced (not smaller than 2 + absolute rating 2 or lower) in the other four languages—Greek, Russian, Czech, and Romanian. Let us call these CAT(EGORY)1 and CAT(EGORY)2 languages, respectively.[10]

	CONTEXT	SERBIAN $n=4$	POLISH $n=5$	HEBREW $n=4$	GREEK $n=6$	RUSSIAN $n=5$	CZECH $n=4$	ROMANIAN $n=4$
a	**habitual present**	5.0	5.0	5.0	5.0	4.0	5.0	5.0
b	**simple past**	5.0	5.0	5.0	4.0	4.0	4.5	4.5
c	**punctual future**	5.0	5.0	4.5	4.5	4.0	4.0	5.0
d	**punctual past**	4.5	4.0	3.5	2.0	2.0	2.0	1.0

Table 1: Median ratings of eFRs per context and language

It further turns out that CAT1 languages are not uniform with respect to the kind of reading that arises in the punctual past context. Serbian speakers accept both the ignorance and the indifference reading (confirmed in post-hoc p.c. with Boban Arsenijević); Polish speakers prefer the indifference reading (confirmed in post-hoc p.c. with Aleksandra Gogłoza); finally, Hebrew speakers prefer the ignorance reading (contra what is reported by Eilam 2007). The (un)availability of modal eFRs (for our purposes, eFRs in context (d)) also corresponds, by and large, to the (un)availability of single event readings in context (b). While speakers of CAT2 languages generally reject single event readings in context (b), speakers of CAT1 report that the single event reading in context (b) is available to them. The only exception is Polish, where 4 out of 5 speakers report the iterative reading as the only available one. This seems to suggest a borderline status of Polish, in which, possibly, the non-modal (iterative) reading is the only possible one if nothing speaks against it, while the modal (indifference) reading is available as a sort of last resort.

[10] In the Greek survey, 3 of the 6 speakers rated context (d) with 1 (clearly in line with CAT1 language speakers), while the other 3 speakers with 3 or 4 (possibly in line with CAT2 language speakers). In other languages, the rating of context (d) was more consistently low.

3.3. Discussion: What underlies the CAT1 vs. CAT2 distinction?

The hitherto published evidence as well as the present empirical survey clearly indicate that there are at least two categories of languages: CAT1 languages (English, Serbian, Hebrew, and Polish), whose eFRs are acceptable in punctual past contexts, conveying a modal inference (indifference and/or ignorance), and CAT2 languages (Greek, Russian, Romanian, and Czech), whose eFRs are not acceptable in punctual past contexts. It further seems evident that all languages, whether CAT1 or CAT2, allow for so-called non-modal readings, such as the quasi-universal iterative readings or definite readings, in case there is an appropriate licensing expression or operator, exemplified here by the future tense.

The existing literature as well as the present survey remain ambivalent as to which factor or parameter underlies the CAT1 vs. CAT2 division. I can think of two plausible candidates. The first option is that the relevant factor is semantics vs. pragmatics. The idea is that eFRs in CAT1 languages may satisfy the variation requirement "semantically", i.e., by anchoring the variation to an object-language operator (such as a modal or aspectual operator), but also "pragmatically", i.e., by anchoring the variation to the belief/epistemic states of discourse participants or to the common ground (this idea is defended for English by Lauer 2009). CAT2 languages, on the other hand, would only allow for the variation requirement to be satisfied "semantically". If there is no suitable semantic operator (the case of punctual past contexts), the eFR is simply unacceptable.

The second option is that the relevant factor is epistemic (including doxastic) vs. root (or rather non-epistemic). The nature of this parameter could thus be either semantic or syntactic (assuming Hacquard's 2010 approach to the epistemic vs. root distinction). The idea is that CAT1 languages allow variation within the domains of either epistemic or root/aspectual operators, whereas CAT2 languages only within the domains of root/aspectual operators. This approach is compatible with the assumption that all eFRs are licensed in the object language (i.e., "semantically"), which in turn entails that every utterance is in the scope of an implicit (speaker-related) doxastic operator (cf. Meyer, 2013), which, in the absence of any other suitable operator, generates the ignorance readings of eFRs.

In Šimík (2016: 123ff.), I showed that the situation in Czech might argue for the latter approach because explicit epistemic necessity modals do not seem to license eFRs. The present empirical survey contained a comparable condition and the results are suggestive of yet another parametric division. Russian and Greek seem to pattern with my intuition about Czech—the participants (who gave low ratings in context (d)) either found eFRs under epistemic modals unacceptable or, if they accepted them, they interpreted them iteratively, clearly suggesting that the epistemic modal is not the licensor. In Romanian and for three of the four Czech participants, on the other hand, eFRs are not only licensed under epistemic modals (median for Romanian: 4.75; median for Czech: 5.0), they also receive single event (definite) readings, suggesting that the epistemic modal can indeed license the eFR.[11]

[11] Cf. Fălăuş (2009), who shows that Romanian free choice/epistemic indefinite determiner *vreun* gets licensed by epistemic necessity modals.

In what follows, I put forth a unified "semantic" analysis of eFRs, building on Hirsch's (2016) proposal on ignorance eFRs. I show how his proposal can be extended to non-modal eFRs and discuss some empirical implications.

4. Ever FRs as (un)conditionals + donkey definites

4.1. Basic idea and some arguments

Hirsch (2016) proposed that ignorance eFRs have a double syntactic and semantic life: on the one hand, they function as unconditionals (in the sense of Rawlins 2013; also called concessive conditionals), on the other, they function as donkey-anaphoric definite descriptions, picking up the referent introduced in the unconditional.[12] An eFR like the one in (15a) receives the LF in (15b), where the unconditional (uC) denotes a set of propositions, pointwise restricting the universal doxastic operator (OP), and the free relative (FR), being part of the conditional consequent (nucleus of OP), denotes a definite description whose value equals the referent introduced by *whatever* in the unconditional. The LF is thus basically identical to the one of the unconditional in (15c).

(15) a. Sue ate whatever Dave cooked.
b. [$_{\mathrm{OP}}$ [$_{\mathrm{uC}}$ whatever Dave cooked]] Sue ate [$_{\mathrm{FR}}$ whatever Dave cooked]
c. Whatever Dave cooked, Sue ate it.

The motivation for treating eFRs as a subspecies of unconditionals is not just their morphosyntactic similarity, but also their interpretation, which involves (or can involve, in the case of eFR) the ignorance inference. This immediately raises the question whether Hirsch's (2016) analysis can be extended to languages in which ignorance is not a possible inference conveyed by eFRs.[13] In my opinion, such an extension is possible, if not desirable. Let us go through some suggestive arguments.

First, eFRs are known to differ from plain FRs in that they allow the use of complex wh-phrases, as shown in (16). The same contrast has been reported for Dutch (Groos and van Riemsdijk, 1981), German (Meinunger, 1998), Polish, Croatian (Citko, 2010), Italian (Caponigro, 2003), or Czech (Karlík, 2013), so it is clearly no accident, and it applies across different semantic types of eFRs.

(16) I'll take **which***(**ever**) book you give me.
(adapted from Bresnan and Grimshaw, 1978: 335)

The unconditional / question-based analysis of eFRs makes it possible to view this contrast in terms of the function(s) played by the wh-expression in eFRs vs. plain FRs: while in plain FRs, the wh-expression is merely a relative operator, and relative operators are normally simplex, in eFRs, the wh-expression also plays the role of an interrogative phrase (being the locus of

[12] The intimate relation between eFRs and conditionals was also noted by Baker (1995).

[13] In fact, this raises many more questions that are worth investigating, concerning how unconditionals and ever free relatives are related, morphosyntactically, as well as semantically, within individual languages.

variation in the set of propositions) and as such, it is free to be complex. The second argument, which reinforces the one just mentioned, comes from the asymmetry illustrated in (17): only plain wh-words can function as relative operators in (light-)headed relatives; ever wh-words cannot. This follows if wh-expressions in eFRs are not really relative operators.

(17) *Polish* (adapted from Citko 2004: 105)
Jan śpiewa to, {**co** / ***cokolwiek**} Maria śpiewa.
J. sings DEM what what.EVER M. sings
(Intended:) 'John sings what(ever) Mary sings.'

Third, eFRs, as opposed to plain FRs, are unable to accommodate a contrastive topic–focus structure. The same holds of conditional antecedents and wh-questions (in Czech; not illustrated here). Apparently, all these structures are too "small" to be able to accommodate such peripheral phenomena as contrastive topic arguably is (see Rizzi 2001 for some relevant discussion).

(18) *Czech*
a. Vařili, **co** Karlovi$_{\mathbf{CT}}$ chutnalo$_{\mathbf{F}}$ (ale Marii$_{\mathbf{CT}}$ bohužel ne$_{\mathbf{F}}$).
cooked what Karel:DAT tasted but Marie:DAT unfort. not
'They cooked what Karel$_{\mathbf{CT}}$ liked$_{\mathbf{F}}$ (but Marie$_{\mathbf{CT}}$ unfortunately did not$_{\mathbf{F}}$).
b. Vařili, **cokoliv** Karlovi$_{(*\mathbf{CT})}$ chutnalo$_{(*\mathbf{F})}$ (*ale Marii bohužel ne).
cooked what:EVER Karel:DAT tasted but Marie:DAT unfort. not
'They cooked what Karel$_{\mathbf{CT}}$ liked$_{\mathbf{F}}$ (but Marie$_{\mathbf{CT}}$ unfortunately did not$_{\mathbf{F}}$).

Fourth, eFRs, as opposed to plain FRs, but like wh-questions and conditional antecedents (McDowell, 1987; Progovac, 1988; Drubig, 2001), cannot host epistemic modals.

(19) He does what(*ever) must be a difficult job.
(Tredinnick 1995; cited via Iatridou and Varlokosta 1998: 16)

Fifth, just like conditional antecedents, eFRs also exhibit a strong tendency towards syntactic and semantic dependency on the main (consequent) clauses in which they are embedded. The example in (19) is, I would say, one illustration of this: the eFR cannot host an independent epistemic modal because its very function is to restrict one. Non-modal eFRs, besides not being able to host epistemic modals, which is illustrated in (20), often exhibit temporal dependencies, such that the tense of the eFR should match the tense of the embedding predicate; see (21).

(20) *Czech*
Na dovolené ti budu vařit, **co** (***koliv**) ti **určitě** bude chutnat.
on vacation you:DAT will:1SG cook what EVER you:DAT surely will taste
'On vacation, I'll cook for you what(ever) will surely taste good to you.'

(21) *Czech*

a. Uvařím ti, **co** {sis přála / si budeš přát}.
cook:1SG you:DAT what REFL.2SG wished REFL will:2SG wish:INF
'I'll cook for you what you wished / (will) wish.'

b. Uvařím ti, **cokoliv** {#sis přála / si budeš přát}.
cook:1SG you:DAT what REFL.2SG wished REFL will:2SG wish:INF
'I'll cook for you whatever you wished / (will) wish.'

The "dependent" character of eFRs (as opposed to plain FRs) is in some languages even built into the very morphosyntactic make-up of these constructions. An example is Bulgarian, which, lacking the ever-morpheme, uses the subjunctive to formally encode eFRs (Pancheva Izvorski, 2000). Similar observations, albeit less categorically, arguably apply to Hungarian, which also lacks the ever-morpheme in (e)FRs (see footnote (i)) and Greek, which does have it, but still opts for the subjunctive in many cases (Veronika Pleskotová, p.c.).

In summary, there are a range of arguments demonstrating (i) an asymmetry between eFRs and plain FRs and at the same time (ii) a similarity of eFRs to wh-questions and/or conditional antecedents. These arguments are valid also for languages which have no ignorance eFRs (such as Czech), suggesting in turn that eFRs in general—not just ignorance eFRs—are akin to questions and (un)conditionals.

By way of concluding this section, it is good to point out that the above-discussed classification of eFRs parallels the familiar and much discussed classification of conditionals into epistemic/truth conditionals (≈ ignorance/irrelevance eFRs), and content/situational conditionals (≈ non-modal eFRs); see Declerck and Reed (2001) or Haegeman (2003) for discussion and references and also Haspelmath and König (1998), who show that the same classification is also applicable to unconditionals. Indifference eFRs are, of course, reminiscent of yet another well-established category of conditionals, namely counterfactual conditionals (von Fintel, 2000). In terms of the epistemic vs. content conditional classification, indifference eFRs can probably fall into either of the two categories; see Tredinnick (2005), who distinguishes between internal and external indifference.

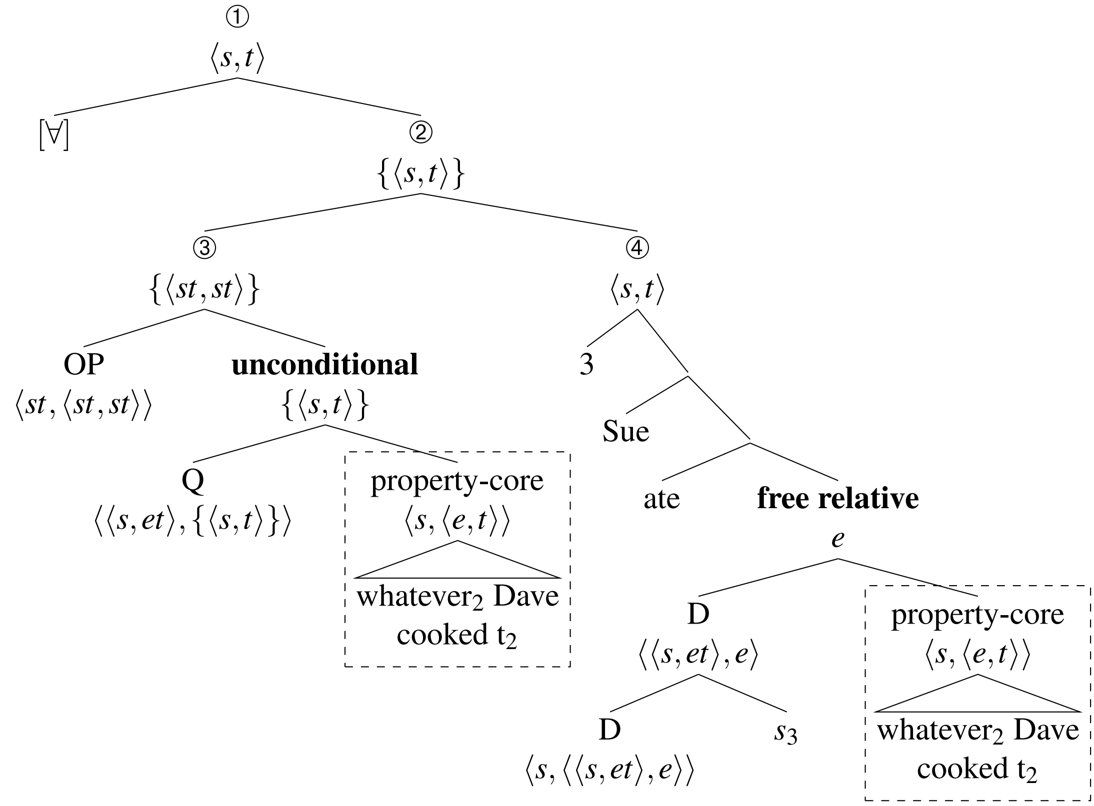
4.2. Ignorance eFRs

Let us now turn to how the (un)conditional-based analysis of eFRs is materialized. I start with spelling out Hirsch's (2016) proposal on ignorance eFRs. I opt for a fully compositional treatment, which makes me introduce some elements beyond Hirsch's (2016) proposal, but hopefully nothing that would affect the gist of it. Consider the LF in (22) and the associated semantic computation in (23).[14]

Let us go through the composition step-by-step. The basic meaning of the free relative is a property (23a) that gets shifted to a (maximal) entity—here the entity that Dave cooked, (23b)

[14]The notation $\{\tau\}$ where τ is a semantic type is to be read as 'a set of expressions of type τ'.

(22) Sue ate whatever Dave cooked.



(23)
a. $[\![\text{property-core}]\!]^g = \lambda s \lambda x[\textsc{cooked}(s)(x)(\textsc{Dave}) \wedge \textsc{thing}(s)(x)]$

b. $[\![\textbf{free relative}]\!]^g = \sigma x\, \textsc{cooked}(g(3))(x)(\textsc{Dave}) \wedge \textsc{thing}(g(3))(x)$

c. $[\![④]\!]^g = \lambda s[\textsc{ate}(s)(\sigma x\, \textsc{cooked}(s)(x)(\textsc{Dave}) \wedge \textsc{thing}(s)(x))(\textsc{Sue})]$

d. $[\![\text{OP}]\!]^g = \lambda p \lambda q \lambda s \forall w[w \in \textsf{DOX}(s)(\textsf{SP}) \wedge p(w) \rightarrow q(w)]$

e. $[\![\textbf{unconditional}]\!]^g = \{\lambda s[\textsc{cooked}(s)(x)(\textsc{Dave}) \wedge \textsc{thing}(s)(x)] \mid x \in D_c\}$

f. $[\![③]\!]^g = \{\lambda q \lambda s \forall w[w \in \textsf{DOX}(s)(\textsf{SP}) \wedge \textsc{cooked}(w)(x)(\textsc{Dave}) \wedge \textsc{thing}(w)(x) \rightarrow q(w)] \mid x \in D_c\}$

g. $[\![②]\!]^g = \{\lambda s \forall w[w \in \textsf{DOX}(s)(\textsf{SP}) \wedge \textsc{cooked}(w)(x)(\textsc{Dave}) \wedge \textsc{thing}(w)(x) \rightarrow \textsc{ate}(w)(\sigma y\, \textsc{cooked}(w)(y)(\textsc{Dave}) \wedge \textsc{thing}(w)(y))(\textsc{Sue})] \mid x \in D_c\}$

h. $[\![[\forall]]\!]^g = \lambda \mathcal{P} \lambda s \forall p[p \in \mathcal{P} \rightarrow p(s) = 1]$

i. $[\![①]\!]^g = \lambda s \forall p[p \in [\![②]\!]^g \rightarrow p(s) = 1]$

(see Jacobson 1995; Caponigro 2003).[15] Node ④ denotes the proposition that Sue ate the thing(s) that Dave cooked, (23c). If the FR did not contain an ever-morpheme, we would be done with the computation of truth-conditions at this point. Because our FR *does* contain one,

[15]The covert D I assume here corresponds to Schwarz's 2012 definite article; it can readily be used for a situation-semantic analysis of donkey anaphora. I further follow Heim and Kratzer (1998) and assume that wh-words in relative clauses function as lambda-operators, which is indicated in (22) by the index 2. I do not address the question of how exactly this works compositionally.

however, its property-core is “used” once more, this time as a complement of an abstract Q morpheme, whose role is to turn properties to sets of propositions.[16] This gives rise to what I term here unconditional—the set of propositions of the form ‘Dave cooked *x*’, where *x* a member of some contextually deteremined domain D_c, (23e).[17] The unconditional, or more precisely the individual propositions in the set it denotes, function as restrictors of the operator OP. **The nature of this operator determines the reading of the eFR** (ignorance, indifference, non-modal). Since our aim is to derive the ignorance reading now, I assume that OP in (22) is a speaker-related doxastic operator—a universal quantifier over speaker’s doxastic alternatives. As standardly assumed (in Kratzerian modal and conditional semantics; see Kratzer 2012), the operator takes two arguments—a restrictor, which codetermines its modal base (here the **unconditional**), resulting in (23f), and a nucleus (here ④). The result (23g) is a set of propositions of the form ‘All worlds compatible with speaker’s beliefs where Dave cooked *x* are such that Sue ate *x* / the thing that Dave cooked’, for all $x \in D_c$.[18] The final step in the derivation is turning this set into an ordinary denotation, which is achieved by the (default) universal quantifier over Hamblin alternatives [∀], which conveys that all the propositions in its argument are true (in some situation).

Suppose now for concreteness that there are two relevant alternatives in the context—$\textbf{DISH}_1$ and $\textbf{DISH}_2$. Then, the meaning of ①, applied to the situation s_0, is true iff all worlds compatible with speaker’s beliefs in which Dave cooked $\textbf{DISH}_1$, Sue ate that dish, and all worlds compatible with speaker’s beliefs in which Dave cooked $\textbf{DISH}_2$, Sue ate that dish.[19]

(24) For $D_c = \{\textbf{DISH}_1, \textbf{DISH}_2\}$ and some situation s_0, $[\![①]\!]^g(s_0) = 1$ iff

a. $\forall w[w \in \mathsf{DOX}(s_0)(\mathsf{SP}) \wedge \text{COOKED}(w)(\textbf{DISH}_1)(\text{DAVE}) \rightarrow \text{ATE}(w)(\sigma x\, \text{COOKED}(w)(x)(\text{DAVE}))(\text{SUE})]$ **&**

b. $\forall w[w \in \mathsf{DOX}(s_0)(\mathsf{SP}) \wedge \text{COOKED}(w)(\textbf{DISH}_2)(\text{DAVE}) \rightarrow \text{ATE}(w)(\sigma x\, \text{COOKED}(w)(x)(\text{DAVE}))(\text{SUE})]$

The benefit of this (i.e., Hirsch’s 2016) semantics is that it derives the ignorance inference effortlessly. The fact that the doxastic state of the speaker in s_0 is compatible with more than just one entity that Dave cooked boils down to saying that the speaker’s doxastic state is not settled on the issue of what Dave cooked. In other words, the speaker does not know (has no settled

[16] The question of how it happens that the property-core appears in two positions at LF is interesting and important, but orthogonal to our present purposes. I side with Hirsch’s (2016: fn. 8) opinion that Johnson’s (2012) approach to quantifier raising seems to be a good fit for the structural situation we are facing.

[17] I adopt the assumption that the set of propositions gets generated by Q from Hirsch (2016) and I do so for presentational reasons. Otherwise, I subscribe to the more standard idea that the source of alternatives is the wh-word itself (as e.g. in Beck 2006, among many others). Making this assumption explicit would complicate the syntax-semantics mapping (a “complication” that might in fact eventually come with empirical benefits; cf. the discussion around (16)). Concerning the nature of the individual alternatives in D_c, I do not assume any particular restriction on these; they can be open-ended (or even “widened”) and unknown to the discourse participants, but they can just as well constitute a closed set known to the discourse participants (see example (4), which illustrates the latter option).

[18] For simplicity, I assume that the composition of OP (ordinary denotation) with the unconditional (Hamblin-style denotation; Kratzer and Shimoyama 2002) happens via Hagstrom’s (1998: 142) flexible function application.

[19] Rawlins (2013) argued that the alternatives are exhaustified (i.e. … Dave cooked **only** DISH_1…, … Dave cooked **only** DISH_1…). I am leaving exhaustification out for presentational purposes.

belief about) what Dave cooked.[20] This in turn has the positive outcome that one need not stipulate the variation requirement as an extra property of eFRs (cf. Dayal 1997 and subsequent literature). All that is needed is the empirically motivated assumption that eFRs—besides being FRs—are also unconditionals, which in turn obligatorily involve alternative denotations (more precisely, non-trivial alternatives, where $|D_c| > 1$). Since these alternatives "feed into" the doxastic operator, they automatically derive variation within the doxastic state; cf. Condoravdi (2015), who also utilizes alternative semantics for eFRs but does not seem to make the step towards abolishing the variation requirement as an extra condition on the use of eFRs.

Ever since von Fintel (2000) (see Lauer 2009 and Condoravdi 2015 for refinements) it has been known that the ignorance inference is not at issue (roughly in the sense of Simons et al. 2011), i.e., it cannot be negated or embedded by attitude predicates, for instance. In order to capture the not-at-issue nature of the ignorance inference, we have to assume that the operator OP in (22) cannot be negated or more generally embedded. I follow much recent literature and assume that the present doxastic OP is a sort of default operator attached to any matrix declarative (see e.g. Meyer's 2013 Matrix K Theory). As such, it cannot be properly embedded (unlike its overt kin, the verb *believe*), or at least not by overtly expressed operators.[21]

4.3. Non-modal eFRs

Let us now see how Hirsch's (2016) analysis can be extended to non-modal uses of eFRs. I will provide an analysis of two examples from my empirical survey—eFRs in the future context—giving rise to a definite interpretation—and in the simple past context—giving rise to a quasi-universal/iterative interpretation. The LF in (25) differs in one crucial respect—the operator which "licenses" the eFR and takes it as its first argument (in its unconditional function) is not an implicit doxastic operator, but rather either (a) the future operator (FUT) or (b) the aspectual iterative operator (ITR).

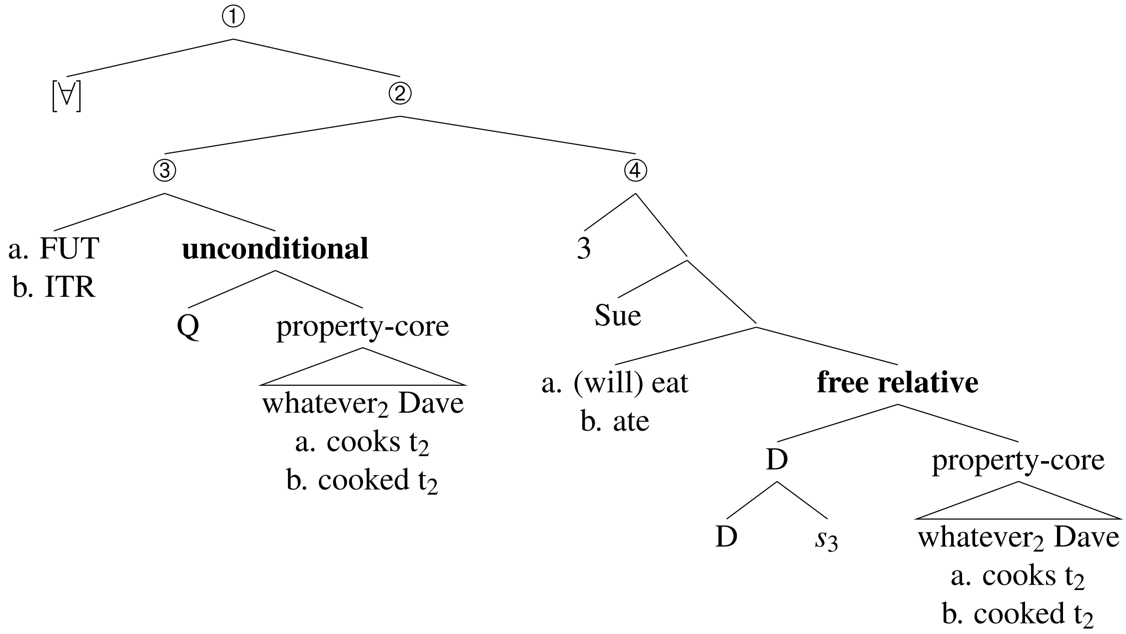
The computation of the truth-conditions is parallel to the one in (23) and will not be repeated here. Of relevance is the denotation of FUT and of ITR, which is provided in (26). The semantics of FUT follows the spirit of Copley's (2009) proposal, according to which the future is a modal with a metaphysical (circumstantial) modal base, yielding a set of worlds/situations that are possible continuations of the evaluation world/situation.[22] The semantics of ITR is based on the situation-semantic analysis of adverbial quantifiers like *always* (see e.g. von Fintel 1994). It quantifies over minimal situations (not encoded in the formula for the sake of simplicity) which are part of the evaluation situation and introduces, in the nucleus of the quantifier, an ad-

[20] As noted already by Rawlins (2013) and reiterated by Hirsch (2016), it must be the case (it is presupposed) that each restrictor in the set denoted by the unconditional is true in at least one world of the speaker's doxastic state (dubbed non-triviality).

[21] Tredinnick (2005: Ch. 4) gives ample evidence of ignorance eFRs' non-embeddability. She notes that there is a single exception, namely that ignorance need not be tied to the speaker, but also to a holder of an attitude expressed by a matrix attitude predicate.

[22] Notice that the circumstantial (root) nature of the licensing operator is crucial if the root vs. epistemic distinction is the relevant factor in licensing eFRs in CAT2 languages (see section 3.3); cf. Giannakidou and Mari (2018), who propose, contra Copley (2009), that the future is epistemic.

(25) a. (Tonight) Sue will eat whatever Dave cooks.
b. (Last week) Sue ate whatever Dave cooked.



ditional existential quantification over minimal situations, which are superparts of the situations introduced in the restrictor.

(26) a. $[\![\text{FUT}]\!]^g = \lambda p \lambda q \lambda s \forall s_1 [s_1 \in \textsf{META}(s) \wedge p(s_1) \rightarrow q(s_1)]$
b. $[\![\text{ITR}]\!]^g = \lambda p \lambda q \lambda s \forall s_1 [s_1 \leq s \wedge p(s_1) \rightarrow \exists s_2 [s_2 \geq s_1 \wedge q(s_2)]]$

In (27) are the resulting truth-conditions of (25a). Sticking to the same domain of two dishes, as in our previous example, the sentence is true in s_0 iff in all the continuations of s_0 in which Dave cooks $\textbf{DISH}_1$, Sue eats that dish, and in all the continuations of s_0 in which Dave cooks $\textbf{DISH}_2$, Sue eats that dish. These truth-conditions capture the intuition that Sue will eat a single dish (or a single group of dishes, in case we allow for plural entities). This is because only one of the two possible continuations will actually be realized.

(27) **Non-modal future-related reading**
For $D_c = \{\textbf{DISH}_1, \textbf{DISH}_2\}$ and some situation s_0, $[\![①]\!]^g(s_0) = 1$ iff
a. $\forall s_1 [s_1 \in \textsf{META}(s_0)) \wedge \text{COOKS}(s_1)(\textbf{DISH}_1)(\text{DAVE})$
$\rightarrow \text{EAT}(s_1)(\sigma x\, \text{COOKED}(s_1)(x)(\text{DAVE}))(\text{SUE})]]$ **&**
b. $\forall s_1 [s_1 \in \textsf{META}(s_0)) \wedge \text{COOKS}(s_1)(\textbf{DISH}_2)(\text{DAVE})$
$\rightarrow \text{EAT}(s_1)(\sigma x\, \text{COOKED}(s_1)(x)(\text{DAVE}))(\text{SUE})]]$

The truth-conditions of (25b) are in (28). The sentence is true in s_0 (say last week) iff all subsituations of s_0 in which Dave cooked DISH_1 are such that they extend to a supersituation in which Sue ate that dish, and all subsituations of s_0 in which Dave cooked DISH_2 are such that they extend to a supersituation in which Sue ate that dish. Since the quantified situations are *actual* situations, it follows that Dave actually cooked two dishes last week and that Sue actually ate both of them. This reading is thus truth-conditionally equivalent to the reading of a sentence containing a universally quantified DP (*Sue ate everything that Dave cooked*), which is a welcome result, given the common assumption in the past that eFRs are or at least can be universal quantifiers.[23]

(28) **Non-modal iterative reading**
For $D_c = \{\mathbf{DISH}_1, \mathbf{DISH}_2\}$ and some situation s_0, $[\![①]\!]^g(s_0) = 1$ iff

a. $\forall s_1[s_1 \leq s_0 \wedge \text{COOKED}(s_1)(\mathbf{DISH}_1)(\text{DAVE})$
$\quad \rightarrow \exists s_2[s_2 \geq s_1 \wedge \text{ATE}(s_2)(\sigma x\, \text{COOKED}(s_2)(x)(\text{DAVE}))(\text{SUE})]]$ **&**

b. $\forall s_1[s_1 \leq s_0 \wedge \text{COOKED}(s_1)(\mathbf{DISH}_2)(\text{DAVE})$
$\quad \rightarrow \exists s_2[s_2 \geq s_1 \wedge \text{ATE}(s_2)(\sigma x\, \text{COOKED}(s_2)(x)(\text{DAVE}))(\text{SUE})]]$

I conclude that Hirsch's (2016) proposal for ignorance eFRs can be effortlessly extended to non-modal eFRs. The differences in meaning follow from the nature of the operator that quantifies over ("licenses") the eFR in its unconditional function.

5. Conclusion

Ever since Dayal (1997), it has been common to assume that ever free relatives convey, in one way or another, a modal meaning—ignorance or indifference. This paper has delivered novel crosslinguistic evidence supporting the more recent view (Lauer, 2009; Condoravdi, 2015; Hirsch, 2016) that modal inferences are not really an integral part of the meaning of ever free relatives: four out of the seven investigated languages cannot even convey ignorance or indifference with their ever free relatives. In contrast, the so-called non-modal uses of ever free relatives, including the quasi-universal ones, are apparently universally available. I continued by delivering some old and novel arguments in favor of the hypothesis that ever free relatives are (un)conditionals of sorts (Baker 1995; recently Hirsch 2016). As (un)conditionals, ever free relatives can function as restrictors of various operators, which in turn derive the different readings that ever free relatives appear to have. The bottom line is: All ever free relatives are non-modal. Their apparent modality is the result of an interaction with certain operators, such as the implicit doxastic operator in ignorance ever free relatives.

The present paper leaves a lot of interesting questions open for future research. The most important one concerns the restriction of so-called modal uses in certain languages. What is it that prevents ever free relatives in these languages to convey the ignorance and/or indifference inference? I formulated two hypotheses, both of which receive a certain amount of empirical backing, but a principled explanation and reduction to an independent factor is still to be found. Resolving the question might also require the use of a more solid empirical methodology, as the judgments prove to be difficult, and there is a lot of cross-speaker variation within languages. It is unclear whether this variation is deeper or simply an artifact of an inadequate methodology. I further attempted to demonstrate that the (un)conditional / question-based approach to the syntax and semantics of ever free relatives opens up a whole new avenue of research into these and related constructions. Under this approach, ever free relatives are typically spelled out in their

[23] eFRs in iterative contexts actually pass many tests applicable to universal quantifiers. See Tredinnick (2005) for a solution of this problem compatible with the present approach.

"in situ" position (like quantifiers and unlike wh-phrases; cf. Johnson 2012), which is probably the reason why they have always been put on a par—syntactically—with plain free relatives. Yet, I provided multi-faceted evidence that ever free relatives (as opposed to plain free relatives) exhibit many formal and semantic properties that clearly reflect their "raised" syntactic position, where they denote propositions (rather than entities) and where they play the role of (un)conditionals / questions. The question is, therefore, which properties reflect which of both syntactic/semantic functions of ever free relatives and *why* this is so. The answers, possibly different for different languages, are likely to lead to new insights into how morphosyntax and semantics communicate with one another.

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Alternating conj/disjunctions: the case of Japanese *-toka* and *-tari*[1]

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Abstract. This paper investigates the interpretation of Japanese *-toka* and *-tari*, two non-exhaustive particles that receive conjunctive interpretations in upward-entailing environments, but disjunctive interpretations in downward-entailing and question contexts. We analyze *-toka* and *-tari* as items that introduce unstructured sets of alternatives in a Hamblin-style alternative semantics (Hamblin, 1973; Kratzer and Shimoyama, 2002), and derive their conjunctive and disjunctive readings via an interaction between these sets and the semantics of the environment containing them.

Keywords: *-toka*, *-tari*, Japanese, alternative semantics, conjunction, disjunction

1. *-toka* and *-tari*

-toka and *-tari* are used in unembedded declarative contexts to introduce non-exhaustive conjunctions of similar individuals and predicates, respectively. For example, (1a) is true if at least Taro and Hanako come, as well as if someone else, say, Jiro, comes, and is false if none or only one of those individuals comes. Likewise, (1b) is true if Taro cleaned his room, did the laundry, and did at least one other thing, such as some other household chore.

(1) a. Taro -toka Hanako-toka -ga ki -ta
Taro -TOKA Hanako-TOKA -NOM come -PST
'Taro, Hanako, and someone else came.'
b. Taro-wa heya-o sooji si -tari sentaku-o si -tari si -ta
Taro-TOP room-ACC clean do -TARI laundry-ACC do -TARI do -PST
'Taro cleaned his room, did the laundry, and did other such things.'

Although often encountered in coordinating constructions, both *-toka* and *-tari* may be used as stand-alone particles non-coordinatively, while still retaining their conjunctive and non-exhaustive interpretation, as demonstrated in (2).

(2) a. Taro -toka -ga ki -ta
Taro -TOKA -NOM come -PST
'Taro and someone else came.'
b. Taro-wa heya-o sooji si -tari si -ta
Taro-TOP room-ACC clean do -TARI do -PST
'Taro cleaned his room and did other such things.'

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These particles’s ability to be used non-coordinatively distinguishes them from the nominal coordinator *-ya*, which also behaves as a non-exhaustive conjunction in upward-entailing contexts but requires two conjuncts (Hayashishita and Bekki, 2012; Sudo, 2014).

(3) a. Taro ya Hanako -ga ki -ta
Taro YA Hanako -NOM come -PST
‘Taro, Hanako, and someone else came.’
b. *Taro ya (-ga) ki -ta
Taro YA -NOM come -PST

Although these conjunctive readings are robust in (1) and (2), in the next section we show that this interpretation is not constant across environments.

2. Disjunctive readings of *-toka* and *-tari*

-toka and *-tari* do not display the conjunctive reading of (1) and (2) in all environments; in fact, they receive *disjunctive* interpretations in several semantic contexts. These environments are generally non-veridical or implicature-cancelling, and include negation, the antecedent of a conditional, imperatives, and polar questions. What is more, the disjunction is also non-exhaustive: it includes individuals/predicates that are not overtly mentioned, regardless of whether *-toka* and *-tari* are used coordinatively or not. As such, in the examples below, we include the second conjunct in parentheses to note that the disjunctive effect is observed in coordinative and non-coordinative uses. We discuss each of the environments in detail below.

2.1. Negation

Beginning with negation, we observe that (4a) is true if Taro studied neither English nor Spanish, nor anything else like that. Similarly, (4b) is true if Taro failed to clean his room, do the laundry, or any of his chores.

(4) a. Taro-wa eigo -toka (supeingo-toka)-o benkyoo si -nakat -ta
Taro-TOP English-TOKA Spanish -TOKA -ACC study do-NEG -PST
‘Taro didn’t study English (or Spanish) or anything like that.’
b. Taro-wa heya -o sooji si -tari (sentaku-o si -tari) si -nakat-ta
Taro-TOP room -ACC clean do-TARI laundry-ACC do-TARI do-NEG -PST
‘Taro didn’t clean his room (or do the laundry) or do anything like that.’

This interpretation is unexpected on an analysis of *-toka* and *-tari* as typical conjunctions; if they were conjunctive in this environment, we would expect (4a) to have the weaker meaning that Taro simply didn’t study every language, i.e. he only studied English, but not Spanish, rather than the actual interpretation of (4a), in which Taro has studied none of the languages at all.

2.2. Antecedent of conditionals

In the conditional in (5a), Yosuke will serve tea if Taro, Hanako, or someone else like them, such as their friend Jiro, comes. Likewise, in (5b), Taro's mom will be happy if he engages in any healthy activity, such as drinking milk, eating an apple, or something similar to that.

(5) a. Taro-toka (Hanako-toka) -ga ki -tara Yosuke-wa ocha-o das -u
Taro-TOKA Hanako-TOKA -NOM come-if Yosuke-TOP tea -ACC serve-PRS
'If Taro (or Hanako) or someone like that comes, Yosuke will serve tea.'
b. Taro-ga gyuunyuu-o non-dari (ringo-o tabe-tari) si-tara mama-wa yorokob-u
Taro-NOM milk -ACC drink-TARI apple-ACC eat-TARI do-if mom-TOP be.happy-PRS
'If Taro drinks milk (or eats an apple) or something like that, his mom will be happy'

Here again, the interpretation of *-toka* and *-tari* is unexpected if they are interpreted conjunctively in these environments; in (5a), for instance, it is not necessary for Taro, Hanako, and someone else to come for Yosuke to serve tea.

2.3. Possibility modals

The disjunctive interpretation of *-toka* and *-tari* is attested in the scope of possibility modals as well, as (6) shows. In (6a), the lucky individual may receive a promotion or an overseas assignment, but not necessarily both. Likewise, Godzilla may engage in either action, or some other destructive act, but not necessarily both possible plans of attack.

(6) a. shoosin -toka (kaigaikimmu -toka) -ga ari-e -ru
promotion-TOKA overseas.assignment -TOKA-NOM be-POSS-PRS
'There is a possibility of promotion (or working abroad), among other things.'
b. Gojira -wa machi-o hakai si-tari (teki -o taosi -tari) si -e -ru
Godzilla-TOP town -ACC destruction do-TARI enemy-ACC defeat-TARI do-POSS-PRS
'Godzilla may destroy the town (or defeat his enemies) or do other such things.'

At this point it is worth pointing out potential objections to the claim that *-toka* and *-tari* receive an interpretation in the environments we have discussed here that is distinct from their interpretation in upward-entailing contexts. For one, one could argue that the apparent disjunctive interpretation of *-toka* and *-tari* under negation is simply due to their taking wide scope with respect to negation. Moreover, one might point out that conjunctions can be weakened in the antecedent of a conditional;[2] (7), for example, is felicitous in English.

(7) If John and Mary come, I'll serve tea. In fact, I'll serve tea if John comes alone.

Finally, English *and* also permits the same kind of interpretation under a possibility modal that *-toka* and *-tari* do, as the modal can distribute over each conjunct. (8), for instance, does not require that John eat shrimp and crab in the same world, but simply that eating shrimp and eating crab are both possibilties for him.

[2] We thank Rajesh Bhatt for bringing this objection to our attention.

(8) John may eat shrimp and crab.

One can therefore question the claim that *-toka* and *-tari* alternate between a conjunctive and a disjunctive reading depending on their environment. Because of this, we consider the behavior of *-toka* and *-tari* in two more environments, imperatives and polar questions, arguing that their behavior in these contexts demonstrates more convincingly the variation in their interpretation.

2.4. Imperatives

In imperatives, disjunctive interpretations of *-toka* and *-tari* are readily available. In (9a), the addressee may satisfy the speaker's request by bringing either food, drink, or some form of sustenance. Likewise, the speaker in (9b) is requesting some form of entertainment, and will be satisfied if the addressee performs at least one of the actions; they need not perform all of them.

(9) a. Tabemono -toka (nomimono -toka) motteko -i!
food -TOKA drink -TOKA bring -IMP
'Bring me food (or drink) or something like that!'
b. Tsumaranai. Odot -tari (utat -tari) si-ro!
boring dance-TARI sing-TARI do-IMP
'I'm bored. Dance (or sing) or something!

It is harder to argue for a conjunctive interpretation of *-toka/-tari* here; if they were interpreted conjunctively, we would expect (9a), for instance, to only be satisfiable if both food and drink are brought to the speaker, but this is not the case. This context, therefore, provides a stronger case for the claim that *-toka* and *-tari* receive disjunctive interpretations in this environment.

2.5. Polar questions

Finally, disjunctive interpretations are also observed in polar questions. An affirmative response is felicitous in (10a) if only one of the people comes, and in (10b) even if only one of the actions is done.

(10) a. Taro-toka (Hanako-toka) -ga ki -ta no?
Taro-TOKA Hanako-TOKA -NOM come -PST Q
'Did Taro (or Hanako) or someone like that come?'
b. Taro-wa heya -o sooji si -tari (sentaku-o si -tari) si -nakat-ta no?
Taro-TOP room-ACC clean do-TARI laundry -ACC do-TARI do-NEG -PST Q
'Did Taro clean his room (or do the laundry) or something like that?'

Here again we find an interpretation that is consistent with a disjunctive treatment, but difficult to account for if *-toka* and *-tari* are in fact conjunctive. In particular, the felicity of an affirmative response even if only one of the overtly mentioned conjuncts comes is unexpected if these particles receive a conjunctive interpretation.

Polar questions are especially useful for demonstrating the non-exhaustive nature of this disjunctive interpretation, and can be used to distinguish *-toka/-tari* questions from disjunctive polar questions using *-ka* 'or'. (11), for instance, may be answered in the affirmative even if none of the overtly mentioned individuals came.

(11) Context: Taro, Ryo, and Jiro are all good friends, and everyone associates them with one another. There was a big party last night, and Hanako wants to know if any of them came. She asks:
a. Taro-toka Ryo-toka-ga ki -ta no?
b. Un, Jiro-ga ki -ta yo.
Yes Jiro-NOM come -PST PRT
'Yes, Jiro came.'

This differs markedly from a question using *-ka*, which may not be felicitously answered affirmatively if neither of the disjuncts came.

(12) a. Taro-ka Ryo-ga ki -ta no?
b. #Un, Jiro-ga ki -ta yo.
Yes, Jiro-NOM come -PST PRT
'Yes, Jiro came.'

This thus shows that the interpretation of *-toka/-tari* in these environments is crucially different from both conjunction and ordinary disjunction.

2.6. Interim summary

In this section, we have shown that *-toka* and *-tari*, though interpreted as non-exhaustive conjunctions in unembedded declarative contexts, receive a non-exhaustive disjunctive interpretation in a range of environments. In the next section, we develop an analysis of *-toka/-tari* that accounts for this alternation.

3. Analysis

Couching our analysis within a Hamblin-style Alternative Semantics framework (Hamblin, 1973; Kratzer and Shimoyama, 2002), we propose that *-toka* and *-tari* are both *similarity-based alternative generators.* More specifically, *-toka* and *-tari* denote sets of individuals and predicates, respectively, that are similar in the context to the overtly mentioned argument of *-toka/-tari*. By virtue of being self-similar, this set will always include the overtly mentioned argument itself. Denotations for *-toka* and *-tari* are given in (13a-b), and we additionally provide example sets of individual and predicate alternatives in (13c-d) to illustrate these denotations.

(13) Denotation and example alternatives for *-toka* and *-tari*

a. ⟦$\alpha_{<e>}$-toka⟧ = { x | x $\sim_C$ α}

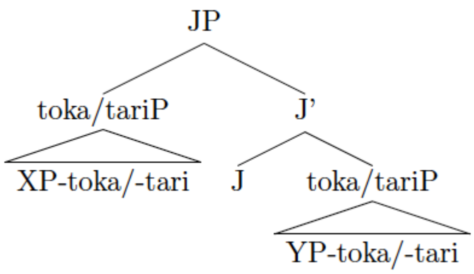
b. ⟦$\alpha_{<e,t>}$-tari⟧ = { P | P $\sim_C$ α}

c. ⟦Taro-toka⟧ = {Taro, Jiro, Ryo}

d. ⟦heya-o sooji si-tari⟧ = {λx.λw.x clean the room in w, λx.λw.x study English in w, …}

Because we analyze *-toka* and *-tari* as stand-alone alternative generating expressions, we follow Mitrović and Sauerland (2014) in making use of a silent coordinating Junction head, or simply J. This results in the syntactic structure in (14) for coordinative uses of *-toka* and *-tari*.

(14) *-toka* and *-tari* in a coordinate structure.



Semantically, we depart from Mitrović and Sauerland's analysis of J in terms of set intersection, and propose instead that it denotes the *union* of the two sets of alternatives introduced by each coordinand. Essentially, J on this analysis behaves the same way *or* does according to Alonso-Ovalle (2006), collecting up the alternatives into a single set, and a similar, disjunctive J head has been proposed for Japanese *-ka* disjunctions by Uegaki (2018).[3]

(15) Where ⟦XP⟧ and ⟦YP⟧ ⊆ D_τ, ⟦[[XP] [J [YP]]]⟧ ⊆ D_τ = ⟦XP⟧ ∪ ⟦YP⟧

The alternatives compose with other elements of the sentence through Pointwise Functional Application (Hamblin, 1973), as defined in (16). This allows members of, say, a singleton set to compose with members of a non-singleton set by applying the member of the former to each member of the latter.

(16) If ⟦α⟧ ⊆ $D_{<\sigma,\tau>}$ and ⟦β⟧ ⊆ D_σ, then ⟦α(β)⟧ = {c ∈ D_τ | ∃a ∈ ⟦α⟧ ∃b ∈ ⟦β⟧ (c = a(b))}

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[3] It may be necessary to place an additional restriction on J here, in order to capture the fact that the two phrases need to be similar to one another. This seems to be warranted anyway, as the null coordinator in Japanese has a similar effect to *ya* in expressing a non-exhaustive alternating conjunction/disjunction (Sudo 2014).

i) Taro, Hanako-ga ki -ta
Taro Hanako-nom come-pst
'Taro, Hanako, and someone else came.'

This could be analyzed as forming a set of alternatives that is restricted to being similar to both coordinands, as well as any alternatives introduced within those coordinands. We leave investigation of this possibility to future research.

Pointwise Functional Application involving sets of alternatives generated by *-toka* and *-tari* ultimately yields a set of propositional alternatives, as in (17).

(17) a. ⟦Taro-toka ga kita⟧ = {λw.Taro came in w, λw.Ryoichiro came in w, …}
b. ⟦Taro wa heya-o soojisi-tari sita⟧= {λw.Taro cleaned the room in w, λw.Taro did laundry in w, …}

What happens after the alternatives reach propositional status depends on the semantics of the environment in which they appear. Having developed the core of our analysis above, we turn now to each of these environments in turn.

3.1. Declaratives

Recall that in unembedded declarative contexts *-toka* and *-tari* are interpreted as non-exhaustive conjunctions, as in (1), repeated below as (18).

(18) a. Taro -toka Hanako-toka -ga ki -ta
Taro -TOKA Hanako-TOKA -NOM come -PST
'Taro, Hanako, and someone else came.'
b. Taro-wa heya-o sooji si -tari sentaku-o si -tari si -ta
Taro-TOP room-ACC clean do -TARI laundry-ACC do -TARI do -PST
'Taro cleaned his room, did the laundry, and did other such things.'

We model this as the insertion of a universal quantifier over propositional alternatives, defined as in (19) following Kratzer and Shimoyama (2002).

(19) ⟦∀⟧ (A) = {λw'. ∀p[p ∈ A → p(w')]}

Following previous work (Menéndez-Benito, 2005; Rawlins, 2008, 2013), we treat the universal propositional quantifier as inserted by default in order to reduce the set of alternatives to a singleton set, due to the presence of an assertion operator in the syntactic structure that requires a singleton set as an argument in order to be defined. Applying this quantifier to the set of alternatives in (17), for instance, results in the singleton set in (20).[4]

(20) {λw'. ∀p[p ∈ {Taro came, Hanako came, Jiro came,…} → p(w')]}

(20) states that sentence (18a) is true if each proposition in the alternative set holds in the world of evaluation.[5] This is equivalent to asserting the conjunction of all of the alternatives

[4] For reasons of space we will restrict our analysis to either a sentence with *-toka* or one with *-tari.* The analysis is valid for both examples, regardless of which example we choose to illustrate the formal treatment.

[5] One might worry here that the derived interpretation is too strong; it asserts that *all* the propositions in the set of alternatives are true, whereas the interpretation of sentences with *-toka* and *-tari* seems to be more accurately paraphrased as asserting that at least one alternative is true, in addition to the overtly mentioned alternatives. Given that the alternatives are constrained both by the similarity relationship and by the context, it is not clear that this would necessarily result in a significant increase in the number of alternatives relative to other possible analyses.

in the alternative set, and, therefore, this derives the conjunctive interpretation of unembedded declaratives with *-toka* and *-tari.*

3.2. Negation

The disjunctive interpretation of *-toka* and *-tari* can be straightforwardly derived by simply applying negation pointwise to each alternative, and then inserting the default universal propositional quantifier, just like in the analysis of non-negated declaratives. This results in (21).

(21) $\{\lambda w'.\ \forall p[p \in \{\neg\text{Taro studied English}, \neg\text{Taro studied Spanish}, \ldots\} \rightarrow p(w')]\}$

This ensures that the negation of each alternative holds in the world of evaluation, and is equivalent to an analysis where conjunction takes wide scope over negation, thereby generating the reading by which Taro studied none of the languages in the set.

3.3. The antecedent of conditionals

For the analysis of conditionals, we follow the treatment of *if* conditionals in Alternative Semantics due to Alonso-Ovalle (2006) in analyzing the antecedent of a conditional as a universal quantifier over propositional alternatives that takes an argument a property of propositions, notated as *f*. This is displayed in (22) below.

(22) $[\![\text{Taro-toka Hanako-toka ga kitara}]\!] = \{\lambda f.\lambda w.\ \forall p[p \in \{\text{Taro comes in w, Hanako comes in w}, \ldots\} \rightarrow f p(w')]\}$

The consequent of a conditional is then treated as the property of propositions, or a function from propositions into propositions. Assuming an implicit universal quantification over possible worlds in bare conditionals (Kratzer, 1986; Lewis, 1975), the consequent receives the following translation in (23).

(23) $[\![\text{Yosuke-wa o-cha-o dasu}]\!] = \{\lambda p.\lambda w.\ \forall w'[f_{\leq w}(p(w')) \rightarrow \text{Yosuke serves tea in w'}]\}$

The antecedent then applies to the consequent, resulting in (24).

(24) $[\![(22)((23))]\!] = \{\lambda w.\ \forall p[p \in \{\text{Taro comes in w, Hanako comes in w}, \ldots\} \rightarrow \forall w'[f_{\leq w}(p(w')) \rightarrow \text{Yosuke serves tea in w'}]]\}$

Spelling this out in words, (24) says that for every proposition p, if p is in the set of alternatives, then for every possible world, if p holds in a world close to the world of evaluation (notated $f_{\leq w}$), Yosuke serves tea in that world. This has the effect of distributing the propositions in the alternative set over the set of closest possible worlds, and therefore allows Yosuke to serve tea in worlds where Taro comes alone, in worlds where Hanako comes alone, and so on. In other words, this analysis captures the fact that it need not be the case that every proposition in the alternative set be true for Yosuke to serve tea. This therefore successfully captures the disjunctive interpretation of *-toka* and *-tari* in the antecedent of a conditional.

3.4. Possibility modals

We provide a standard translation for the possibility modal *-e* as existential quantification over possible worlds, as in (25).

(25) $[\![\text{-e}]\!] = \{\lambda p.\lambda w.\exists w'[wRw' \wedge p(w')]\}$

As with negation in (21), the possibility modal is applied pointwise to each proposition in the alternative set. The default universal propositional quantifier is then inserted to flatten the alternative set into a singleton, resulting in (26).

(26) $\{\lambda w''.\forall p[p \in \{\lambda w.\exists w'[wRw' \wedge \text{Godzilla destroys the town in } w'], \lambda w.\exists w'[wRw' \wedge \text{Godzilla defeats his enemies in } w'], \ldots\} \rightarrow p(w'')]\}$

According to (26), each of the modalized propositions in (26) holds in the world of evaluation. This results in an interpretation according to which each proposition holds in at least one world accessible from the world of evaluation, effectively distributing the propositions in the alternative set over the worlds accessible from the worlds of evaluation, as with the conditional case in (24). Crucially, this does not require that every proposition in the alternative set end up coming about in the actual world, nor does it require that every proposition hold at every possible world accessible from the world of evaluation. Rather, each proposition is merely an option.

3.5. Imperatives

We can extend the account given of possibility modals above to analyze imperative expressions, adapting ideas from Aloni (2007) into the single-tier alternative semantics framework in which we have couched our analysis. Concretely, we can treat the imperative operator as something akin to universal quantification of the set of alternatives, in combination with existential quantification over a set of worlds that encode the set of desires the imperative aims to satisfy. Applying this to (9a), repeated as (27a) below, we derive (27b) as its interpretation.

(27) a. Tabemono -toka (nomimono -toka) motteko -i!
food -TOKA drink -TOKA bring -IMP
'Bring me food (or drink) or something like that!'

b. $\{\lambda w.\forall p[p \in \{\lambda w'.\text{ you bring food in } w', \lambda w'.\text{you bring drink in } w', \ldots\} \rightarrow \exists w'' \in W_{Des}[wRw'' \,\&\, p(w'')]]\}$

Breaking this down, (27) states that each proposition in the alternative set is associated with at least one world, accessible from the world of evaluation, where that proposition holds. Put another way, this can be thought of as meaning that any of the actions done in one of the desire worlds satisfies the imperative. Just like in the possibility modal case, this does not require every proposition to hold in every world, and therefore we correctly predict a disjunctive-like interpretation for *-toka* and *-tari* with imperatives, where the imperative will be satisfied by any of the actions taken.

3.6. Polar questions

We conclude our analysis with polar questions. A recurrent theme throughout our analysis has been the application of a universal propositional quantifier over the set of alternatives. This, however, will not derive the correct results for polar questions; rather than universal quantification over the set of alternatives, it seems that we need *existential* quantification in order to capture the interpretation of *-toka* and *-tari* in polar questions. Fortunately, we can make use of the existential propositional quantifier defined by Kratzer and Shimoyama (2002), defined as in (28).

(28) $[\![\exists]\!]\,(A) = \{\lambda w'.\ \exists p[p \in A \wedge p(w')]\}$

The insertion of a quantifier to flatten the alternative set into a singleton will be required by the partition operator, which takes a singleton set as argument and generates the bipolar denotation of a polar question.

(29) $[\![\mathrm{Part}(\{\lambda w'.\ \exists p[p \in A \wedge p(w')]\})]\!] = \{\lambda w'.\ \exists p[p \in A \wedge p(w')],$
$\lambda w'.\neg\exists p[p \in A \wedge p(w')]\}$

This brings about an interpretation for a question like (10a) to which one could answer 'yes' if one or more of the alternatives holds, and 'no' if none of them do. This delivers the correct disjunctive interpretation of *-toka* and *-tari* in polar questions.

One might ask why the existential propositional quantifier is inserted in this context, rather than the universal propositional quantifier. Empirically, of course, insertion of the universal quantifier delivers the wrong result, but we have not yet provided independent justification for the insertion of a different propositional quantifier. There are two possible ways to implement the selection of the right quantifier. One possibility is that this choice is essentially syntactic: the universal quantifier agrees with a declarative head C_{decl}, while the existential quantifier is inserted to agree with the head responsible for generating polar question interpretations. Another option is that the choice is semantic in nature: the grammar inserts whichever quantifier produces the strongest meaning given the semantic environment. This is the tack taken by Davidson (2013) in her analysis of general use coordination in American Sign Language.[6] In order for this approach to work in the case at hand, however, it would be necessary to guarantee that existential quantification really is stronger in polar questions, which, given the non-monotonic nature of questions, will not necessarily be the case.[7] We leave further exploration of this issue to future research.

[6] We would like to thank Yuko Asada for bringing Davidson (2013) to our attention.
[7] We thank Maribel Romero for discussion on this point.

4. Predictions

The account we have developed here makes additional predictions beyond the data it was designed to explain. We focus on three predictions here: 1) the behavior of *-toka* and *-tari* under necessity modals, 2) the context sensitivity of the non-exhaustive interpretation, and 3) the interpretation of a non-coordinative *-toka/-tari* question.

For the first case, our analysis predicts that *-toka* and *-tari* should possess *conjunctive* interpretations in the scope of necessity modals, just like in ordinary declaratives, but unlike the other contexts we have discussed. This is because the necessity modal, in combination with the default propositional quantifier inserted in declarative clauses, will require that each proposition in the alternative set hold in *every* possible world accessible from the world of evaluation. This predicted interpretation is given in (30) below.

(30) $\{\lambda w.\forall p[p \in \{\lambda w'.\forall w''[w'Rw'' \rightarrow \text{Godzilla destroys the town in } w''], \lambda w'.\forall w''[w'Rw'' \rightarrow \text{Godzilla defeats his enemies in } w''], \ldots\} \rightarrow p(w)]\}$

This prediction is in fact borne out. As the *-tari* sentence in (31) shows, *-tari* does indeed receive a conjunctive interpretation in the scope of the necessity modal expression *hitsuyoo-ga aru.*

(31) insei-wa gakkai-de happyoosi-tari ronbun-o shuppansi-tari su-ru hitsuyoo-ga ar-u
grad-TOP conf -at present -TARI paper-ACC publish -TARI do-PRS need -NOM be-PRS
'It is necessary for graduate students to present at conferences and publish papers, etc.'

Another prediction of our analysis is that the non-exhaustive interpretation may vanish if the set of contextually salient similar alternatives only contains the overtly mentioned individuals or predicates. This is borne out as well: the non-exhaustive inference may in fact be directly cancelled, as (32) shows.

(32) Taro-toka Hanako-toka-ga ki -ta. Jitsuwa, Taro-to Hanako-dake-ga ki -ta.
Taro-TOKA Hanako-TOKA-NOM come-PST in.fact Taro-and Hanako-only-NOM come-PST
'Taro, Hanako, etc. came. In fact, only Taro and Hanako came.'

A final prediction of our analysis is that the non-exhaustive disjunctive inference should be available in non-coordinating uses of *-toka* and *-tari.* That is, we predict that one could felicitously answer 'yes' to the following question, modified from (11), even if the overtly mentioned individual did not come.

(33) Context: Taro, Ryo, and Jiro are all good friends, and everyone associates them with one another. There was a big party last night, and Hanako wants to know if any of them came. She asks:
a. Taro-toka -ga ki -ta no?
b. Un, Jiro-ga ki -ta yo.
Yes Jiro-NOM come -PST PRT
'Yes, Jiro came.'

The status of this prediction is not entirely clear. While the second author of this paper, a native speaker of Japanese, finds the discourse in (33) to be felicitous, other Japanese speakers find (33) infelicitous if Taro does not come.[8] As such, there seems to be inter-speaker variation on this point. Our current account does not provide an explanation for the judgment of those speakers for whom (33) is infelicitous, and we therefore leave it as a puzzle for future research to address.

5. Conclusion

In this paper, we examined the semantic properties of the Japanese particles *-toka* and *-tari*. We showed that the interpretation of these particles is sensitive to their semantic environment: although they receive non-exhaustive conjunctive interpretations in unembedded declaratives, they receive a non-exhaustive disjunctive interpretation in a variety of other environments. Furthermore, this alternation between a conjunctive and a disjunctive reading remains regardless of whether the particles are used coordinatively or not. In order to explain this variation in interpretation, we developed an analysis in a single-tier Hamblin-style Alternative Semantics, treating *-toka* and *-tari* as introducing sets of similar individual and predicate alternatives, respectively. We then proceeded to derive the conjunctive and disjunctive interpretations through an interaction between the generated sets of alternatives and the semantics of the environment in which the alternatives appear.

Several issues remain to be explored in this line of research. For one, we would like to attempt to relate the work we have done on *-toka* and *-tari* to work that has been done on another Japanese non-exhaustive coordinator, *-ya*, which behaves much like *-toka* in that it takes nominals as arguments and alternates between a conjunctive and disjunctive interpretation in the same environments that *-toka* and *-tari* do (Sauerland et al., 2017; Sudo, 2014). Work on *-ya* primarily adopts an implicature-based approach: *-ya* is analyzed as a simple disjunction, identical in meaning to *-ka* 'or' discussed in example (12) in the current paper. It is then enriched and ultimately receives a conjunctive and non-exhaustive interpretation, through competition with either pragmatically enriched versions of *-to* 'and' and *-ka* 'or', as in Sudo's (2014) higher-order implicature analysis, or with substring alternatives as in Sauerland et al.'s (2017) approach. Although we do not attempt it here, we are interested in reconciling our approach to *-toka* and *-tari* with these analyses of *-ya*.

An avenue of inquiry that may prove fruitful in shaping future work on these particles is an investigation of their interaction with quantificational elements in the sentence. For instance, we note that the sentence in (34) permits a reading in which Taro, Hanako, and anyone else in the context were seen by different children. It is judged true as long as Taro, Hanako, and possibly someone else are seen by at least one of the kids in the set. That is, the individuals in the set denoted by the *-toka* coordination may be distributed across the set of kids.

(34)	subete	-no	ko	-ga	Taro-toka	Hanako-toka	-o	mi -ta
	all	-GEN	child	-NOM	Taro-TOKA	Hanako-TOKA	-ACC	see-PST

[8] We thank Katsuhiko Yabushita and Michael Yoshitake Erlewine for discussion on this point.

'All the kids saw one of Taro, Hanako, etc.'

This is reminiscent of the interpretation of dependent plurals in English (Zweig, 2009); for instance, (35) is true even if each kid only flew one kite, as long as there are at least two kites flown overall.

(35) All the kids flew kites

It is not clear how our approach can handle cases like (34); the insertion of the default universal quantifier will result in too strong of an interpretation, in which every kid sees every one of the individual alternatives, but the insertion of the existential quantifier results in too weak of an interpretation that is satisfied if at least one of the individual alternatives is seen by every kid. However, it is not clear that an implicature-based approach, which would strengthen an underlying disjunctive meaning for *-toka* to a conjunctive one, would fare any better. We leave this interesting issue, as well as interactions with other quantificational elements, to future research.

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good as a predicate of worlds[1]

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Abstract. The paper proposes a new semantics for *good*-predications involving finite *if*-and *that*-clauses. The proposal combines a standard semantics for conditionals with a standard semantics for the positive form of gradable adjectives and a minimal semantics for modal *good*. The predicted truth-conditions and conditions of use solve the mood puzzle presented in the first part of the paper. The remainder of the paper defends the classical notion of comparative goodness in terms of a comparison between possible worlds against Lassiter (2017)'s challenge.

Keywords: gradable adjectives, subjunctive conditionals, preference predicates, factivity.

1. Introduction

The topic of this paper are predicative constructions of the adjective *good* that involve *if*- and *that*-clauses with an indicative and past / subjunctive inflection related to the subject-position of *good*, as illustrated in (1).

(1) a. It is good that the cat is fat.
b. It is good if the cat is fat.
c. It would be good if the cat was / were fat.

For ease of reference, I will call these constructions "*good*-predications" and the finite clauses within "FIN-clauses". The general pattern of these constructions is characterized in (2):

(2) α = the cat be-INFL fat FIN-clause
a. It is good [that α-IND].
b. It is good [if α-IND].
c. It would be good [if α-PAST / SUBJ].
good-predication

The main interest of this paper is the compositional semantics of *good*-predications and their interpretation at the syntax-semantics interface.

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2. The conditional nature of *good*-predications

2.1. *good* is unlike *likely*

In recent work, Daniel Lassiter has argued that the FIN-clauses of *good*-predications should be analysed as propositional arguments of the predicate *good* (see Lassiter, 2017). His assumption is that–although there are differences between *likely* and *good* with respect to their characteristic properties as scalar adjectives–at the syntax-semantics interface *likely* and *good* behave exactly alike, i.e., they both take clausal arguments that are semantically interpreted as their propositional arguments. (3) and (4) give the relevant details in a very simplified form:

(3) a. It is likely that α.
[$_t$ **it is likely**$_{\langle\langle s,t\rangle,t\rangle}$ [$_{\langle s,t\rangle}$ **that** α]]
b. It is good that α.
[$_t$ **it is good**$_{\langle\langle s,t\rangle,t\rangle}$ [$_{\langle s,t\rangle}$ **that** α]]

(4) a. $[\![\textbf{likely}]\!]^w = \lambda p_{\langle s,t\rangle}.\ \text{LIKELY}_w(p)$
b. $[\![\textbf{good}]\!]^w = \lambda p_{\langle s,t\rangle}.\ \text{GOOD}_w(p)$

I think this parallel treatment is misguided for two reasons. First, the range of FIN-clause types in *likely*-predications differs from the range of FIN-clause types in *good*-predications: While *likely* only allows *that*-clauses (5), *good* also allows *if*-clauses in indicative and subjunctive mood (6).

(5) It is likely [that the cat is fat]. that α-IND

(6) a. It is good [that the cat is fat]. that α-IND
b. It is good [if the cat is fat]. if α-IND
c. It would be good [if the cat was / were fat]. if α-PAST / SUBJ

Second, *that*-clauses of *good*-predications are factive while *that*-clauses of *likely*-predications are not. Let's assume Mary says: "I don't know where John is." Against the background of this utterance she cannot presuppose that John is at the office. Compare now the follwing utterances (where # marks the infelicity against the assumed conversational background):

(7) a. It is (not) likely that John is at the office. not factive
b. #It is (not) good that John is at the office. factive
c. It is (not) good if John is at the office. not factive

It seems that *good* and *likely* behave grammatically very differently.[2] The obvious question with respect to the *if*-clauses in *good*-predications is: Is there a relation to conditionals? And if so, how close is it?

[2]I want to mention two other respects in which *good*-predications differ from *likely*-predications that fit the grammatical pattern of *good*-predications as described above. First, we find non-conditional subjunctive mood with *good*-predications but not with *likely*-predications.
(8) It is good that your wedding be simple and make what is truly important stand out. http://www.usccb.org

2.2. *good*-predications have the outer appearance of conditionals

There are striking similarities between *good*-predications and conditionals. First of all, the pattern of "mood-matching" between the main predicate and the FIN-clause in *good*-predications mirrors the pattern of mood-matching between the antecedent and the consequent of conditionals, compare (10) with (11).

(10) a. John will-IND like the picture, if the cat is-IND fat.
b. John would-SUBJ like the picture, if the cat was-PAST / were-SUBJ fat.

(11) a. It is-IND good, if the cat is-IND fat.
b. It would-SUBJ be good, if the cat was-PAST / were-SUBJ fat.

As with conditionals, *would* seems to be disprefered in the *if*-clause.

(12)

		Search results for the strings on Google:
a.	"It would be better if you were"	67.400.000
b.	"It would be better if you would be"	0
c.	"It were better if you were"	10
d.	"It were better if you would be"	0

2.3. *good*-predications have the use conditions of conditionals

Another similarity between *good*-predications and conditionals is that they have the same conditions of use. Let me first introduce the conditions of use for conditionals as characterized by Kratzer (1979) (where q is the proposition expressed by α and w is the world where the utterance is performed):

(13) Rule of use for indicative conditional sentences – An utterance of **must / necessarily, if** α, β will only be appropriate if q and its negation are both compatible with what is common knowledge in w.

(14) Rule of use for subjunctive conditionals –An utterance of **would**, **if** α, β will only be appropriate if the negation of q is compatible with what is common knowledge in w.

(15) Rule of use for counterfactuals – The use of a subjunctive conditional sentence is a counterfactual use if and only if q is incompatible with what is common knowledge in w.

With non-conditional subjunctive mood we do not necessarily get a factive reading for the *that*-clause.

The second difference concerns the interaction with negation. Lassiter (2011) argues that *good* like *likely* is a neg-raising predicate. This seems to be at least doubtful for *good*-predications in subjunctive mood since the overt position of the negation affects the conditions of use. Let's take the following utterance as part of the conversational background: "The cat is fat." Against this background the sentences in (9a) and (9b) cannot be used interchangably since their conditions of use are crucially different, cf. the test in Lassiter (2011).

(9) a. It wouldn't be good if the cat were slim.
b. #It would be good if the cat weren't slim.

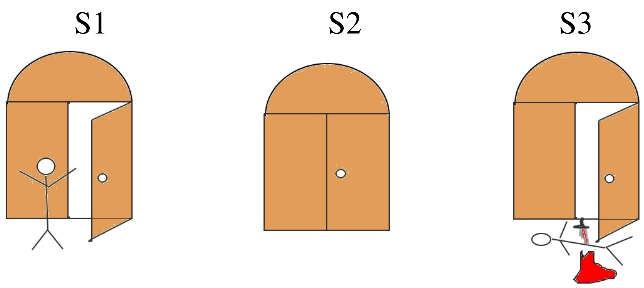
To illustrate the conditions of use, Kratzer (1979) introduces the following story:

> "The following story is reported about ancient Rome: When Caligula left the arena one day, suddenly the doors shut behind him and he was attacked by his own bodyguards. The crowd in the arena heard him screaming but they could only guess what had happened." Kratzer (1979)

From here on, I will modify her example slightly. Let's assume that there are three possible outcomes of the story:

(16) S1 = The doors open and the audience learns that Caligula is still alive.
S2 = The doors stay closed and the audience won't know what happened.
S3 = The doors open and Caligula is found dead.

The following pictures represent what is common knowledge in the corresponding situations according to the outcomes characterized in (16).



Imagine now Tullius (who wants to get promoted) uttering the sentences in (17) in the different situations. If we check our intuitions about the appropriateness conditions for the different types of conditionals, we find the following:

(17) a. [Since Caligula is still alive], I will get promoted. ⇝ S1
b. [If Caligula is still alive], I will get promoted. ⇝ S2
c. [If Caligula were still alive], I would get promoted. ⇝ S2, S3

The table summarizes the use conditions dependent on the type of FIN-clause used.

α = Caligula be-INFL still alive

type of FIN-clause	form	appropriate in
factive	since α-IND	S1
indicative conditional	if α-IND	S2
subjunctive conditional	if α-SUBJ/PAST	S2, S3

Table 1: use conditions dependent on the type of FIN-clause

If we now turn to the different types of *good*-predications and check our intuitions about the appropriateness conditions, we find the same conditions of use depending on the type of FIN-clause used.

(18) a. It is good [that Caligula is still alive]. $\rightsquigarrow$ S1
b. It is good [if Caligula is still alive]. $\rightsquigarrow$ S2
c. It would be good [if Caligula were still alive]. $\rightsquigarrow$ S2, S3

2.4. The puzzle: unconditionally *good*

Although *good*-predications look like conditionals and share their conditions of use, their truth-conditions crucially differ from conditionals: While any conditional interpretation of *good*-predications will result in a shifted interpretation for the predicate *good*, the predicate *good* in a *good*-prediction on the relevant reading is interpreted with respect to the world of evaluation. This is not to say that sentences of the form in (18b) and (18c) cannot have an interpretation as a true conditional. This interpretation is sometimes called the "logical reading", Williams (1974), cf. (20a). On this reading the pronoun *it* is interpreted as anaphorically refering to some given situation in the discourse context. But this is not the relevant reading under discussion. There is agreement in the literature that the relevant reading is "non-logical" (see Pesetsky, 1991; Kaufmann, 2017b).[3] According to a popular paraphrase for this reading, the proposition expressed by the antecendent of the conditional also plays the role of the propositional argument of *good*, cf. (20b). The example is taken from Kaufmann (2017b):

(20) *It would be good if Bill were here.*
a. logical reading:
'If Bill were here it [$\Rightarrow$ the relevant situation] would be good.'
b. non-logical reading:
'If Bill were here [that Bill is here] would be good.'"

At first sight, the interpretation suggested by this paraphrase seems to be a plausible candidate for the relevant non-logical interpretation. But this still doesn't give us the right truth-conditions. To see this, I give a more explicit version of the logical form corresponding to the paraphrase in (20b) annotated with semantic types for the extensions of the expressions.

(21) a. It is good if α. non-logical reading
b. $(\textbf{if}\ \alpha)$ MUST $[_t$ [**that** α] $\textbf{good}_{\langle\langle s,t\rangle,t\rangle}$]

Independent of how one plans to spell out the truth-conditional contribution of the predicate *good*, it is clear from the LF that, since MUST is an intensional operator, we need to apply the rule of Intensional Functional Application to combine the intensional operator with a type t clausal argument (see Heim & Kratzer, 1998). This will result in a shifted interpretation for the predicate *good* in the sense of *under such and such circumstances it is good that . . . .* But what we want to say when we utter a sentence like (21a) in the unmarked case is that it is *actually*

[3] It has been observed for German that *good*-predications in subjunctive mood can occur with a V2-clause that is interpreted as an *if*-clause (see for example Meinunger, 2007).

(19) Es wäre gut, er würde noch leben.
It be-SUBJ good he would-SUBJ still live
'It would be good if he were still alive.'

The use of a V2-clause disambiguates in favour of the relevant reading under discussion.

good if certain circumstances turn out to be the case.[4] The assessment of the goodness of the described circumstances is not shifted to another world. For example, the paraphrases in (22b) and (23b) readily have a cynical reading that welcomes Mary's recovery only under certain conditions. But this reading doesn't match the unmarked reading for (22a) and (22b).[5]

(22) a. It is good if Mary will recover again.
b. If Mary will recover again, [that she will recover again] is good.

(23) a. It would be good if Mary would recover again.
b. If Mary would recover again, [that she will recover again] would be good.

In general, sentences of the form *It is / would be good, if* φ in the unmarked case are used to express *actual preferences* for certain conditions and *not conditional preferences*. W.r.t. *good*-predications in subjunctive mood the empirical findings can be restated as a puzzle:

(24) **The mood puzzle**
How can it be explained that the main predicate of a *good*-predication in subjunctive mood (*it would be good* on the unmarked interpretation) is overtly marked with subjunctive mood, when at the same time the world argument of *good* doesn't get a shifted interpretation.

The background for this puzzle is that in conditionals the world argument of a predicate that is overtly marked with subjunctive mood *always* gets a shifted interpretation. This is true, both, for the antecendent and the consequent of conditionals. The question is: How can we account for the overt subjunctive marking of a predicate if its world argument doesn't get a shifted interpretation? What we need is a compositional semantics for *good*-predications that a) gives us the right distribution of the overt mood morphology b) makes sense of the use conditions associated with the different types of FIN-clauses and c) gets the unshifted interpretation of *good* right, i.e., solves the mood puzzle.

3. The Proposal

The proposal has two parts: First, I propose that *good*-predications involve conditional operators. This allows us to account for the mood distribution, the restriction of *would* to the matrix-clause and the conditions of use associated with indicative and subjunctive mood. Both, with conditionals and *good*-predications these properties can be uniformly attributed to the conditional operator involved. Second, I propose that modal *good* denotes a relation between possible worlds. In particular, I will treat modal *good* in parallel to Arnim von Stechow's treatment of the temporal gradable adjective *spät* in von Stechow (2006): While *spät* is predicated of times, modal *good* is predicated of worlds. As a consequence of this treatment, the modal operator and the *good*-predicate have to be combined by Extensional Functional Application–instead of Intensional Functional Application–resulting in an unshifted interpretation of the (anchoring) world argument of modal *good*.

[4]The "unmarked case" is the case in which *it* doesn't get an anaphoric interpretation.
[5]Similar observations have been made by Pullum (1987), Grosz (2012), Kaufmann (2017a).

The section is devided in five subsections: First, I introduce my assumptions about the interpretation of the conditional operator involved. Then, I present the semantics for *good*. In a third part, I show how the semantic composition of the conditional operator and modal *good* results in an unshifted interpretation for the world of evaluation of modal *good*. In subsection four, I discuss the predictions of this proposal for a simple example. In the last subsection, I summarize how the proposal accounts for the mood puzzle.

3.1. *good*-predications involve conditional operators

To be able to spell out the details of the proposal, I have to make some assumptions about the interpretation of conditionals. The proposal itself doesn't commit me to a particular theory. Any theory that explains the distribution of mood in indicative and subjunctive conditionals and accounts for their conditions of use will do. For the exploratory purpose of this paper, I choose to go with a basic Kratzer-style semantics for conditionals that takes conditional antecendents to be restrictors of overt or covert modal operators, Kratzer (1981, 2012). In (25), I give the general form of indicative and subjunctive conditionals on such an account.

(25) a. (**if** α) MUST β Indicative
b. (**if** α) WOULD β Subjunctive

For Kratzer, both MUST and WOULD are special cases of a modal necessity-operator NEC. NEC is interpreted relative to two conversational backgrounds f and g, where f functions as the modal base and g as the ordering source, (26).[6]

(26) $[\![\text{NEC } \beta]\!]^{f,g} = \lambda w.\ \forall w' \in \bigcap f(w){:}\ \exists w'' \in \bigcap f(w){:}\ w'' \leq_{g(w)} w' \wedge \forall w''' \in \bigcap f(w){:}$ $w''' \leq_{g(w)} w'' \rightarrow [\![\beta]\!]^{f,g}(w''')$ Kratzer (2012)

The contribution of the *if*-clause is that it adds another premise to the conversational background f that functions as the modal base (27).[7]

(27) $[\![(\textbf{if } \alpha)\ \beta]\!]^{f,g} = [\![\beta]\!]^{f^*,g}$, where $f^*(w) = f(w) \cup \{||\alpha||^{f,g}\}$, for all $w \in W$ Kratzer (2012)

The resulting semantics for the general case is given in (28):

(28) $[\![(\textbf{if } \alpha)\ \text{NEC } \beta]\!]^{f,g} = \lambda w.\ \forall w' \in \bigcap f^*(w){:}\ \exists w'' \in \bigcap f^*(w){:}\ w'' \leq_{g(w)} w' \wedge$
$\forall w''' \in \bigcap f^*(w){:}\ w''' \leq_{g(w)} w'' \rightarrow [\![\beta]\!](w''')$,
where $f^*(w) = f(w) \cup \{||\alpha||^{f,g}\}$, for all $w \in W$

The differences between indicative (=MUST) and subjunctive (=WOULD) conditionals on Kratzer's account come about by a particular choice for the modal base f and the ordering

[6] $w \leq_A w'$ iff $\{p \in A{:}\ w' \in p\} \subseteq \{p \in A{:}\ w \in p\}$
[7] $||\alpha||^{f,g} =_{def} \{w \in W{:}\ [\![\alpha]\!]^{f,g}(w)\}$. If the interpretation of α is not sensitive to the conversational backgrounds f and g, I will simply write $||\alpha||$ instead of $||\alpha||^{f,g}$.

source g. For example, under the assumption that the modal base f is an empty conversational background and the ordering source g is a totally realistic conversational background[8], we get the following truth conditions for the subjunctive conditional in (29a):

(29) a. If Caligula was / were still alive, Tullius would be rich.

b. $[\![$(**if Caligula alive**) WOULD **Tullius rich**$]\!]^{f,g}$ =

$\lambda w.\ \forall w' \in ||$**Caligula alive**$||$: $\exists w'' \in ||$**Caligula alive**$||$: $w'' \leq_{g(w)} w' \wedge$
$\forall w''' \in ||$**Caligula alive**$||$: $w''' \leq_{g(w)} w'' \rightarrow$ rich$_{w'''}$(Tullius)

'Every $||$**Caligula alive**$||$-world that is at least as close to an ideal determined by the facts in the world of evaluation w (represented by the set of propositions $g(w)$) as any other $||$**Caligula alive**$||$-world is a world in which Tullius is rich.'

Against this background I propose the following logical forms for indicative and subjunctive *good*-predications.

(30) a. It is good if Caligula is alive. Indicative

b. (**if Caligula alive**) MUST [POS **good**]

(31) a. It is would be good if Caligula was / were alive. Subjunctive

b. (**if Caligula alive**) WOULD [POS **good**]

The crucial differences between conditonals and *good*-predications that result in an unshifted interpretation of the world argument of modal *good* have to be attributed to the semantics of modal *good*. This is the topic of the next section.

3.2. Modal *good* as a predicate of worlds

Good is a gradable adjective. Like other gradable adjectives it combines with a POS-morphem in its positive form. As a background for the discussion, I want to first introduce some assumptions about the semantics of gradable adjectives and their positive forms following von Stechow (2006).[9]

3.2.1. Degree adjectives: *tall*

I want to illustrate the assumptions that I take to be the background for the following discussion for the gradable adjective *tall*. The semantics of the adjective *tall* involves a measure function HEIGHT that maps an individual to its maximal degree of tallness. *Tall* denotes a relation between an individual x and a degree d such that the maximal degree of tallness of x given by

[8]"A counterfactual is characterized by an empty modal base f and a totally realistic odering source g." (Kratzer, 2012: p. 66)

[9]As in the case of conditionals, the proposal in this paper is not commited to a particular semantics for gradable adjectives. Other proposals in the literature (see for example the references in von Stechow, 2006; Beck, 2010) would serve the purpose of this paper as well.

HEIGHT(x) is at least as high as d, cf. (32).[10]

(32) $[\![$**tall**$_{\text{S}}]\!]^g = \lambda d$: $d \in g(\text{S}) \wedge g(\text{S}) \subseteq S_{\textbf{tall}}$. $\lambda x \in D_e$. HEIGHT$(x) \geq d$,
where $g(\text{S})$ is a contexually salient subinterval on the tallness scale $S_{\textbf{tall}}$

Following von Stechow (2006), the positive form of the adjective introduces an operator POS. Semantically, POS specifies a neutral interval $N(S)$ of degrees on the tallness scale $S_{\textbf{tall}}$ that are neither short nor tall. The denotation of [POS **tall**] when applied to an individual x returns true iff the maximal degree of tallness of the individual x is higher than any degree in the neutral interval $N(S)$. On a reading for (34a) where Ede's height is judged against the interval $N(S)$ the sentence is true iff Ede's maximal degree of tallness exceeds any degree of tallness in the contextually given interval $N(S)$.

(33) $[\![\text{POS}_{\text{N,S}}]\!]^g = \lambda A_{\langle d,t\rangle}.\ \forall d \in N(S)\colon A(d)$ von Stechow (2006)

(34) a. Ede is tall. von Stechow (2006)
b. $\text{POS}_{\text{N,S}}\ \lambda d.\textbf{tall}_{\text{S}}(d)(\textbf{Ede})$
c. $[\![(34\text{b})]\!] = 1$ iff $\forall d \in N(S)$: HEIGHT(Ede) $\geq d$

HEIGHT(Ede)
↓
|——————————————————————|

|————————— [/////////$N(S)$////////] —————————->|
small neither short nor tall tall

3.2.2. Times as degrees: *spät* ('late')

In von Stechow (2006), the gradable temporal adjective *spät* ('late') is analyzed in analogy to *tall* with the difference that *spät* doesn't relate an individual and a degree but instead two times.

(35) 'late': type $\langle i, \langle i, t\rangle\rangle$ (official rule) von Stechow (2006)
$[\![$**spät**$_{\text{I}}]\!] = \lambda t' \in \text{I} \subseteq \text{T}.\ \lambda t \in \text{I}.\ t \geq t'$

The basic idea is that in the temporal domain times can treated as degrees (see the discussion in von Stechow (2006) for further details). Consequently, the temporal version of the POS-morphem according to von Stechow (2006) is a quantifier over times (as degrees):

(36) $[\![\text{POS}_{\text{I,N}}]\!] = \lambda P_{\langle i,t\rangle}.\ \forall t \in N(I)\colon P(t)$ von Stechow (2006)

The resulting semantics is illustrated for the example in (37).

[10]In this section, $[\![\ \cdot\ ]\!]$ is a function from expressions of English to their extensions – and not as before (and later on) to their intensions.

(37) Es war spät. 'It was late.' von Stechow (2006)
$\text{POS}_{\text{I,N}}$ λ_2 [PAST_5 [t_2 **late**]]
$\forall t \in N(I)$: $\text{Past}_5 \geq t$
|...........................(.........)........Past$_5$............> |
early $N(I)$ late

3.2.3. A minimal semantics for modal *good*

I propose that a relational semantics in the spirit of von Stechow's semantics for *spät* can straightforwardly be transfered to modal *good* if we substitute worlds for times.[11] Under this assumption, modal *good* simply expresses a relation between worlds according to an ideal specified by a contextually given conversational background f. The relevant conversational background can be deontic, teleological or bouletic (see Lassiter (2017) for a discussion of the range of possible readings). I want to call this the "minimal semantics" for modal *good*.[12,13]

(39) Minimal semantics for modal *good*
$[\![\textbf{good}]\!]^f = \lambda w.\ \lambda w'.\ \lambda w''.\ w'' \leq_{f(w)} w'$

As in the temporal case the corresponding POS-operator is sensitive for the ordering of its argument. I give the adjusted version for the POS-operator in the modal domain (=$\text{POS}_\Box$) in (40), where $\text{NEUTRAL}_{w,R}$ specifies the set of "neutral" worlds (that are neither good nor bad) in w with respect to the given order relation R.

(40) $[\![\text{POS}_\Box]\!] = \lambda w.\ \lambda R_{\langle s,\langle s,t\rangle\rangle}.\ \lambda w'.\ \forall w'' \in \text{NEUTRAL}_{w,R}\text{: } R(w'')(w')$

The resulting semantics for $\text{POS}_\Box$ **good** is as in (41):

(41) $[\![\text{POS}_\Box\ \textbf{good}]\!]^f = \lambda w.\ \lambda w'.\ \forall w'' \in \text{NEUTRAL}_{w,\leq_{f(w)}}\text{: } w' \leq_{f(w)} w''$

Good by itself is not a modal quantifier on the proposed account; but if we combine **good** with $\text{POS}_\Box$ the resulting semantics is the predicative core of an upper end degree modal in the sense of Kratzer (2012):

[11] If we were to take degrees as equivalence classes of individuals (see Cresswell, 1976)), we could define a meassure function $\text{GOOD}_{\leq_{f(w)}}$ that maps a world to its corresponding degree (=equivalence class) according to the order relation $\leq_{f(w)}$. This would allow us to restate the semantics of *good* in a more conventional format involving a meassure function: $[\![\textbf{good}]\!]^f = \lambda w.\ \lambda d.\ \lambda w'.\ \text{GOOD}_{\leq_{f(w)}}(w') \geq d$. With the right adjustements, this can be done without affecting the overall truth-conditions.
[12] In analogy to the semantics of *früh* ('early') as the antonym of *spät* ('late'), we can follow von Stechow (2006) and define the meaning of *bad* via the "internal negation" of *good*.
(38) $[\![\textbf{bad}]\!] = [\![\neg\textbf{good}]\!]$, where $[\![\neg]\!] = \lambda w.\ \lambda R.\ \lambda w'.\ \lambda w''.\ \neg R(w')(w'')$

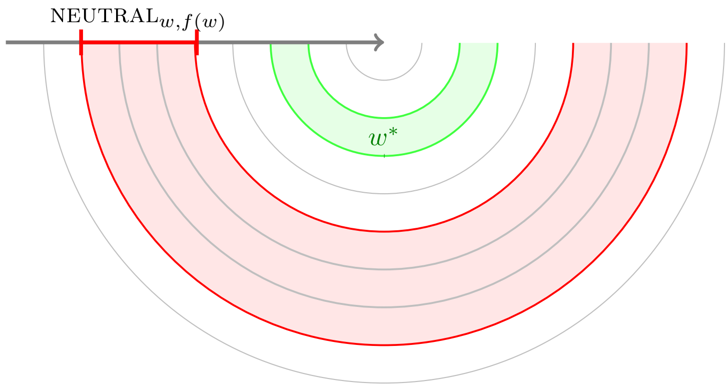
[13] Unlike Lassiter (2017), I do not assume that modal *good* needs any special treatment. What makes modal *good* modal is that it is predicated of worlds instead of individuals. I assume that the semantics of modal *good* is a special case of a general semantics for the gradable adjective *good* that covers the individual and the modal domain. Spacial restrictions prevent me from going into further details.

„[...] a modal without dual could also be a degree expression covering the upper end of a scale of degrees of probabilities or preferences. Such upper-end degree modals could correspond to notions like, "it is (somewhat) probable," or, "it is (somewhat) desirable." We would then expect there to be a certain amount of vagueness with respect to the lower bound of the range of probabilities allowed." (Kratzer, 2012: p. 46)

The vagueness mentioned by Kratzer can be attributed to the vagueness coming with $\mathrm{POS}_\Box$. If we apply the denotation of $\mathrm{POS}_\Box$ **good** to a world w^*, we get the truth conditions in (42).

(42) $[\![\mathrm{POS}_\Box\ \textbf{good}]\!]^f(w)(w^*) = 1$ iff $\forall w' \in \mathrm{NEUTRAL}_{w,\leq_{f(w)}}: w^* \leq_{f(w)} w'$

For a case where this can be represented by Lewisian spheres (see Kratzer (1979) for a discussion when this is the case) and the predication is true this can be visualized as follows:



3.3. The composition

The standard mode of semantic composition that I'm assuming as a background for the discussion is Extensional Functional Application, as in (43), cf. Heim and Kratzer (1998).

(43) Extensional Functional Application (=EFA)
$[\![(\alpha\ \beta)]\!] = \lambda w.\ [\![\alpha]\!](w)([\![\beta]\!](w))$

Intensional operators like modal necessity-operators usually combine with their prejacent by Intensional Functional Application for type reasons, cf. (45) under the assumption that $[\![\mathrm{NEC}]\!]^{f,g}$ is of type $\langle s, \langle\langle s,t\rangle,t\rangle\rangle$.

(44) Intensional Functional Application (=IFA)
$[\![(\alpha\ \beta)]\!] = \lambda w.\ [\![\alpha]\!](w)([\![\beta]\!])$

(45) $[\![\mathrm{NEC}\ \beta]\!]^{f,g} = \lambda w.\ [\![\mathrm{NEC}]\!]^{f,g}(w)([\![\beta]\!]^{f,g})$

Crucially, in the case where the prejacent is [$\mathrm{POS}_\Box$ **good**] IFA would result in a type mismatch since $[\![$[$\mathrm{POS}_\Box$ **good**]$]\!]$ is of type $\langle s, \langle s,t\rangle\rangle$. Here only EFA results in a semantically wellformed composition.

(46) $[\![\text{NEC [POS}_\Box\ \textbf{good}\ ]]\!]^{f,g,h} = \lambda w.\ [\![\text{NEC}]\!]^{f,g,h}(w)([\![\text{POS}_\Box\ \textbf{good}]\!]^{f,g,h}(w))$

The result of the composition via EFA is as follows:

(47) $[\![(\textbf{if}\ \alpha)\ \text{NEC [POS}_\Box\ \textbf{good}\ ]]\!]^{f,g,h} =$
$$\lambda w.\ \forall w' \in \bigcap f^*(w){:}\ \exists w'' \in \bigcap f^*(w){:}\ w'' \leq_{g(w)} w' \wedge \forall w''' \in \bigcap f^*(w){:}$$
$$w''' \leq_{g(w)} w'' \rightarrow \forall w'''' \in \text{NEUTRAL}_{w,\leq_{h(w)}}{:}\ w''' \leq_{h(w)} w'''',$$
where $f^*(w) = f(w) \cup \{||\alpha||^{f,g}\}$, for all $w \in W$

This is the general semantics for *good*-predications with *if*-FIN-clauses that I propose. As with conditonals, the differences between indicative and subjunctive *good*-predications are related to different choices for the conversational backgrounds f and g. That POS$_\Box$ **good** can be thought of as the predicative core of an upper end degree modal can be seen now more clearly if we take a look at the special case where f and g are empty conversational backgrounds.

(48) $[\![(\textbf{if}\ \alpha)\ \text{NEC [POS}_\Box\ \textbf{good}\ ]]\!]^{h} = \lambda w.\ \forall w' \in ||\alpha||{:}\ \forall w'' \in \text{NEUTRAL}_{w,\leq_{h(w)}}{:}\ w' \leq_{h(w)} w''$
'Every $||\alpha||$-world lies above the neutral range of worlds according to an ideal determined by the conversational background h in the world of evaluation w.'

3.4. The predictions

I want to illustrate the predictions of the theory for the example in (49).

(49) It would be good if Caligula were alive.

Let's assume we are in S3 of (16): The doors of the arena open and Caligula is found dead. Let's assume that, despite the tragedy of the circumstances, what is on Tullius' mind in this situation is his plan to get promoted. He considers his chances: If Caligula were still alive, he would get the promotion that Caligula had promised him. But since Caligula is dead, his chances of getting promoted are unclear since the next ruler might have his own protégés. Against the background of these facts (represented by g) and his plan of getting promoted (represented by h), he utters the sentence in (49). The sentence is true in this situation if the following truth-conditions hold:

(50) $[\![(\textbf{if Caligula alive})\ \text{WOULD [POS}_\Box\ \textbf{good}\ ]]\!]^{f,g,h} =$
$$\lambda w.\ \forall w' \in ||\textbf{Caligula alive}||{:}\ \exists w'' \in ||\textbf{Caligula alive}||{:}\ w'' \leq_{g(w)} w' \wedge$$
$$\forall w''' \in ||\textbf{Caligula alive}||{:}\ w''' \leq_{g(w)} w'' \rightarrow$$
$$\forall w'''' \in \text{NEUTRAL}_{w,\leq_{h(w)}}{:}\ w''' \leq_{h(w)} w''''$$
where f is the empty conversational background

'Every $||$**Caligula alive**$||$-world that is at least as close to an ideal determined by the facts in the world of evaluation w–represented by $g(w)$–as any other $||$**Caligula alive**$||$-world is a world that is as least as good according to an ideal characterized by Tullius' plans in w of getting promoted–represented by $h(w)$–as any other world in a set of neutral worlds according to the same ideal.'[14]

At first glance the predictions of this proposal seem to be notoriously vague. But notice that we have identified at least two elements in this construction that are independently known to be sources of vagueness: conditionals and the POS-operator. So every approach that wants to derive the truth conditions compositionally against the background of standard assumptions about these elements is in for a high degree of vagueness and context-sensitivity. In other words, the predicted vagueness and context-sensitivity is not a bug, it's a feature.

3.5. Summary

The ingredients for the solution to the mood puzzle are: a) a standard semantics for conditionals b) a standard semantics for the POS-operator and c) a minimal semantics for modal *good*. Although *good* by itself is not a modal, the combination of modal *good* with the POS-operator results in a semantics akin to an upper end degree modal. This explains the modal character of *good* in its positive form. The similarities of *good*-predications to conditionals (the mood distribution, the restriction of modal *would* to the matrix clause and the conditions of use depending on the choice of mood) can be attributed to the conditional operator involved. The unshifted interpretation of the world of evaluation of modal *good* (that we observed in the unmarked case) is predicted on the minimal account for modal *good* since the semantic composition of the conditional with modal *good* calls for Extensional Functional Application for type reasons. The resulting semantics gives us reasonable truth conditions for *good*-predications that predict a certain degree of vagueness that can be traced back to the vagueness that we find with conditionals and the positive form of gradable adjectives.

4. Factive *that*-clauses as restrictors

What should we say about *that*-clauses? First, if the predicate *good*, as in the case of conditionals, is a predicate of worlds, then the factivity of *good*-predications with a *that*-clause cannot be attributed to the predicate *good* but has to be attributed to the *that*-clause. Second, the contribution of the rest of the construction including the *that*-clause cannot be a plain proposition for type reasons. One way to go would be to assume that a factive *that*-clause denotes a fact as a particular as proposed in Kratzer (2006). Another way to go is to assume that we do have a factive propositional *that*-clause after all: *that* α introduces the presupposition that $[\![\alpha]\!](w)$ = 1, i.e., that α is true in the world of evaluation w. In addition, the *that*-clause restricts a covert

[14]In German, *gut* ('good') can sometimes have an interpretation in the sense of *schon gut* ('good enough', literally: 'already good'). I want to call this a "sufficiency-interpretation". Let's assume a situation where 15-year old Karin says to her mother: 'I have already cleaned my room. Shall I help you clean the kitchen?' Her mother replies:

(51) Nein. Es ist gut, wenn du dein Zimmer aufgeräumt hast.
No. It is good if you your room cleaned have.

If we assume that there is a silent *schon* ('already') involved and give it a semantics in analogy to von Stechow (2006)'s semantics for *schon spät* ('already late'), we get very good predictions for the sufficiency-interpretation.

Let me emphasize that the proposal is also compatible with a usage where *good* is used to express indifference as in the following example:

(52) It is good if Mary is in town but it is also good if she isn't. I don't care.

Depending on the given conversational background an utterance of (52) could be used to communicate that Mary's being in town won't affect the success of my plans since everything has been sufficiently taken care of. Spacial restrictions prevent me from going into more detail on this point. I would like to thank Magda Kaufmann for pointing out to me examples of this kind.

modal MUST as in the case of indicative conditionals. This is what I'm going to assume here.[15]

(53) $[\![(\textbf{that}\ \alpha)\ \text{MUST}\ \beta]\!]^{f,g,h} =$
λw: $[\![\alpha]\!]^{f,g}(w)$. $\forall w' \in \bigcap f^*(w)$: $\exists w'' \in \bigcap f^*(w)$: $w'' \leq_{g(w)} w' \wedge \forall w''' \in \bigcap f^*(w)$:
$w''' \leq_{g(w)} w'' \rightarrow \forall w'''' \in \text{NEUTRAL}_{w,\leq_{h(w)}}$: $w''' \leq_{h(w)} w''''$,
where $f^*(w) = f(w) \cup \{||\alpha||^{f,g}\}$, for all $w \in W$ compare with (28)

5. A remark on Percus (2000)'s Generalization X

In a nutshell: What allows us to solve the mood puzzle, i.e., account for the conditional nature of *good*-predications while at the same time to keep the world of evaluation for modal *good* unshifted, is the assumption that the conditional operator in *good*-predications is not used as an *adverbial* binder but as if it were an *adnominal* binder. This can be seen more cleary if we represent the world arguments directly in the syntactic structure as in Percus (2000).

(54) a. Conditional used as adverbial binder
λ_1 (**if** λ_2 [w_2 **Caligula alive**]) WOULD$_{w_1}$ λ_3 [w_3 **Tullius** POS **rich**]

b. Conditional used as adnominal binder
λ_1 (**if** λ_2 [w_2 **Caligula alive**]) WOULD$_{w_1}$ WH$_3$ [w_1 w_3 POS **good**]

The binding constellation in (54b) is in conflict with Generalization X from Percus (2000): "**Generalization** X**:** The situation pronoun that a verb selects for must be coindexed with the nearest λ above it." Since the closest binder for the world argument that the predicate *good* selects for is the binder index of the relative pronoun WH$_3$, the generalization seems to be violated. This is even more obvious in the reformulation of the generalization (Percus, 2000: p. 228) that directly refers to relative pronouns: "the relative pronoun whose movement makes the VP into a proposition must move from the situation position in the structure the verb projects". Under the perspective of the distinction in (54), we can add now the following amendment: "...except for when the predicate selects for another world argument in a thematic position."

6. Lassiter's challenge

The proposal as I have presented it so far is commited to the classical notion of comparative goodness as a comparison between possible worlds. Lassiter (2017) argues that any account based on this notion is doomed on principled grounds. In this section I want to a) introduce what I take to be the most challenging problem from Lassiter's discussion, b) sketch Lassiter's semantics for *good* and how it attempts to solve this problem, c) point out some problems for his proposal related to the data discussed in this paper, and d) suggest a new place where to look for a solution to his challenge. The main focus of Lassiter's critique of the classical notion of comparative goodness are the accounts in Lewis (1973) and Kratzer (1981, 2012). As Lassiter (2017) shows, the degree scales that we derive from an order over possible worlds assumed by the classical proposals are not the right kind of scales that we need to account for the gradibility behaviour of modal *good*. Lassiter (2017) shows that *good* behaves like a relative adjective. To account for this behavior we need at least interval scales. The translation of the order relations

[15] I follow the convention in Heim and Kratzer (1998) and add the factive presupposition after a colon.

in premise and order semantics gives us ordinal scales at best. This objection directly carries over to the proposal in this paper. Here is a sketch of what Lassiter proposes to solve this problem. He starts out by characterizing a value function V which takes possible worlds to real numbers. V tells us "exactly how good it would be for the world to be like that". The relevant notion of goodness could be moral goodness, instrumental goodness, desirability for a given individual etc. Since Lassiter assumes that the things that we predicate goodness and badness of are propositions, he needs a way to lift a scale representing the values of worlds to a scale representing the values of propositions:

> "In decision theory, a standard way to do this is **expected value**: a weighted average of the values of the worlds in the proposition, representing our best guess about how good things will be if the proposition obtains. The weights are given by the conditional probabilities of the various worlds, assuming that the proposition obtains.
>
> (7.22) The **expected value** of a proposition φ, relative to a domain D, is a weighted average of the actual values of worlds in $\varphi \cap D$.
>
> $$\mathbb{E}_V(\varphi) = \sum_{w \in \varphi \cap D} V(w) \times \text{prob}(\{w\} \mid \varphi \cap D).$$
>
> [...] In many cases of interest, the domain D can be equated with the epistemically possible worlds." (Lassiter, 2017: p. 187)

The function $\mathbb{E}_V$ is at the heart of Lassiter's semantics for modal *good*. Let me comment on the four ingredients of this function from the point of view of the discussion in this paper. I will begin with the value function V: This function is Lassiter's first step to solving the scale problem. Nothing that I have said in this paper is in conflict with the assumption of a measure function GOOD (see footnote 11) that has V at its core. Second, the epistemic domain D that Lassiter refers to is naturally accounted for on this account by the conversational backgrounds of the conditional operators involved. Lassiter doesn't discuss *good*-predications with subjunctive mood. But in analogy to the indicative case, I assume that a domain revision associated with subjunctive mood would also have to be attributed to the domain D as a part of the semantics of *good*. Here is a general argument from ellipsis that the interpretable feature associated with subjunctive mood couldn't originate with modal *good*. We find *good*-comparatives with a factive and a counterfactual FIN-clause, (55). If the interpretable feature associated with the revision of the quantificational domain were associated with *good*, the condition of LF-identity for ellipsis would be violated, (55a).[16] On the account in this paper, LF-identity is respected, (55b).[17]

[16] Also, we would have to assume agreement from below.

[17] I assume that the interpretable features that license indicative and subjunctive mood originate with the conditional operator. We can think of MUST as NEC-Ind and WOULD as NEC-Subj, where "Ind" and "Subj" stand for the corresponding interpretable features.

(55) It is better that Caligula is alive than if he weren't alive.

a. [er [[if α][~~$T_{[Subj]}$ be good-Subj~~]]][[that β][$T_{[Ind]}$ be good-Ind]]
↑__________| ↑__________|

b. [er [[NEC-Subj if α][~~$T_{[Subj]}$ be good~~ ------]]][[NEC-Ind that β][$T_{[Ind]}$ be good]]
|__________↑ |__________↑

Third, let's consider the conditional probabilities. The data in this paper point to a problem for Lassiter's account. Let's assume we are in situation S3, cf. (16), in which it is common knowledge that Caligula isn't alive anymore. Now consider an utterance of (56).

(56) It would be better if Caligula were still alive.

Since with the utterance of (56) against the assumed conversational background it is presupposed that Caligula is not alive anymore, the probability of Caligula being alive is 0. What I take this to show is that the assignment of probability–if probability assignments play a role–has to be sensitive to the conditions of use associated with the type of FIN-clause. If the corresponding semantic adjustements were attributed to the adjective *good* itself, we would run again in the problem from ellipsis mentioned above. The last aspect of the function $\mathbb{E}_V$ at the heart of Lassiter's proposal is the sum-function $\sum$. Here something very similar to what Lassiter has in mind is in reach for the proposal in this paper. What I haven't considered so far is an alternative to the quantificational theory of conditionals: an account of conditionals that treats them as plural definite descriptions (see for example Schlenker, 2004). There is independent evidence that such an account is on the right track (see Schlenker, 2004). Under this assumption, the interpretation of a sentence like (57a) would be similar to a comparative sentence with plural definite descriptions as in (57b).

(57) a. It is better if it is raining than if it is snowing.
b. The girls are taller than the boys.

The sentence in (57b) can be true even if it's not the case that for every girl it is true that she is taller than every boy. There is a discussion in recent literature how to account for the different readings of comparatives with plural DPs like (57b) (see Dotlačil and Nouwen, 2016 and the literature cited there). Dotlačil and Nouwen (2016) propose that we can account for them if we assume pluralities of degrees. Tools of this sort that have an independent motivation suggest that there might be a direct answer to the scale problem after all.[18,19] My plea in this paper is that we shouldn't dismiss the idea that *good* is predicated of worlds before we have explored all the theoretical options, in particular, before we have considered what the predictions are if we take into account recent developments in the semantics of conditionals and the semantics of comparatives with plural/quantificational DPs.

[18]There are other relevant and important recent developments that could contribute to the proposal in this paper from the discussion of quantifiers in *than*-clauses, see for example Beck (2010). These considerations are directly relevant, if we stay with a quantificational theory of conditionals.

[19]In Kaufmann (2017b) we find a proposal for *good*-predications in Japanese, approaching this topic from a propositional-argument-view, that arrives at a very similar conclusion as the account in this paper, if we switch from a quantificational analyis of conditionals to an analysis of conditionals as plural definite descriptions.

7. A few remarks on the similarities between *good*-predications and desire reports

The proposal in this paper derives truth conditions for *good*-predications that are very similar to the semantics that Heim (1992) assumes for desire reports. The basic idea of her proposal is that there is a "hidden conditional in every desire report". The parallels can be seen very clearly if we take a look at her informal paraphrases (to which I added italics).

(58)
a. John wants you to leave. $\rightsquigarrow$ 'John thinks that *if you leave he will be in a* more *desirable world* than if you don't leave.'
b. John wishes you were gone. $\rightsquigarrow$ 'John thinks that *if you were gone he would be in a* more *desirable world* than he is in because you are not gone'
c. John is glad you are gone $\rightsquigarrow$ 'John thinks that *because you are gone he is in a* more *desirable world* than he would be in if you were not gone'

want corresponds to a *good*-predication with an *if*-FIN-clause in indicative mood, *wish* corresponds to a *good*-predication with an *if*-FIN-clause in subjunctive mood and *glad* corresponds to a *good*-predication with a *that*-FIN-clause in indicative mood. We even find a parallel in the conditions of use for the corresponding hidden FIN-clauses (which in case of the desire reports are relativized to the belief of the attitude holder).[20] If we look at the details of Heim's semantics, we see that the way the conditional combines with the desire predicate on her account corresponds to the proposed adnominal interpretation for the conditional.

(59) $w \in [\![a \textbf{ wants } \phi]\!]$ iff for every $w' \in \mathrm{Dox}_a(w)$: $\mathrm{Sim}_{w'}([\![\phi]\!]) <_{a,w} \mathrm{Sim}_{w'}(W \backslash [\![\phi]\!])$

I want to mention two more parallels from German. In German, a counterfactual wish can be expressed either with *wünschte* ('wish') or *wollte* ('want'). In both cases these verbs are overtly marked with subjunctive mood. The overt subjunctive marking doesn't go along with a shifted interpretation of the world of evaluation of the matrix predicate; the corresponding interpretation is the same as in English.

(60) Ich wünschte / wollte, du wärest hier.
I wish.SUBJ / want.SUBJ you were here

There is additional evidence in support of the assumption that the overt subjunctive forms of German desire verbs in subjunctive mood are a reflex of their hidden counterfactual semantics. In German, subjunctive forms in conditionals can be expressed analytically with *würden* ('would') + infinitival. If we try to do this with the subjunctive forms of 'wish' and 'want', (61), we loose the unmarked interpretation and the sentences get a conditional interpretation in the sense of *under such and such circumstances would I wish ...*.

(61) Ich würde wünschen / wollen, du wärest hier.
I would want / wish you were here

[20] In all three cases (conditionals, *good*-predications and desire reports) the conditions of use can be traced back to an overt or hidden conditional operator.

8. Conclusion

In this paper I have argued that we can account for the similarities and differences between conditionals and *good*-predications if we assume that *good*-predications combine a standard semantics for conditionals with a standard semantics for the positive form of gradable adjectives and a minimal semantics for modal *good* that takes *good* to be a predicate of possible worlds.

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Shared mechanism underlying unembedded and embedded enrichments: Evidence from enrichment priming

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Abstract. In this paper, we use a priming paradigm to explore the mechanisms underlying unembedded and embedded scalar enrichments. In particular, the aim is to see if local pragmatic enrichment could be a shared mechanism, involved in both. The two experiments presented adopt Bott & Chemla's (2016) enrichment priming paradigm and test whether unembedded and embedded enrichments could prime each other. The goal is to investigate whether local pragmatic enrichment is indeed being accessed for the interpretation of the unembedded scalar and whether local enrichments, like other lexical semantic phenomena, are susceptible to priming.

Keywords: pragmatics, scalar enrichments, priming.

1. Introduction

Scalar implicatures are widely discussed as potentially Gricean conversational implicatures. (1-2) are examples of scalar implicatures, where what follows '~>' are implications that would follow in many easily imaginable situations:

1. Player A scored some of his shots.
   ~> Player A did not score all of his shots.
2. A: Alice was planning to cut the grass and wash the car. I wonder how she got on.
   B: She cut the grass.
   ~> Alice didn't wash the car.

Here we use 'scalar implicature' and 'scalar enrichment' as descriptive terms for the phenomenon where an implication arises which seems to involve the negation of a contextually salient alternative.

Many well-known proposals explain the implications in (1-2) broadly-speaking as Gricean conversational implicatures (see e.g. Gazdar, 1979; Geurts, 2010; Sauerland, 2004). On this kind of approach, an alternative for the assertion is inferred to be not true on the basis of reasoning about the speaker's intentions. A widely discussed limitation of this approach is that it cannot explain certain so-called 'embedded scalar enrichments' (Chierchia, 2004; Chierchia, Fox, and Spector, 2012; Potts et al., 2016). An example of an embedded enrichment is given in (3) – taken from Potts et al. (2016):

3. Exactly one player hit some of his shots
   ~> Exactly one player hit some and not all of his shots

The observation is that it is unclear how a Gricean account of contextual implications can derive this effect, since the implication under (3) neither entails nor is entailed by what might have been literally asserted in (3). It seems rather that this effect is the product of an

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enrichment of a sub-constituent of (3) (Chierchia, 2004) and it patterns together with other 'local pragmatic effects' that have been discussed virtually since Grice's original theory was proposed (Cohen, 1971; Wilson, 1975; Carston, 1998).

Perhaps unlike any other kind of 'local' or 'embedded' pragmatic effect, embedded scalar enrichments have been quite intensively studied experimentally, with the aim largely being to establish the extent to which embedded scalar enrichments actually arise. Results have varied quite widely (Geurts and Pouscoulous, 2009; Chemla and Spector, 2011), and there has been some critical discussion of the methods used and the interpretation of results. However, a recent study reported in Potts et al. (2016) was designed to avoid many of the perceived methodological flaws of previous research, and found that participants quite regularly responded to a task based on an understanding of sentences like (3) as involving the implication indicated above.

1.1 Theoretical background

Two rather different approaches to embedded scalar phenomena have been outlined in the literature. According to the Grammatical Theory of Scalars (GT), the effects described in (1-2) and (3) are explained by the presence of a operator in the syntactic representation for the sentence. The only difference between the embedded scalar enrichment in (3) and the unembedded enrichments in (1-2) is the scope site at which the operator is inserted. This difference is illustrated in (4-5), where (4) is the LF for (1) and (5) is the LF for (3). Here *O* is an operator whose interpretation relates that of its argument and the argument's scalar alternatives in a manner akin to 'only' (see Chierchia et al., 2011 for details):

4. [O [[Player A]$_i$ [t$_i$ hit some of his shots]]]
5. [[Exactly one player]$_i$ [O [t$_i$ hit some of his shots]]]

According to GT then, we can say that there is but one operation by which both unembedded and embedded scalar enrichments are derived.

Somewhat in contrast to GT, a variety of more-or-less Gricean approaches see at least some embedded scalar enrichments as the result of a separate process of local adjustment to the literal meaning of expressions. This approach takes a cue from the research tradition mentioned above in that it sees embedded scalar enrichments as a result of a general local enrichment mechanism that can result in a variety of different embedded effects, not just scalar enrichments (see Carston, 2002). According to this approach, it is conceptually possible that even unembedded scalar enrichments result from local enrichment. However, it is also allowed that unembedded scalar enrichments could be the result of general reasoning about the speaker's intentions, along the lines of the well-known Gricean approach to scalars.

A recent articulation of this view is presented within the RSA framework (Frank and Goodman, 2012; Goodman and Frank, 2016). In that framework, it is possible to explain unembedded scalar implicatures in terms of general reasoning speakers and hearers may engage in about each other, making assumptions about how speakers would optimise the utility of their utterance by making the most specific assertion compatible with their knowledge. In addition, as Bergen et al. (2016) observe, it is possible to incorporate the apparent fact that local enrichments of an expression's literal meanings are possible. Bergen et al. set out a framework for computing an interpretation of an utterance given that expressions may be interpreted using their literal meaning or one of a number of possible enrichments. Thus a sentence such as (1), containing an unembedded 'some', may imply *not all* because this can be inferred by 'global' reasoning about the speaker, as set out in the standard RSA approach; alternatively, the implication may simply arise as an entailment of the locally enriched interpretation of 'some'. Bergen et al.'s RSA with lexical uncertainty (RSA-LU) simply builds this fact into the reasoning that speaker and hearer engage in. Likewise, when 'some' appears in an embedded context like (3), the framework simply takes into account that there are several logically independent readings available.

Potts et al. (2016) show that models derived from RSA-LU better predict the results of an experiment in which participants are asked to judge sentences like (3) against visual displays that make the unenriched and locally enriched interpretation true. Potts et al. observe that model performance can be closer or further from actual participants' responses depending on how the prior probabilities of local enrichments are adjusted. This point will be relevant to our discussion of the results of our experiments below. For now, it is sufficient to observe that RSA-LU is a framework for explaining embedded and unembedded scalar implicatures (as in (1-3)) where a single operation (lexical enrichment) is active in both cases, but where there is a second operation (global reasoning) in the unembedded case.

Thus, two approaches suggest that a common means exists for deriving unembedded and embedded scalar enrichments. In this paper, we utilise the 'enrichment priming' paradigm of Bott & Chemla (2016) as a means to determine experimentally whether, in fact, embedded and unembedded scalar enrichments share a mechanism, or have a common operation.

1.2 Enrichment priming paradigm

Bott & Chemla (2016) developed an enrichment priming paradigm for the purpose of obtaining empirical evidence for shared mechanisms within and across different categories of unembedded scalar enrichments (i.e. quantifiers, numerals, ad hoc). In this task, each sentence is presented with two pictures, and participants are asked to click on the picture that is a better match for the given sentence. The critical items for a 'within-category' priming condition are illustrated in Figure 1.

In this condition, the target and prime trials involve the same enrichment category. That is, a target trial with 'some' is preceded by prime trials also with 'some'; a target trial with numerals is preceded by prime trials with numerals, etc. There are two types of prime trials, Strong and Weak. Consider *some → some* in the top panel of Figure 1. In the Strong prime condition, given the sentence *Some of the symbols are clubs*, the 'strong' image shows some and not all symbols are clubs, and the other, 'weak' image shows all symbols are clubs. The strong image makes the scalar-enriched interpretation (*some and not all symbols are clubs*) true. The 'weak' image is only true on an unenriched interpretation of the target sentence. Participants who choose the strong image prior to a target trial are thus primed by the SI-enriched reading. In contrast, in the Weak prime condition, given the sentence *Some of the* *symbols are stars*, one picture contains all stars and the other contains only non-stars. Neither picture makes the interpretation that includes the scalar implicature true. Participants who give a correct response in Weak prime trials have had to entertain the unenriched interpretation of the sentence prior to the target trial.

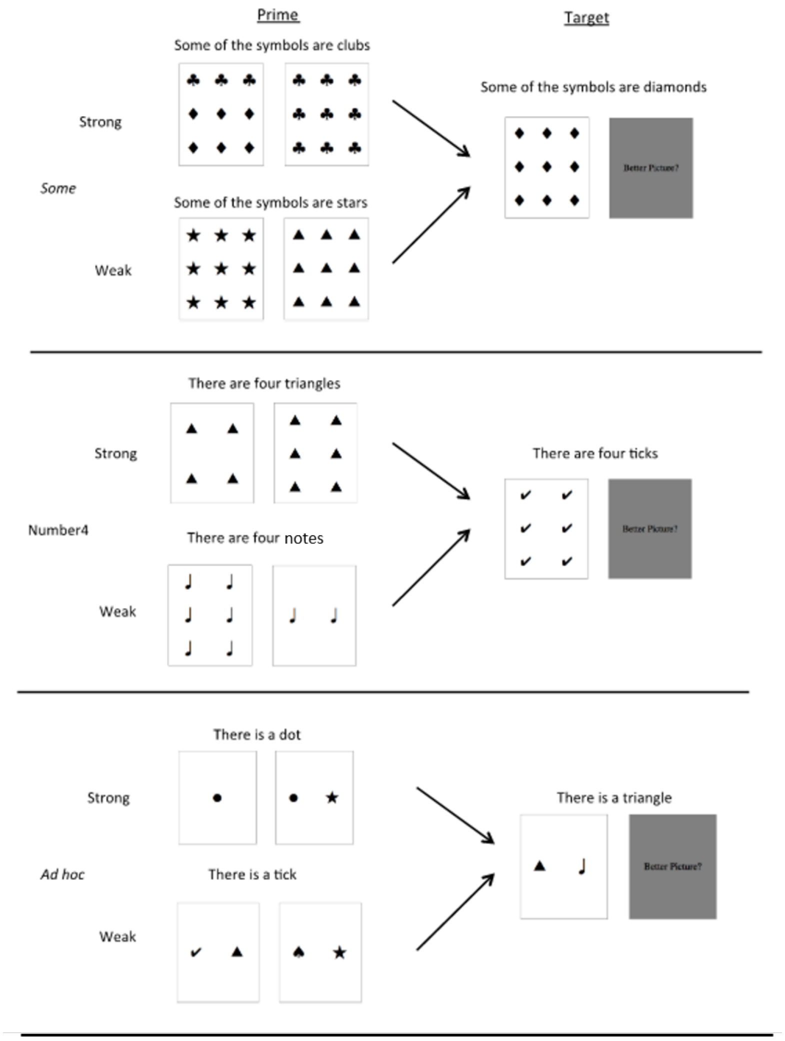

Figure 1 *Example items in Bott & Chemla (2016)*[1]

For the target trials, Bott & Chemla (2016) adopted the 'Better-picture' method used in Huang, Spelke & Snedeker (2013). Participants are shown one of two images while the other is covered. Participants are told that if they think that the covered picture would be a better match for the sentence, they can choose the covered picture. In this design, the visible image makes the unenriched reading true. Since the visible picture is inconsistent with the SI-enriched reading of the target sentence, choosing the covered picture indicates that participants access the SI-enriched reading.

[1] We have had permission from Dr Bott to use the figure from Bott & Chemla (2016).

In addition to within-category priming, the other condition is between-category priming, where the target and prime trials involve different enrichment categories. For instance, a target trial with number term (e.g. 'four') is preceded by prime trials with 'some'. Bott & Chemla included all between-scale combinations in this condition, such as *some* ↔ *number*, *some* ↔ *ad hoc*, and *number* ↔ *ad hoc*.

The logic behind this paradigm is that, if there is a shared derivation mechanism which is subject to priming, then for both conditions it is more likely for participants to access the enriched reading of the target sentence (i.e. choosing the covered picture) after strong prime trials than after weak prime trials. Their results show a within-category priming and a between-category priming effect. The within-category effect was stronger. There was also a surprising effect of within / between, such that more SI-based responses occurred in the between-category condition. We will return to discuss the latter result in Section 4. The main result of this kind of study, however, is that unembedded scalar enrichments can be primed by unembedded scalar enrichments.

Bott & Chemla (2016) interpreted the between-category priming effect as evidence for activation of shared mechanisms in deriving enrichments involving different scales. As for the within-category priming effect, they suggested that along with the activation of the derivation mechanism, there could also be a lexical priming effect, which is an association between the stimulus, the derivation mechanism and specific alternative. For Bott & Chemla, the between-category priming effect is most interesting result, because it shows that general SI derivation mechanism can be primed.

The general idea, then, is that an enrichment priming paradigm could be employed to investigate whether local pragmatic enrichment is a shared mechanism between unembedded and embedded scalar enrichments.

1. Experimental overview

The first goal of the experiments in this paper is to determine whether embedded and unembedded scalar phenomena have a shared mechanism. We investigate the mechanisms underlying unembedded scalar enrichment using the same paradigm as in Bott & Chemla (2016). The rationale is that, if unembedded scalar implicatures are derived using an operation or mechanism that is also involved in embedded scalar enrichments, then participants should be more likely to access embedded enrichments after strong primes with unembedded scalar implicature than after weak primes with no implicature. The critical items are illustrated in Figure 2.

In the embedded target condition, the target trial involving embedded 'some' is preceded by prime trials involving unembedded 'some'. In strong primes, the unembedded scalar implicature is true, while in weak prime trials, the unembedded scalar implicature is false. For example, given a prime sentence 'Some of the symbols are diamonds', in strong primes, the sentence is presented with one picture depicting a row with some but not all symbols being diamonds and another picture depicting a row with all symbols being diamonds. The 'some-not-all' picture makes the SI-enriched reading true. For the weak primes, the same sentence is presented with one picture in which all symbols in the row are diamonds and one picture depicting a row of non-diamond symbols. Neither picture makes the SI-enriched reading true. Thus, participants are primed by the SI-enriched reading in strong primes and the unenriched reading in weak primes.

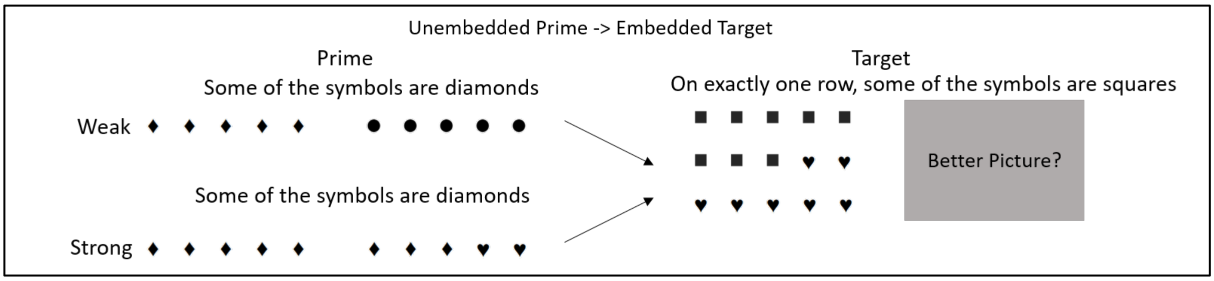

Figure 2 *Critical items for embedded target condition in Experiment 1 and 2*

As in Chemla & Bott, we employ the covered picture paradigm in the target trials. We have experimental trials in which a sentence with an embedded scalar term is the target. We also include a set of trials where an unembedded sentence is the target, following embedded prime trials. For target trials in the embedded target condition, a target sentence like ‘On exactly one row, some of the symbols are squares’ is presented with a visible picture and a covered picture. The visible picture makes the locally enriched reading true and other available readings false. The image in Figure 2 shows the visible image having two rows containing squares. One of those has some and not all squares, the other has all squares. Only if the sentence is understood as *On exactly one row, some and not all of the symbols are squares* would a participant not choose the covered card. If the literal meaning of the target sentence is accessed, or even an interpretation that includes a global implicature, the participant should choose the covered card.

This is a change from Bott & Chemla’s procedure. As previously mentioned, the visible picture used in Bott & Chemla’s paradigm makes the literal reading true and SI-enriched reading false. The motivation for changing their design comes from the availability of the global-SI reading. The global-SI reading of the target sentence is that *on exactly one row, some symbols are squares and it’s not true that on exactly one row, all symbols are squares*. If the target sentence is presented with a visible picture that makes the literal reading true, as shown in Figure 3 (left), then participants might choose the covered picture because they derive a reading of the sentence that includes a global SI and expected a better match, such as Figure 3 (right). If this is the case, then choosing the covered picture in Figure 3 might reflect a mixture of local reading and global reading.

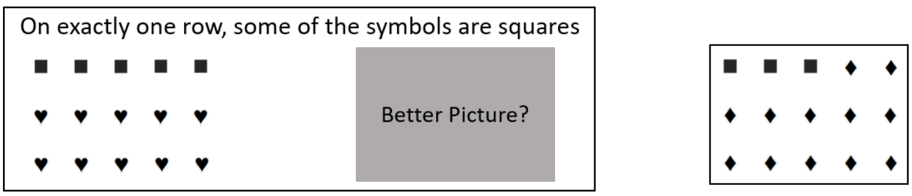

Figure 3 *Alternative displays*. The target (left image) consists of one picture that makes the literal reading true and the ‘Better Picture?’ option. The right image makes the global-SI reading of ‘On exactly one row, some of the symbols are squares’ true.

Thus, in order to properly measure the rate of locally enriched reading, in both Experiments 1 and 2 below, the embedded target sentence is paired with a visible picture for which the sentence is false on any available reading except for the local one. In this case, choosing the visible picture indicates that participants access the locally enriched reading, whereas choosing the covered picture indicates that they access either the literal reading or the global reading.

Regarding whether unembedded enrichments could prime embedded enrichments, the grammatical account predicts a priming effect, as there is a single mechanism for both prime and target trials involving *O* operator in LF. On the other hand, the RSA-LU approach predicts priming between the two based on the mechanism of lexical adjustment, which can be used in both prime and target trials. However, RSA-LU does not rule out the possibility that there is no priming effect. This is so since there are two mechanisms underlying scalar enrichments, rather than a single one. It is possible that the lexical adjustment mechanism is not used very much in prime trials. If this is the case, then there might not be a priming effect between unembedded and embedded enrichments.

In addition to the embedded target condition, both experiments also included an unembedded target condition. In the unembedded target condition, the target trial involving unembedded ‘some’ is preceded by prime trials involving embedded ‘some’. Experiment 1 and 2 differ in the prime items used in unembedded target condition, which will be discussed in more detail below. Regarding whether embedded enrichments could prime unembedded scalar implicature, the grammatical account again predicts a priming effect on the basis of a single shared mechanism. The RSA-LU also predicts a priming effect, as the lexical adjustment mechanism is needed for embedded prime trials (especially in Experiment 2), and the target trial can be enriched in the same way.

2. Experiment 1

3.1. Overview and prediction

In prime trials, participants were presented with a sentence paired with two pictures. Their task was to click on the picture that makes the sentence true. The sentences contained a scalar term ‘some’, which could occur in either unembedded or embedded position. Three types of pictures were available for each sentence: (i) false pictures, which make all possible readings false, (ii) weak pictures, which make the literal reading true but the enriched reading false, and (iii) strong pictures, which make enriched readings true. As will become clear below, the design of this study differs a little from Bott & Chemla. In their paper, strong pictures make not only the enriched meaning true but also the literal meaning. This is also the case in our unembedded prime and target trials, as well as the embedded prime trials in Experiment 1. However, it is not the case for the embedded target trials in either Experiment 1 or Experiment 2, for the reason discussed above (in relation to Figures 2 & 3). As mentioned above, in order to avoid responses that were not solely based on a genuine local enrichment operation, we had to make the verifying scenario for the embedded target sentence falsify the literal meaning.

Two types of priming effects were examined: unembedded prime → embedded target, as shown in Figure 2, and embedded prime → unembedded target, as shown in Figure 4 below. There were two types of prime trials. Participants were primed by the literal reading in weak primes and the enriched reading in strong primes. Following the procedure in Bott & Chemla (2016) and Raffray & Pickering (2010), each target trial was preceded by two prime trials, in order for the priming effect to be given a better chance of having an effect. For target trials, the sentence was presented with an open picture and a covered picture. Participants were instructed to click on the covered picture (‘Better Picture?’) if they thought there was a picture that would be a better match for the given sentence.

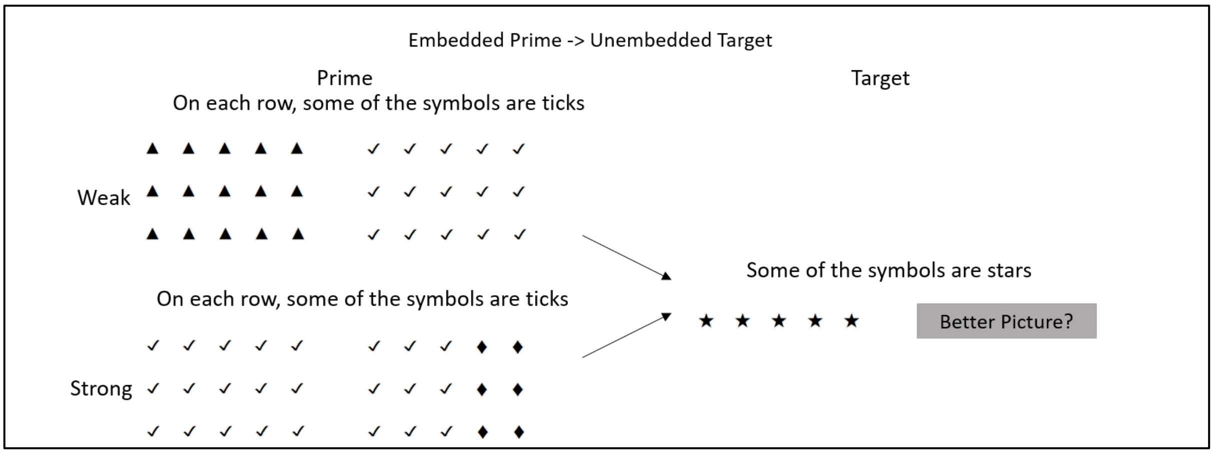

Figure 4 *Critical items for unembedded target condition in Experiment 1*

The embedded target condition has been discussed in detail in the previous section. Here we focus on the unembedded target condition. The critical items of this condition are illustrated in Figure 4. In the unembedded target condition, the target trial involving unembedded ‘some’ was preceded by prime trials involving embedded ‘some’. For embedded prime trials, given the prime sentence like ‘On each row, some of the symbols are ticks’, in strong primes, the sentence was presented with a weak picture depicting all symbols being ticks and a strong picture depicting rows of symbols with some but not all being ticks. The strong picture made the locally enriched reading of the sentence true (i.e. *On each row, some but not all of the symbols are ticks*). For the same sentence, in weak primes, it was presented with a weak picture and a false picture depicting all symbols being non-ticks. Neither picture made the local reading true. Participants were thus forced to access the literal reading in weak primes.

Note that the sentences used for embedded target trials like ‘on exactly one row, some of the symbols are squares’ were not used in embedded prime trials. This is because when ‘some’ is embedded under a non-monotonic quantifier, the literal reading and local enriched reading are logically independent. Thus, if non-monotonic cases are used as embedded primes, there is no better picture (in the sense of entailment) between a picture that makes the literal reading true and a picture that makes the enriched reading true.

As for unembedded target trials, the target sentence was the same as the one used for unembedded prime trials. Unlike embedded target trials, here the unembedded target sentence was presented with a visible picture that made the literal reading true. In this case, choosing the visible picture indicates that participants access the literal reading, whereas choosing the covered picture indicates that they access the SI-enriched reading.

In general, both the GT and the RSA-LU approach predict priming effects between unembedded and embedded enrichments, since both approaches assume there is a shared mechanism between unembedded and embedded enrichments. Overall, the rate of enriched-reading responses to target trials should be higher after strong primes than after weak primes. However, as mentioned above, there is a subtle difference between the two approaches in terms of the potential strength of priming in the different target conditions. The GT says that there is only one mechanism of exhaustification and it is present in both unembedded and embedded scalar enrichments. Thus, whether unembedded trials or embedded trials are primes, the subsequent target should receive more enriched responses after strong prime trials. For the RSA-LU approach, this prediction holds for the embedded prime → unembedded target trials. However, for the case where the prime is unembedded, there are two routes to an enriched response. Only if enriched responses in unembedded primes involve a local pragmatic enrichment should there be substantial priming in the embedded target conditions. We shall return to this difference below.

3.2. Method

3.2.1. Participants

20 participants were recruited via Prolific Academic (http://prolific.ac). All participants were native English speakers.

3.2.2. Materials

This experiment had a two-by-two within-participant design. The two independent variables were the embeddedness of the target and the type of the prime. These two variables generated four prime-target combinations, as shown in Table 1. Sixteen experimental prime-target triplets were constructed. In each triplet, one target trial was preceded by two prime trials. Each trial consisted of a single sentence and two pictures. Eight triplets formed the unembedded prime → embedded target trials, the other eight formed the embedded prime → unembedded target trials. In half of the unembedded prime → embedded target trials, the target was preceded by two weak primes, while in the other half, the target was preceded by two strong primes. This was the same for the embedded prime → unembedded target trials.

Target embeddedness	Prime type	Number of sets	Number of trials
embedded target	weak	4	12
	strong	4	12
unembedded target	weak	4	12
	strong	4	12
			48

Table 1 *Design of experimental items in Experiment 1*

For unembedded prime and unembedded target trials, the sentence was of the form *Some of the symbols are [symbol]*. For embedded prime trials, the prime sentence was of the form *On each row, some of the symbols are [symbol]*, whereas for embedded target trials, the target sentence was of the form *On exactly one row, some of the symbols are [symbol]*. The symbols came from the set of circles, crosses, diamonds, hearts, squares, stars, ticks, and triangles.

48 filler trials were constructed. As with experimental trials, each consisted of a single sentence and two pictures. The sentence either contained 'some' as in *Some of the symbols are [symbol]* or *On each row, some of the symbols are [symbol]*, or contained 'all' as in *All of the symbols are [symbol]* or *On each row, all of the symbols are [symbol]*. Following the design in Bott & Chemla (2016), each type of filler sentences occurred in three situations: (i) the sentence was presented with a strong picture and a 'Better Picture?', (ii) the sentence was presented with a false picture and a 'Better Picture?', and (iii) the sentence was presented with a false picture and a strong picture. (i) and (ii) were included to counterbalance the times when, in the target trials, the covered picture ('Better Picture?') was always paired with the weak picture. These trials also counterbalanced the extra times when in prime trials the sentence was always paired with two visible pictures. (iii) was included so that all possible pair combinations of three picture types (false, weak, strong) occurred equally frequently.

In total, Experiment 1 contained 48 experimental trials (i.e. 16 prime-target triplets) and 48 fillers. The triplets of trials and the fillers were presented in a randomized order created for each participant. For prime trials, the position of the correct choice was counterbalanced across trials, so that for half of the trials the correct choice was on the left, and for the other half on the right[2]. Furthermore, for half the experimental triplets the correct choice was on the same side for the first and the second prime, while for the other half it was on the opposite side. For target trials, the covered picture was always on the right. In addition, in one dual prime-target triplet, a different symbol was used as the predicate for each sentence. There were 8 symbol types. Each was used as the predicate an equal number of times.

3.2.3. Procedure

Participants were instructed to click on the picture that made the sentence true. On occasions where one of the two pictures were covered, the task was the same. But participants were told that "if you think that there is a picture that would be a better match for the sentence, click on the 'Better Picture?' option". Two examples were given. One involved 'many', in which the sentence 'There are many stars' was presented with one picture containing six stars and the other containing two. Participants were told to click on the picture containing six stars. The other example involved an ad hoc enrichment, in which the sentence 'There is a spade' was presented with one covered picture and one picture containing a spade and a diamond. In this case, participants were instructed to click on the 'Better Picture?' option.

[2] For weak primes, the correct response was the weak picture. For strong primes, although both pictures made the sentence true, we coded the strong picture as the correct response.

There were four practice trials to familiarise participants with the task. In these trials, the sentence was either presented with a false picture and a strong picture or with a false picture and a covered picture. No feedback was given in either practice or experimental trials. The whole experiment lasted approximately 10 minutes.

3.2.4. Data treatment and analysis

The analysis was performed on the responses to target trials. Only target responses that were preceded by two correct prime responses were included in the analysis. This resulting in the removal of 35 out of 320 target responses. Of the 35, 19 were embedded targets and 16 were non-embedded targets. For the remaining target responses, we coded the enriched response as 1 and the unenriched response as 0. Note that the enriched response for embedded target trials was choosing the visible picture, whereas the enriched response for unembedded target trials was choosing the covered picture.

We fitted a logistic mixed-effect model to predict the log odds of choosing an enriched over unenriched response from fixed effects of embeddedness (embedded targets / non-embedded targets) and prime type (weak / strong). Embeddedness and prime type were deviation coded (embedded = 0.5, non-embedded = -0.5; strong = 0.5, weak = -0.5). The model contained maximal random effects structure supported by the data, which included random intercepts and slopes for subjects and random intercepts only for items. All fixed effects and their interactions were included as random slopes. Statistical analyses were carried out using R (version 3.3.3, R Core Team, 2017) with the lme4 package (Bates et al. 2015) and the lmer Test package (Kuznetsova, Brockhoff, and Christensen 2014).

3.3. Results and discussion

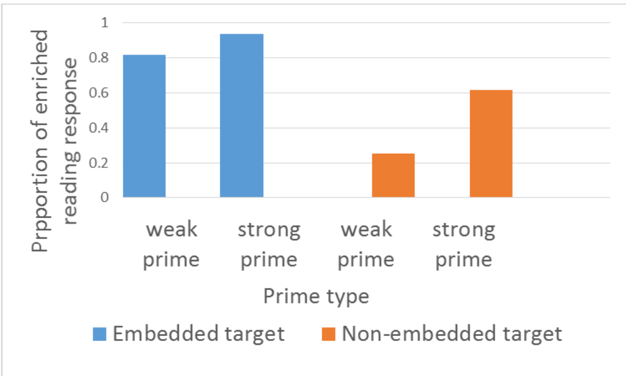

Figure 5 *The proportions of enriched responses across conditions in Experiment 1*

Figure 5 shows the proportions of enriched responses across conditions. We found a main effect of priming (β = 1.84, SE = 0.62, p = .003). However, planned comparisons on each level of prime type showed that the rate of enriched responses was significantly higher after strong primes than after weak primes only in unembedded target conditions (β = 3.48, SE = 1.36, p = .01) but not in embedded target conditions (β = 4.55, SE = 3.87, p = .24). Thus, the observed priming effect was mainly driven by the priming in the unembedded target condition. There was a main effect of embeddedness ($\beta = 4.81$, $SE = 1.22$, $p < .001$), suggesting that the overall rate of enriched responses was higher for embedded target trials than for unembedded target trials. The interaction between embeddedness and prime type was not significant ($\beta = -2$, $SE = 1.42$, $p = .16$).

The main effect of embeddedness in the present study is inconsistent with findings from previous research that demonstrate unembedded scalar enrichments are more robust than embedded cases (e.g. Benz & Gotzner, 2014; Geurts & Pouscoulous, 2009). However, it is difficult to read too much into this result, since the enriched response in the embedded target condition is the open card, while the enriched response in the unembedded target condition is the covered card.

Regarding whether unembedded enrichments could prime embedded enrichments, the results of this experiment are difficult to interpret. On the one hand, there is a main effect of prime type and we found no significant interaction. On the other hand, we failed to find a significant difference between Strong and Weak conditions in the embedded target condition. The main effect was driven by the significant difference between Strong and Weak trials in the unembedded target condition. This latter result is supportive of the idea that there is a shared mechanism between unembedded and embedded scalar enrichments. However, an alternative explanation for this priming effect could be given without appealing to local enrichment. Consider the items in Figure 4 again. As long as participants access the reading *On each row some of the symbols are ticks and it is not the case on each row all of the symbols are ticks*, they would choose the strong picture. This means that local enrichment is not required in deriving this reading. Enriched responses in embedded primes could be the result of global inference mechanism. Then what seems to be a local → local priming would turn out to be a global → global priming. Thus, the priming effect in unembedded target condition cannot be taken as conclusive evidence for a shared mechanism in deriving unembedded and embedded enrichment.

4. Experiment 2

In order to properly explore whether embedded and unembedded enrichments could prime each other, we conducted Experiment 2, which addressed the problems of interpreting the results of Experiment 1.

4.1. Method

4.1.1. Participants

30 participants were recruited via Prolific Academic (http://prolific.ac). All participants were native English speakers.

4.1.2. Materials, procedure

The materials were similar to Experiment 1 with one key difference, namely that for the embedded prime trials, the prime sentence was of the form *On exactly one row, some of the* *symbols are [symbol]*. As illustrated in Figure 6, in strong primes, the sentence was presented with a picture that made the literal reading true and a picture that made only the local reading true. If the participants access the local enriched reading, *On exactly one row, some but not all of the symbols are ticks*, then the only picture that made the sentence true is the 'local' picture. Since embedded enrichments in the non-monotonic environment can only be explained by local enrichment, in Experiment 2, participants who choose 'local' picture in embedded prime trials must access local enrichment.

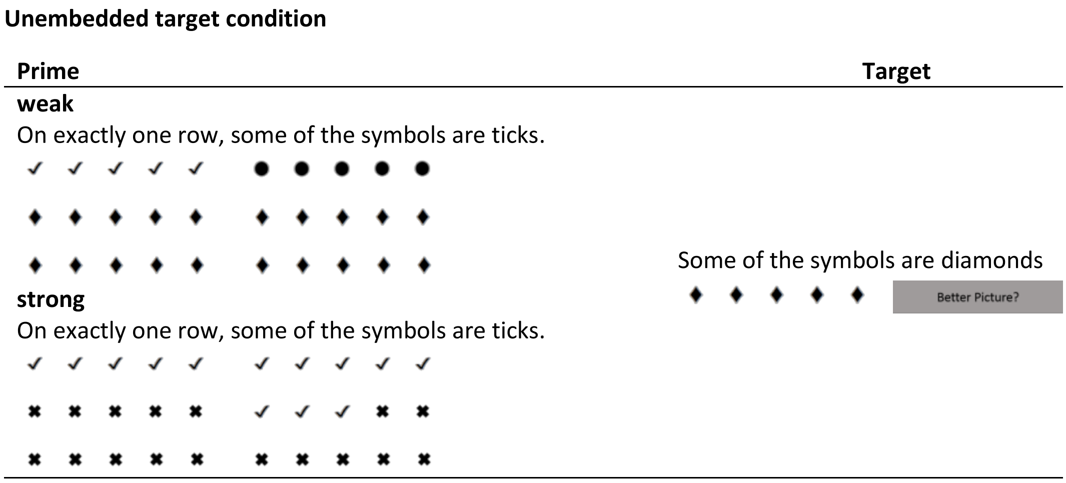

Figure 6 *Critical items for unembedded target condition in experiment 2*

As with Experiment 1, 48 filler trials were constructed. The filler sentence was of the form *All of the symbols are [symbol]* or *On exactly one row, all of the symbols are [symbol]*. Like in Experiment 1, each type of filler sentence occurred in three situations: (i) the sentence was presented with a strong picture and a 'Better Picture?', (ii) the sentence was presented with a false picture and a 'Better Picture?', and (iii) the sentence was presented with a false picture and a strong picture. All the other materials and the procedure were the same as Experiment 1.

4.1.3. Data treatment and analysis

As in Experiment 1, the analysis was performed on target responses that were preceded by two correct prime responses. This resulting in the removal of 84 out of 480 target responses. Of the 84, 24 were embedded targets and 60 were non-embedded targets. For the remaining target responses, we coded the enriched response as 1 and the unenriched response as 0.

Again we fitted a logistic mixed-effect model to predict the log odds of choosing an enriched over unenriched response from fixed effects of embeddedness (embedded / non-embedded) and prime type (weak / strong). The model contained random intercepts and slopes for subjects and random intercepts only for items. All fixed effects were included as random slopes.

4.2. Results and discussion

Figure 7 shows the proportions of enriched responses across conditions. There was a main effect of priming (β = 1.33, SE = 0.39, $p < .001$). Again, planned comparisons on each level of prime type showed that the rate of enriched responses was significantly higher after strong primes than after weak primes only in unembedded target conditions (β = 1.56, SE = 0.54, p = .004) and not in embedded target conditions (β = -1, SE = 1.71, p = .56). There was no main effect of embeddedness (β = 2.07, SE = 1.23, p = .07), and the interaction between embeddedness and prime type was not significant (β = -0.75, SE = 0.77, p = .33).

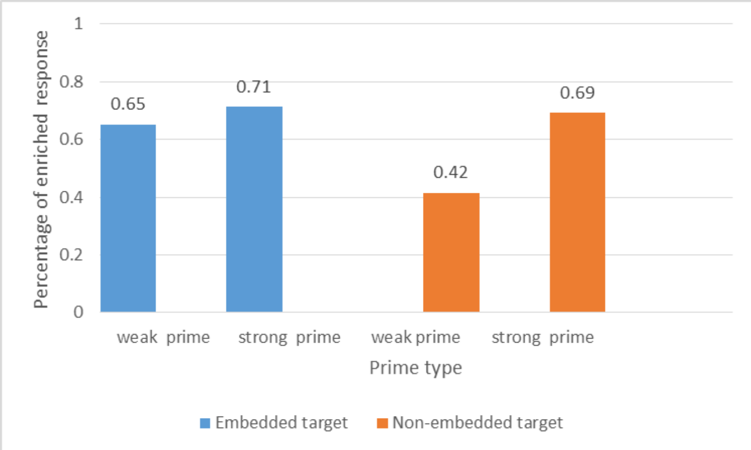

Figure 7 *The proportions of enriched responses across conditions in Experiment 2*

In this experiment, enriched responses in both embedded prime and embedded target trials could not be the product of a global enrichment. Thus, the main effect of prime types provides clear evidence that embedded and unembedded scalar implicature share a mechanism. In particular, the priming of the enriched response in the unembedded target by the embedded prime provides somewhat more direct evidence that unembedded scalar enrichments can be derived by the mechanism for local enrichment.

Overall, the main effect of prime provides support to both GT and RSA-LU accounts. In terms of discriminating between the two approaches, once again, the results are difficult to interpret, although suggestive. On the one hand, we found a priming effect in the unembedded target condition but not the embedded target condition; on the other hand, the interaction did not reach significance. It is also worth noting that the items in the embedded target condition were identical across both experiments and in both cases no effect was found in either case. As mentioned above, the RSA-LU approach predicts that, if there were an asymmetry in the priming effect, it would occur in the direction found. This is because, while embedded prime trials involve mandatory enrichment, unembedded prime trials do not. Thus the RSA approach suggests a stronger priming effect in the unembedded target condition.

5. Inverse Preference and Frequency of Local Enrichment

In this section, we will relate the results of Experiment 2 to the so-called 'Inverse Preference Effect'. Inverse preference is the phenomenon whereby a less frequent parse of a word or structure gives rise to a larger priming effect than more frequent parses (Hartsuiker, Kolk, and Huiskamp, 1999; Hartsuiker and Westenberg, 2000; Hartsuiker and Kolk, 1998;

Scheepers, 2003). For example, studies that manipulate active and passive syntactic structures find that passives, which are the less frequent construction, give rise to larger priming effects than actives (Bock, 1986). Currently favoured explanations of this effect revolve around the idea that priming itself is a result of implicit learning (Pickering and Ferreira, 2008) and that inverse preference results from error correction (Jaeger and Snider, 2013).

Inverse preference is relevant to the results in Bott & Chemla (2016), because it potentially helps to explain a surprising result in their main experiment. This is the fact that Bott & Chemla found a main effect of Within / Between, such that there were more enriched responses in the Between condition than Within, even though there was a significantly bigger effect of prime in the Within condition. This can be explained in terms of inverse preference if it is assumed that the unenriched response in prime trials is the less frequent or somehow unexpected one. This means that for Weak prime trials, there is a large priming effect for the unenriched response, causing participants to select the open picture in target trials. Bott & Chemla observe that the large priming effect in Within trials is indeed mostly due to a below baseline response in Weak trials. That is, compared to a condition where the prime was unrelated to the target in terms of scalar implicature, participants made fewer enriched responses in the Weak prime condition.

Let us now turn back to the results of Experiment 2 to consider where there might be an inverse preference effect. When we consider the unembedded target condition, it could be that because unenriched ‘some’ in Weak prime trials is unexpected, this primes the unenriched interpretation in the target. However, if the priming effect in unembedded target trials is because of below-baseline rates in weak trials, this would not explain why a similar effect is not obtained in the embedded target condition. Of course, it could be that, again, we simply failed to find the same below-baseline effect in this condition. Alternatively, if there are two mechanisms involved in scalar implicature, the literal interpretation of ‘some’ may be intermediate in its expectedness between a more frequent globally enriched reading and a less frequent locally enriched reading. This would explain the large priming effect in unembedded target trials, because the Strong primes in this condition require local enrichment and, by hypothesis, local enrichment is a less frequent response than no enrichment.

When it comes to the Embedded target condition, if global enrichment is more often used to respond to strong unembedded prime trials than local enrichment, and literal unenriched meanings are used in weak trials, then we should not expect to see such a great priming effect, because the target trials require local enrichment. This would mean that, although both global and local processes may be responsible for unembedded scalar enrichments, the global process may be the more common route.

At present, we have too little data to discriminate among these possibilities. Further studies would be required to shed light on the relation between global and local scalar enrichments in terms of their frequency. At a minimum, we would need to include an unrelated control condition here to get a better baseline.

6. Conclusion

The primary aim for this paper was to use the enrichment priming paradigm to determine whether embedded scalar enrichments and unembedded scalar enrichments involve a shared mechanism. In two experiments, we found evidence supporting a shared mechanism. In particular, Experiment 2 showed clearly that embedded prime trials, where local enrichments are mandated, lead to more unembedded scalar enrichments in targets than when only the literal meaning of 'some' is used in primes. This latter result in particular highlights that activation of locally enriched meanings of 'some' can impact on rates of unembedded scalar enrichments.

Although there are relevant differences between the RSA-LU and GT, the data in this paper does not conclusively favour one or the other. However, a twice-replicated lack of effect in the embedded target condition fits better with the Gricean picture than the Grammatical one. Again, more studies would be needed to pursue this matter further. For instance, a similar kind of study that mixes lexical triggers in a unembedded target condition might provide such a test. We leave this question open for future research.

Finally, a speculative discussion about whether the results reported in Experiment 2 might be the result of an inverse preference effect led to the suggestion that perhaps the locally enriched interpretation of 'some' is less frequent or more surprising than either the globally enriched or literal interpretation.

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Generics and typicality[1]

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Abstract. Cimpian et al. (2010) observed that we *accept* generic statements of the form '*G*s are *f*' on relatively weak evidence, but that if we are unfamiliar with group *G* and we learn a generic statement about it, we still *interpret* it in a much stronger way: (almost) all *G*s are *f*. This paper makes use of notions like 'representativeness' and 'contingency' from (associative learning) psychology to provide a semantics of generics that explains why people *accept* generics based on weak evidence. We make use of the Heuristics and Biases approach of Tversky and Kahneman (1974) and the Associative Theory of Probability Judgements to explain pragmatically why people *interpret* generic statements in a much stronger way. The spirit of the approach has much in common with Leslie's (2008) cognition-based ideas about generics, but the semantics is grounded on Cohen's (1999) relative readings of generic sentences. The basic intuition is that a generic of the form '*G*s are *f*' is true, not because most *G*s are (or tend to have) *f*, but because *f* is typical for *G*, which means that *f* is valuably associated with *G*.

Keywords: generics, association, probabilities, pragmatics.

1 Introduction

Although generics are studied mostly in formal semantics and philosophy, they have recently attracted the attention of cognitive psychologists as well. The reason is that generics play a core role in the way we *learn*, *represent* and *reason* about groups in the world (cf. Leslie (2008)). Indeed, generic statements express very basic kinds of inductive generalizations, learned during the process of categorization. A central hypothesis of this paper is that the way we learn new categories is, and remains, of crucial importance for judgements involving those categories. I will argue that generic statements about categories, or groups, express typical information about these groups, and that the way we learn about a group is of crucial importance for what is typical about this group. The notion of *contingency* from associative learning psychology plays an important role in learning, and I will argue that a slight generalization of it is crucial for typicality as well, and thus for the analysis of generics.

After providing a biased overview of some semantic theories of generics (concentrating in particular on Cohen's proposal) in section 2 and theories of categorization in section 3, I will discuss my own semantic account of generics in section 4. This semantic analysis will give rather weak truth conditions to generic sentences. After that we will provide in section 5

[1]The ideas behind this paper were first presented in a conference on lying in Leiden, January 2017. Further presentations on the topic were given in Stockholm, Amsterdam and Zurich, before it was presented at the Sinn und Bedeutung conference in Berlin. I profited from the comments given after these talks, and in particular from those of Nicholas Asher, Nils Franzen, Manfred Krifka, Hannes Leitgeb, and Stephanie Solt. The comments on the abstract were also very useful. I discussed many ideas of this paper with Katrin Schulz. I like to thank all of these for their valuable comments. Finally, I would like to thank Jonathan Pesetsky for correcting my English.

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a pragmatic explanation of why generics are normally interpreted in a much stronger way, making use of insights of Tversky and Kahneman (1974) Heuristics and Biases program, and of the Associative Theory of Probability Judgements.

2 Some Semantic Theories of Generics

Generic sentences are sentences that, by their very nature, express useful generalizations. The main question addressed in the literature is about the type of generalization. First, generic sentences are clearly not **universally quantified** sentences: although not all birds fly (penguins don't), (1) is a good generic sentence that most people consider true.

(1) Birds fly.

Indeed, this is one of the most typical features of generic sentences: they express generalizations that allow for exceptions. But it also need not be the case that almost all, or **most** *G*s have feature f in order for the generic '*G*s are f' to be true:

(2) Birds lay eggs.

Although (2) is true, it is not the case that the majority of birds lay eggs; only the adult female birds do! Moreover, even if most *G*s are (or are taken to be) f, the corresponding generic sentence still doesn't have to be true, as exemplified by sentences such as the following:

(3) Germans are right handed.

Finally, such an analysis is extensional, and that is taken to give rise to problems exemplified by the following, much discussed, generic (4):

(4) Mail from Antartica is handled by Tanja.

This generic can be true, even though we've never gotten any mail from Antartica. It is normally argued that what such an example points to is a demand for an *intensional* treatment of generics. Arguably, however, (4) is a *normative* generic, and normative generics cannot be given a purely extensional treatment anyway. But, of course, there is a much better reason why generics should not depend on certain actually observed extensionally given sets: if our theory claimed this, we could not account for their inductive, or unbounded, character.

According to the **modal nonmonotonic** approach of Asher and Morreau (1995), Pelletier and Asher (1997) and others, '*G*s are f' is true if and only if for any entity d and all worlds in which d is a normal G, d has feature f. Such theories want to account for a type of **default instantiation**, that is, for the fact that if all we know is that the sentences '*G*s are f' and 'x is a G' are true, we can normally, or by default, conclude by instantiation that x has feature f. Proponents of nonmonotonic logic typically argue that what is normal need not have anything to do with proportions. But without a independent characterization of what normal is, such a theory is not very predictive (Krifka et al., 1995; Pearl, 1988).[2] Moreover, whatever 'normality' is taken to mean, any analysis that wants to account for 'default instantiation' will have problems accounting for the intuition that the following generics are both true.

(5) a. Ducks lay eggs.
    b. Ducks have colourful feathers.

In order to predict that (5a) is true, it must be the female ducks that should be relevant or normal, while it is the opposite sex that is relevant or normal for (5b).

There is another typical kind of example that is problematic for the analyses discussed so far. Consider the following (seemingly true) generics:

(6) a. Ticks carry the Lyme disease.
    b. Sharks attack people.

Sentences (6a)-(6b) are examples of what Leslie (2008) calls 'striking generics'. A generic sentence is striking if only very few of the *G*s need to have feature f for the generic sentence '*G*s are f' to be true. According to Leslie, striking often means 'horrific or appalling'. However, the truth conditions suggested above also seem to hold for familiar examples like (7a)-(7b) that are intuitively not 'horrific'.

(7) a. Frenchmen eat horsemeat. from Schubert & Pelletier (1987)
    b. Dutchmen are good sailors.

Intuitively, a sentence like (7a) is true not because most Frenchmen eat horse meat, but because *relatively many* Frenchmen do so. These types of examples motivated Cohen (1999) to claim that generic sentences are in fact *ambiguous*. They can both have an *absolute* and a *relative* reading. On the absolute reading, '*G*s are f' is true iff most *G*s are f, while on the relative reading it is true iff relatively more *G*s are f, than $\neg G$s are, where $\neg G$s are the relevant alternatives to *G*. Cohen proposes that generic sentences are standardly interpreted in the absolute way, but that sentences that are problematic for many other treatments of generics like (7a)-(7b) should be interpreted in the relative way, just as examples like (5a) 'Ducks lay eggs' and 'Lions have manes'. Presumably, the same is the case for the striking generics (6a)-(6b).

Where Cohen (1999) gives two separate treatments of absolute and relative generics, in Cohen (2001) he provides yet another analysis of **non-descriptive generics** like the following:

(8) a. Bishops move diagonally.
    b. The Speaker of the House succeeds the Vice-President.

[2]Of course, this is reminiscent of a similar criticism one might give to semantics of counterfactuals that make crucial use of a primitive notion of 'similarity'.

Cohen (2001) assumes that non-descriptive generics have an underlying logical form that differs radically from their surface form, and that they also have a very different interpretation.

Although I undoubtedly take Cohen's analysis to be a major step forward compared to other analyses of generics, it is certainly not without problems. The **first problem** for Cohen's analysis I take to be the claimed **ambiguity**. Can it really be the case that there is no common core between all types of generics? Should absolute generics really be given a separate treatment from relative and non-descriptive ones? The proposal, for instance, that non-descriptive generics have an underlying logical form that differs radically from their surface form, and that they also have a very different interpretation from descriptive generics is prime facie, at least, problematic. It would be more natural, intuitively, to give all types of generics the same logical form, and have an interpretation of generics that works similarly for them all.

A **related problem** is noted by Leslie et al. (2011), who observe that Cohen's analysis of relative generics predicts that an example like (9) comes out true.

(9) Dogs have three legs.

Example (9) is clearly predicted to be false on its absolute reading. It is predicted to be true on the relative reading, however. The reason is that dogs have a higher probability of staying alive after losing a limb than wolves, foxes, hyenas, et cetera, because three-legged dogs will be taken care of by their owners. Furthermore, dogs seem to have a higher probability of losing a limb then say hamsters, rabbits, miniature donkeys, and parakeets. Hence, the generic (9) is true relative to both the alternative set Pets and the alternative set Dog-like animals.

Of course, Cohen could simply claim that (9) only has an absolute reading, and on that reading the sentence is correctly predicted to be false. But this move only brings us back to the first problem: how should we determine which reading each generic sentence should have?

What (9) also illustrates is that Cohen's analysis of relative readings is **too weak**. This is not only the case empirically, but also conceptually: they seem to be too weak to be of any use.

Although various aspects of Cohen's analysis of generics have come under attack, in this paper I will build on Cohen's analysis, in particular on his relative readings. Let me here already point to one, I feel, under-appreciated aspect of such readings. Consider generic sentences that express *comparative relations*, like (10):

(10) Boys are taller than girls.

Although other analyses of generics might be able to account for such readings as well, an analysis in terms of relative readings is almost immediate. The reason is that relative readings are (perhaps implicitly) already treated as comparatives! Let us assume, just for simplicity, an analysis of comparatives as given in Klein (1980): 'John is taller than Sue' is true iff there is a comparison class including (perhaps only) John and Sue such that John is tall with respect to this comparison class, while Sue is not. Similarly, (10) will be true if there is a comparison class c including (perhaps only) boys and the girls such that with respect to this comparison class boys are tall and girls are not. Notice that according to the relative reading of the generic sentence 'Boys are tall', the sentence is true iff $P(tall(c)/boys) > P(tall(c)/\neg boys)$. If c consists of only the boys and girls this reduces to $P(tall(c)/boys) > P(tall(c)/girls)$. Similarly, the generic sentence 'Girls are not tall' is true on its relative reading in this context iff $P(\neg tall(c)/girls) > P(\neg tall(c)/boys)$, i.e., iff $1 - P(tall(c)/girls) > 1 - P(tall(c)/boys)$ iff $P(tall(c)/girls) < P(tall(c)/boys)$. As a result, sentence (10) is predicted to be true iff $P(tall(c)/boys) > P(tall(c)/girls)$, which indeed seems to be the correct result.

Leslie (2008) observes that although generics are extremely hard to analyse truth-conditionally, we are able to understand and use them successfully with relative ease. She suggests that this is so because generics are the expression of a very primitive default mode of generalizing, which picks up on significant or striking properties and links them to psychologically salient kinds. I completely agree with her **cognitive approach**, and that the analysis of generics should be closely tied to the way we categorize and make inductive generalizations. I would like to focus on this insight as well. As we will see though, this doesn't necessarily mean that truth-conditional approaches like those of Cohen (1999) are wrong headed. Moreover, or so I will argue, this doesn't mean that generics are as (at least 5-way) ambiguous as Leslie et al. (2011) suggest. Perhaps it is possible to give a more uniform semantic analysis of all types of generic sentences, once we know more about typicality and how we learn inductive generalizations.

3 Typicality and associative learning

People have the natural tendency to classify the objects around them in terms of categories. Objects are grouped together to form a category if they have characteristics in common or are roughly similar to one another. Our thinking in terms of categories reduces the complexity of the world around us considerably. Categorization is one of the most common and most important things we do all the time and crucially influences our behavior. One of the most important functions of categories is that they allow us to make use of induction and generalization. Indeed, the process of categorization itself is perhaps the most basic type of generalization we make. It is only natural to assume with Leslie (2008) that generic sentences about categories express these basic generalizations. This suggests that to figure out why we accept certain generic sentences but not others, it is crucial to understand this basic process of categorization.

One of the main claims of this paper is that a generic of the form 'Gs are f' is true if f is a typical feature of Gs, or if typical members of the category G have feature f. Typicality is well-studied in cognitive psychology. According to prototype theory, groups (or categories) are represented by typical members, rather than by all of them and only them, or by typical features, rather than by necessary and sufficient features, because agents have limited attention and limited recall of examples. But what are a group's typical members or features? According to Rosch (1973), it is the *central*, or *average* members of the group, or the features *most* members have. Centrality is determined in terms of a notion of similarity. Barsalou (1985) experimentally showed on the basis of a thorough correlational analysis, however, that at least for goal-derived artificial categories, the typical members are instead the category's *ideal* members; those that *best* satisfy the goal. For example, the ideal of the category 'things to eat on a diet' presumably is 'zero calories,' which clearly is not a common, but rather an extreme value for members of the category. Idealness can be defined as the extent to which a certain object displays a quality that is directly related to the goal. More recent empirical findings (Ameel and Storms, 2006; Burnett et al., 2005) show that extreme members of a group are also considered typical for many, if not most, other types of categories, namely if categorization is performed in a *contrastive* way. Typical members of a category have features that *distinguish* them from members of other categories; as such, they highlight, but also exaggerate, real differences between groups.

Typical features for a group are taken to be features that are **representative** for the group. This is important for our analysis of generics. Furthermore, I claim that the way we **learn** categories is, and remains, of crucial importance for *judgements* involving those categories.

A popular way to approach the learning of categories involves associative learning based on frequencies and correlations. Much of that psychological research was done before the cognitive revolution in psychology, in classical conditioning. In classical conditioning, what is learned is an association between a cue and an outcome. The cue, C, such as the sound of a bell, or a tuning fork, can become associated with an outcome, O, which can be thought of either as something like the taste of food, or a shock, or an unlearned reflex response to that, like salivation, or high blood pressure indicating fear. Pavlov hypothesized that the strength of association between cue and outcome depends on the number of times the two are paired.

Subsequent research has revealed, however, that for prediction it is not exactly the number of pairings between cue and outcome that is crucial. In a classic study, Rescorla (1968) showed that rats learn a tone (C) $\rightarrow$ shock (O) association if the frequency of shocks immediately after the tone is higher than the frequency of shocks undergone otherwise. Within associative learning psychology, this difference in frequency is known as the **contingency** of the shock on the tone. The central finding of Rescorla (1968) was that the higher the contingency of shock on the occurrence of the tone, the more the rats anticipated the fear of a shock. Thus, the higher the contingency, the more useful the tone is as a predictor of the shock. Of crucial importance for our paper is that these experiments show that rats will develop a tone $\rightarrow$ shock association even if shocks occur only in, say, 12% of the trials in which a tone is present, as long as the frequency of the shocks experienced otherwise is (significantly) lower. Formally, this contingency, or strength of association, between C (e.g. tone) and O (e.g. shocks) is measured by $P(O/C) - P(O/\neg C)$, abbreviated by ΔP^O_C, where P measures frequencies during the learning phase.[3]

Other experiments in the aversive (i.e. fear) and appetitive conditioning paradigms (Thomas and LaBar, 2008) show that the speed of acquisition increases with the *intensity* of the shock. More generally, stronger emotions promote faster learning, more enduring memories, and stronger associations (Chatlosh et al., 1985). One could say that for trained rats, tones play

[3]For a counterfactual analogue of contingency, see Pearl (2000). He shows that under some conditions (exogeneity and monotonicity), his counterfactual notion comes down to the standard statistical notion.

an important role in their categorization of shocks: the tone is a useful predictor and thus provides valuable information to the rat on how to prepare for the future. Moreover, this role of the tone in categorization becomes more entrenched with increased intensity of the shock.

Whereas early work in classical conditioning mostly involved animals, more recent work shows that humans learn associations between the representations of certain cues (properties or features) and outcomes (typically another property or a category prediction) in a very similar way (Gluck and Bower, 1988; Schanks, 1995). On the basis of these findings, on my *preliminary* proposal, I measure the **representativenes** of feature f for category or group G as the contingency between f and G, ΔP_G^f, $P(f/G) - P(f/\neg G)$, where $\neg G$ abbreviates $\bigcup Alt(G)$ (and $G \notin Alt(G)$). Then I will say that a feature f is representative for a group G in a particular context iff there is no relevant alternative feature g with a (significantly) higher contingency with G than f, i.e., $\neg\exists h \in Alt(f) : \Delta P_G^h > \Delta P_G^f$. Notice that a representative feature for group G doesn't have to be one that most, or even many, members of the group have. Instead, a representative feature is one that *distinguishes* group G from its alternative(s) (for simplicity taken to be $\neg G$), which is exactly in line with the view on typicality discussed above: those features are representative for a group that highlight, or exaggerate, differences with other groups. Similarly, even though two features f and h are mutually incompatible for members of a certain group (e.g., no peacock both lays eggs and has fantastic blue-green tails), they can still both be representative, because they are distinguishable, for that same group.

Contingency is important for learning associations. Thus, it is the frequencies that animals and people were exposed to in the learning phase that count. But in many cases people are not exposed to the *actual* frequencies of cues (properties or features) with outcomes (typically another property or a category prediction), but rather with a *distorted* picture of it. Distortion is especially likely to happen when we learn associations through the (social) media. For instance, Kahneman (2011) notes that he had a long-held impression that adultery is more common among politicians than among physicians or lawyers. Only later he realized that this associative belief was probably caused by the fact that the extramarital relations of politicians are much more likely to be reported in the media than the affairs of lawyers and doctors. Still, it is only natural to assume that people will pick up associations from news items in a very similar way that people learn associations through actual exposure. This suggests that learning associations between cues with outcomes from the media also goes via contingency, our ΔP_G^f, but now the frequencies measure not the actual frequencies, but a distorted picture of them via media coverage which is strongly biased towards novelty and poignancy (cf. Kahneman (2011)).

Slovic et al. (2004), among others, argue that there exists a deeper link between representativeness of events or features and our emotional reactions to them. Events which give rise to fear and danger come easy to mind not only because of higher media coverage, but also simply because they give rise to strong emotional reactions. We have seen above that humans are, in this sense, not so different from the animals used in classical conditioning experiments: strong emotions like fear promote faster learning and more enduring memories. The empirical success of reinforcement learning in humans, again, only corroborates this idea.

To incorporate the insight of Slovic et al. (2004) and of fear-conditioning, I will extend our earlier proposal and will define representativeness in a more general way. I will measure the representativeness of f for G by $P(f/G) \times Intens(f) - P(f/\neg G) \times Intens(f)$, or equivalently $\Delta P^f_G \times Intens(f)$, where $Intens(f)$ measures the *intensity* of f. I will abbreviate this measure by ∇P^g_G. Next I will say in our *final proposal* that f is among the most representative features of G iff there is no contextually salient alternative feature h which has a (significantly) higher measure of representability for G, which I will say holds if $\neg\exists h \in Alt(f) : \nabla P^h_G \gg \nabla P^f_G$. I normally assume that all relevant features have the same intensity, i.e. $\forall f, h \in Alt(f) : Intens(f) = Intens(h)$. This means that under normal circumstances our notion of representability reduces to contingency, $\nabla P^f_G = \Delta P^f_G$.

4 Weak Semantics: Generics state typicalities

In this section I will claim that a generic of the form '*G*s are f' is true if f is a representative feature for G. Therefore I make the following **semantic claim**:

- '*G*s are f' is true iff there is no $h \in Alt(f) : \nabla P^h_G \gg \nabla P^f_G$,
  where '$\gg$' means '*significantly* larger'.

Observe that under any circumstance the generic sentence can only be true if $\Delta P^f_G > 0$, i.e., if the generic is true on Cohen's relative reading.[4] I claim that this general definition can account for the generics I discussed so far, due to the context dependence of various notions involved.[5] To make that clear, let us first make some general observations concerning some special cases:

1. If $Alt(f) = \{f, \neg f\}$ and $Intens(f) = Intens(\neg f)$, the generic '*G*s are f' is true just in case $\Delta P^f_G \gg 0$, i.e., $P(f/G) \gg P(f/\neg G)$, i.e., Cohen's *relative reading*.[6]

[4]Instead of using standard contingency, it is tempting to make use of *weighed* contingency or representativeness instead. Let us just consider weighed contingency, defined as follows: $\Delta^\alpha P^f_G := \alpha P(f/G) - (1-\alpha)P(f/\neg G)$, with $\alpha \in [\frac{1}{2}, 1]$. Now one can define the (simplified) truth conditions of generics for which intensity is irrelevant as follows: '*G*s are f' is true iff $\neg\exists h \in Alt(f) : \Delta^\alpha P^h_G > \Delta^\alpha P^f_G$. One can show easily that in case $\alpha = 1$, Cohen's (1999) absolute reading follows, while if $\alpha = \frac{1}{2}$, the result is Cohen's relative reading. This is certainly an appealing result. However, I won't go for this proposal because (i) in contrast to our definition, if $\alpha \neq \frac{1}{2}$ positive contingency, $\Delta P^f_G > 0$, is not required for generics to be true (which I think is undesirable), (ii) the use of the extra parameter α only adds more context-dependence, and (iii) we can derive the relative reading without making use of α and we can account for the generics that Cohen treats as absolute ones as well.

[5]Sterken (2015) has recently argued that generics are more context dependent than is generally assumed: not only the domain of quantification is context dependent, but also the required force of quantification. Notice that on our analysis the required force of 'quantification' depends on context as well. How high $P(f/G)$ must be in order for the generic '*G*s are f' to be true depends on what $Alt(G)$, and thus $P(f/\neg G)$ is, what $Intens(f)$ is and what $Alt(f)$ is. Thus, I agree with Sterken that the required quantificational force for a generic to be true depends on context, but given our analysis of generics that is not something that should be build on top of the analysis: it just follows from the context dependence required anyway.

[6]Proof: Under these circumstances the sentence is true iff $\Delta P^f_G > \Delta P^{\neg f}_G$. For $\Delta P^f_G > \Delta P^{\neg f}_G$ to be the case it has to hold that $P(f/G) - P(f/\neg G) > P(\neg f/G) - P(\neg f/\neg G)$ iff $P(f/G) - P(f/\neg G) > 1 - P(f/G) - (1 - P(f/\neg G))$ iff $P(f/G) - P(f/\neg G) > P(f/\neg G) - P(f/G)$ iff $P(f/G) > P(f/\neg G)$.

2. If $\forall h \in Alt(f) : Intens(h) = Intens(f)$ and $P(f/G)$ is not high, 'Gs are f' is true just in case $P(f/\neg G)$ is very low, and thus f is very *distinctive* for Gs.

3. If $\forall h \in Alt(f) : Intens(h) = Intens(f)$ and $P(h) \approx P(f)$, 'Gs are f' is true only if $\forall h \in Alt(f) : P(f/G) \gg P(h/G)$, or if ΔP_G^f is only somewhat above 0 and $\forall h \in Alt(f)$, $P(h)$ is not low, $P(f/G)$ has to be (very) high ('*standard*' generics)[7]

4. If ΔP_G^f is only somewhat above 0, and $P(f/G)$ is not high, $Intens(f)$ has to be high for 'Gs are f' to be true. (*striking* generics)

5. If $Alt(f) = \{f, \neg f\}$, $Intens$ is irrelevant and $\bigcup Alt(G) \cap f = \emptyset$, then '$G$s are f' is true just in case $P(f/G) > 0$, i.e., the *existential* reading.[8]

Let us now look at some examples with the above cases in mind.

(1). If $Alt(f) = \{f, \neg f\}$ and $Intens(f) = Intens(\neg f)$, the generic '$G$s are f' is true just in case $\Delta P_G^f \gg 0$. Notice that this is already stronger than Cohen (1999)'s relative reading for which he argues to deal with sentences like 'Dutchmen are good sailors'. However, I think even for these cases that the reading should be stronger. This is what we predict, especially if we assume that $Alt(f)$ can contain many other alternative features than just $\neg f$ (if it contains $\neg f$ at all). That is, the generic is true iff there is no relevantly salient h that is a more distinguishing feature for being a G than f is. I claim that this is exactly not the case for examples like (9) 'Dogs are 3-legged' which indicated that Cohen (1999)'s relative reading of generics is too weak. Indeed, intuitively, one does not distinguish dogs from other pets by looking at whether or not they have three legs; checking whether they bark makes much more sense.

(2). A generic sentence 'Gs are f' is true if f is *very distinctive* for Gs. I claim that a generic like 'Tigers have stripes' is considered true because 'having stripes' is (among the relative alternative features $Alt(f)$) among the most distinctive features of tigers. A generic sentence like 'Germans are right handed', on the other hand, is not predicted to be true simply because 'being right handed' does not distinguish Germans in any significant way from, say, other European citizens.

[7]To show this, recall that $P(f/G) > P(f/\neg G)$ just in case $P(f/G) > P(f)$. It follows that if we only take features like h into account such that $P(h) \approx P(f)$, $\Delta P_G^f > \Delta P_G^h$ just in case $P(f/G) \gg P(h/G)$. The same holds if we assume alternatively, and perhaps more naturally, that $\forall h \in Alt(f) : P(h/\bigcup Alt(G)) \approx P(f/\bigcup Alt(G))$. In both cases it means that $P(f/G)$ must be high.

[8]For simplicity I will take $Alt(G) = \{\neg f\}$. Assuming that $Intens$ is irrelevant, we have to check whether $[P(f/G) - P(f/\neg f)] > [P(\neg f/G) - P(\neg f/\neg f)]$. By taking $P(f/G) = p$, what follows is that $[p - 0] > [(1-p) - 1]$. This reduces to $p > -p$, which holds exactly if $p > 0$, i.e., if $P(f/G) > 0$: the existential reading. Recall that $P(f/G) > -P(f/G)$ iff $P(f/G) + P(f/G) > 0$. This suggests that generics with frequency adverbs like 'Mammals seldom fly' can be interpreted in terms of contingency as well with the same choice of $Alt(f) = \{f, \neg f\}$ and $Alt(G) = \{\neg f\}$. For the above generic to be true we demand that $\frac{1}{2}(\Delta P_G^f - \Delta P_G^{\neg f}) \ll 1$, which comes down to $\frac{1}{2}(P(f/G) + P(f/G)) \ll 1$ and reduces to $P(f/G) \ll 1$, which is Cohen's (1999) analysis. Alternatively, we can simply demand that $\Delta P_G^f \ll 1$, with $Alt(G) = \{\neg f\}$, although this would complicate a compositional analysis.

Our analysis accounts for the intuition that generics like 'Birds fly' and 'Birds lay eggs' are acceptable and true. The reason is that 'flying' and 'laying eggs' are indeed among the most distinguishable features for birds (compared to alternative middle sized animals). Our semantic analysis of generics also explains the following example that is paradoxical to many other theories: although only (adult) male lions have manes, (11a) is an accepted generic, but (11b) is not.[9]

(11) a. Lions have manes.
b. Lions are male.

The reason is that compared to lions, relatively few other animals have manes, but it is not the case that compared to other animals relatively many lions are male. Our analysis thus correctly predicts that 'Gs are f' can be true and 'Gs are h' false, although $P(h/G) > P(f/G) < \frac{1}{2}$.

I have proposed that generic sentences should be analyzed in terms of representativeness, and that the representativeness of feature f for group G should be measured by ∇P_G^f. I have noted before that this reduces to contingency, ΔP_G^f, if $\forall f, g \in Alt(f) : Intens(f) = Intens(g)$. Notice, now, that ΔP_G^f behaves very similar to two other interesting measures, $\frac{P(f/G)}{P(f)}$ and $\frac{P(f/G)}{P(f/\neg G)}$.[10] It is remarkable that $\frac{P(f/G)}{P(f)}$ and $\frac{P(f/G)}{P(f/\neg G)}$ have been proposed as measures of **stereotypicality** of f for G within social psychology (McCauley et al., 1980; Schneider, 2004). Indeed, just like ΔP_G^f, also $\frac{P(f/G)}{P(f)}$ and $\frac{P(f/G)}{P(f/\neg G)}$ give those features a high value that are distinctive for group G, and thus highlight or exaggerate differences between groups. From this proposal, together with our own, it naturally follows that in case ΔP_G^f is high, we could say that f is a stereotypical feature of G. Is that already enough evidence to propose that 'Gs are f' is a good and true generic?

Indeed, a number of authors, including Declerck (1996) and Geurts (1985), have proposed that generics are about stereotypical properties. This account has been criticized by Krifka et al. (1995), however, and is largely abandoned in the literature. A first argument used by Krifka et al. (1995) is that stereotypes are just widely acknowledged ideas within a speech community, while the truth of a generic depends on actual facts: even if uttered in a culture where everybody believes that cows are a special kind of horse, or that snakes are slimy, they argue, cows are not horses, and snakes are not slimy. This argument is obviously invalid with respect to our analysis of stereotypes, however, if I base my analysis not on a subjective probability function, but on objective frequencies, or propensities. The truth of a generic is then predicted to depend on actual facts. A second counterargument of Krifka et al. (1995) is that stereotypes are tied to well-known groups or situations, while generics are often not about any of those things. But, again, I don't see why this could be problematic for our analysis. A third counterargument is

[9] This example is strikingly similar to the famous *conjunction fallacy* of Kahneman and Tversky (1972). In the next section I will show that our analysis accounts for the two 'paradoxes' in the very same way, in terms of our implementation of Tversky and Kahneman (1974)'s *representativeness*-heuristics making use of contingency.

[10] Contingency increases with increasing $P(f/G)$ and decreasing $P(f/\neg G)$ just as $\frac{P(f/G)}{P(f/\neg G)}$. Next, one can show that contingency, ΔP_G^f, behaves monotone increasingly with respect to the standard notion of relevance, $P(f/G) - P(f)$. Obviously, $\frac{P(f/G)}{P(f)}$ increases with increasing $P(f/G)$ and decreasing $P(f)$, just as $P(f/G) - P(f)$.

the fact that although the stereotype states that Hindus don't eat meat, a generic like 'Hindus eat meat' can be true in certain contexts, e.g. as a rejection of the claim that no Hindu eats meat. I agree with the linguistic intuition, but along with Cohen (2004) I think that the truth of this use of the generic is peculiar to its use of rejections. I will come back to this problem later in this section. For now, I conclude that the standard arguments against an analysis of generics in terms of stereotypicality are not valid on our implementation of the latter notion.

Our analysis of generics is based on typicality and as such is very similar to an analysis based on **prototypicality** as well. But the linguistic literature has not been friendly to such an approach. How could I still defend it? Let's see whether we can rebut the troubles typically discussed for such an analysis. First, this approach is criticized for simply passing on the problem of generics to a new problem of what it means to be prototypical. But this can't be a serious problem anymore, given our very explicit proposal, based on psychological research, for what it means to be (proto)typical. A second problem normally discussed is that this approach cannot deal with the fact that the following two sentences both seem to be true:

(12) a. Peacocks have fantastic blue-green tails.
b. Peacocks lay eggs.

The reason why this example is taken to be a problem is that the proposal to handle generics in terms of prototypicality is mostly taken to be that the sentence '*G*s are f' is true just in case the prototypical *G*s have feature f. Hence: 'Tigers have stripes' is true if and only if all (proto)typical tigers have stripes. Natural as such an analysis might be, it falsely predicts that (12a) and (12b) cannot both be true, because it is not the case that the typical peacock both has a blue-green tail and lays eggs, simply because there is no peacock that is male *and* female. Fortunately, my analysis differs from the one that is criticized. According to my analysis it is possible that '*G*s are f' and '*G*s are h' are true, even though f and h are, in fact, incompatible. It only has to be the case that $\neg\exists g \in Alt(f) : \Delta P^g_G > \Delta P^f_G$ and $\neg\exists g \in Alt(h) : \Delta P^g_G > \Delta P^h_G$, where the sets of alternative features $Alt(f)$ and $Alt(h)$ could be, though need not be, the same. This, obviously, is very well possible: relative to other animals (in general), many peacocks have beautiful blue-green tails and many peacocks lay eggs.[11] What is predicted not to be possible is that both '*G*s are f' and '*G*s are $\neg f$' are true (if $\neg f \in Alt(f)$ and $f \in Alt(\neg f)$), which is as it should be according to Hoeltje (2017).

(3). Recall that on our analysis f is a representative feature of G if f is very distinctive for G. However, it seems that some generics of the form '*G*s are f' are true, without f being a very distinctive feature. This holds, arguably, for (13a)-(13d), which are all undoubtedly good generics:

[11] Leslie (2008) provides a stronger argument against the prototype theory. She argues that not only (7a) and (7b) are true, but also 'Peacocks have fantastic blue-green tails and lay eggs'. Perhaps a more convincing example is given by Nickel (2010): 'Elephants live in Africa and Asia'. Note that on our analysis it might well be possible that for two mutually incompatible features like f and h it could be that $\neg\exists g \in Alt(f) : \Delta P^g_G > \Delta P^f_G$ and $\neg\exists g \in Alt(h) : \Delta P^g_G > \Delta P^h_G$, even if $Alt(f) = Alt(h)$. What is obviously not possible on our analysis is that for the *conjoined* feature $f \wedge h$ it holds that $\neg\exists g \in Alt(f) : \Delta P^g_G > \Delta P^{f\wedge h}_G$. Thus, for such cases, '$\wedge$' must have wide scope.

(13) a. Humans are mortal.
b. Birds are warm blooded.
c. Dogs are 4-legged.
d. Lions are mammals.

Intuitively, these generics are true simply because the vast majority of the mentioned animals have the relevant features. Our analysis can account for such cases as well. Notice, first, that although in all the above cases having the feature f hardly distinguishes the animals involved, Gs, from their alternatives, $\bigcup Alt(G)$, it is still the case that $P(f/G) > P(f/\bigcup Alt(G))$ (taking some immortals into account for (13a)), and thus the feature is predicted to be associated with G, even if not in a maximal way.[12] Second, in examples (13a) and (13b) it is only reasonable to assume that $Alt(f) = \{f, \neg f\}$, and thus $P(f/G) > P(f/\bigcup Alt(G))$ is already enough to make the sentences true. If $P(f/\bigcup Alt(G))$ is high, it just means that $P(f/G)$ has to be *very* high, which indeed is the case. Third, the features involved in (13c) and (13d) (and in (13a) and (13b)) are rather common among all animals. If we only take other such features into account as well (0-legged, 2-legged and birds, fish, reptiles, amphibians), it is demanded on our analysis for 'G is f' to be true that $P(f/G)$ is *very* high (assuming $Intens$ to be irrelevant).

Still, it seems that the analysis as it stands is not quite appropriate for examples like (13a)-(13d). For other generics our analysis required that the measure of representativeness, $\nabla P^f_G = \Delta P^f_G \times Intens(f)$ is high. For the above examples, however, that doesn't hold: $Intens$ seems irrelevant, and the features are not really distinctive, meaning that ΔP^f_G is low (though positive). Fortunately, one can define a measure closely related to ΔP^f_G (adopted from Shep (1958)), called 'relative difference' and denoted by $\Delta^* P^f_G$, which will have the result that the resulting ∇P^f_G (where in its definition ΔP^f_G is replaced by $\Delta^* P^f_G$) will be high:

- $\Delta^* P^f_G \quad \stackrel{df}{=} \quad \frac{\Delta P^f_G}{1 - P(f/\bigcup Alt(G))}$

Replacing ΔP^f_G in the definition of ∇P^f_G by $\Delta^* P^f_G$ will mean that contingency, and thus distinctness, still plays a major role: for $\Delta^* P^f_G > 0$ it is required that $\Delta P^f_G > 0$, and high ΔP^f_G still results in high $\Delta^* P^f_G$. However, it has the extra effect that $\Delta^* P^f_G$ *increases*, if $P(f|\bigcup Alt(G))$ increases. For instance, if $P(f|\bigcup Alt(G)) = 0.9$, $\Delta^* P^f_G$ will be **ten times** as high as ΔP^f_G (if $\Delta P^f_G > 0$)! Thus, for relatively common features (as in examples (13a)-(13d)) it has the effect that $\Delta^* P^f_G$ will be high, even though ΔP^f_G is relatively low. More intuitively, the use of $\Delta^* P^f_G$ instead of ΔP^f_G has the consequence that for representativeness of f for G, the value $P(f/G)$ is more important than $P(f/\neg G)$.[13]

(4). Next, if $\Delta P^f_G > 0$ but small, and $P(f/G)$ is not high, $Intens(f)$ has to be high for 'Gs are f' to be true. Recall that $Intens$ was brought in to take over some insights from fear-conditioning.

[12] This distinguishes these examples from a sentence like 'Germans are right handed'.

[13] Although the general approach should be stated in terms of $\Delta^* P^f_G$, for simplicity I won't make use of in the rest of this paper, because nothing in the further discussion of this paper relies on it.

I claim that it is exactly this that makes our analysis immediately account for **striking generics** like (6a) 'Ticks carry the Lyme disease' which are problematic for default-based approaches (e.g. Asher and Morreau (1995)). Indeed, Leslie (2008)) notes that 'striking' often means 'horrific or appalling', which means having a high *Intens*.

A feature can be striking also just because it is very peculiar, i.e., uncommon. Learning that members of a group have this peculiar feature more than on average can be very interesting. Making use of Shannon's Information Theory, I will say that A is peculiar exactly if A's informativity, inf(A), is high. The latter notion is defined as $\log_2 \frac{1}{P(A)} = -\log_2 P(A)$. According to this definition, inf(A) receives a high value exactly if $P(A)$ is small. ∇P^f_G now comes down to $[P(f/G) - P(f/\neg G)] \times \text{inf}(f)$.[14] If f is a very common feature, inf(f) will be small and ∇P^f_G can be high only if ΔP^f_G is high. For very uncommon features for members of G and their alternatives, however, ∇P^f_G can be high even if ΔP^f_G is low (but > 0). I claim that this is going on for (at least some) *relative generics* like (7a) 'Frenchmen eat horsemeat'.

(5). Earlier in this section I mentioned an example of a generic statement like (14) that is, intuitively, interpreted **existentially**, and noted that according to Krifka et al. (1995) this shows a problem for any analysis of generics based on stereotypicality. Existential generics like (14) (from (Cohen, 1999)), however, seem to pose a problem for nearly any analysis of generics.

(14) A. No Indian eats beef.
B. No! Indians $[\text{do}]_F$ eat beef.

Cohen (2004), however, is able to account for existential readings of generics by assuming that these are interpreted on his absolute reading with $Alt(f) = \{f\}$. Although formally appealing, the proposal looks conceptually artificial. For one thing, the focal stress on the verb *do* suggests that $\neg f$ should be an element of $Alt(f)$ as well. What is clear, though, is that for the interpretation, only Indians count, which seems to suggest that our *contrastive* analysis is not well suited to the situation. As shown in a previous footnote, however, I can account for existential readings formally by assuming that *Intens* is irrelevant, $Alt(f) = \{f, \neg f\}$ and $Alt(G)$ is such that $\bigcup Alt(G) \cap f = \emptyset$. Intuitively this seems correct, because the natural way to think about $\bigcup Alt(G)$ is as the set of Indians that verify what is said by A: the Indians that don't eat beef. The result is that the generic in (14) is interpreted as saying that more Indians eat beef than expected.

Let us finally consider **non-descriptive generics** like (8a) 'Bishops move diagonally'. At least since Kripke we know that identity statements can be used in two different ways: (i) to state the identity of meaning (intension) of the two terms, or (ii) to fix the meaning of one term in terms of the meaning of the other. Kripke explains the *a priori* character of a sentence like 'Stick S is one meter long' when talking about the ideal stick, or standard meter, preserved in Paris ever since the French Revolution by the second use of identity statements. Generic sentences are much like identity statements and can be used in those two similar ways. On a definitional use

[14] What inf(f) is meant to measure is the informativeness that an arbitrary x has feature f.

of generics of the form 'Gs are f', this means that having f is a *necessary* condition for being a G. If the definition is complete, f is also a *sufficient* condition. Note that if 'Gs are f' is a complete definition of Gs, f is a feature that all and only all Gs must have. But this means that ΔP_G^f will have the maximal value, because in that case $P(f/G) = 1$ (the maximal score) and $P(f/\neg G) = 0$ (the minimal score). This suggests that for definitional, or constitutive, uses of generics, just like for descriptive generics, contingency plays a crucial role!

Not all non-descriptive generics are constitutive in an equally strong manner as (8a) and 'Keys open doors', where without such generics bishops and keys would not even exist. Consider examples like the following:

(15) a. Boys don't cry.
b. Gentlemen open doors for ladies.

Leslie (2015) argues that (15a), at least on its normative reading, is used to tell a boy that crying is not an appropriate behavior for him and that he should hold back his tears: the sentence says something about what it takes, according to the speaker, to be an *ideal* boy. This picture is reminiscent of the way we categorize goal-derived categories according to Barsalou (1985), and we have seen that what are typical features for such a category are features that do a good job of distinguishing members from this category from members from others. But obviously, this is exactly what our analysis of generics is meant to do in the first place. This suggests that, just like for descriptive generics, contingency $\Delta P_G^f = P(f/G) - P(f/\neg G)$ should play an important role for normative generics like (15a) and (15b) as well.

But what, then, does distinguish normative from descriptive generics? What distinguishes the two types of generics, I would like to claim, is exactly the fact that the generics of the former type are not descriptiv.! More precisely, the probabilities involved in normative generics measure *normative expectations* rather than actual propensities. If so, it immediately follows that ΔP_G^f is high for such a generic of the form 'Gs are f', and thus that except for the interpretation of P, we could interpret non-descriptive generics in exactly the same way as descriptive generics.

Intuitively, normative expectations do not only involve beliefs, i.e., expectations measured by probabilities, but also desires. Indeed, I would think it is natural to claim that (15a) is really about *desirable* features for boys. With a slightly more general definition of ∇P_G^f we can account for this. Let us redefine ∇P_G^f in a slightly more general way than we have so far as $(P(f/G) \times Value(f/G)) - (P(f/\neg G) \times Value(f/\neg G))$. A user of (15a) values it highly if boys don't cry, i.e., if $Value(\neg cry/Boys)$ is high, although for this speaker $Value(\neg cry/Girls)$ might as well be low. Assuming that $P(\neg cry/Boys) \approx P(\neg cry/Girls)$ with P just measuring expectations, it still follows that ∇P_{Boys}^{cry} is high, and the speaker signals that (s)he wants boys not to cry.

5 Strong Pragmatics: from biases to probabilities

On the basis of experimental evidence, Cimpian et al. (2010) concluded that to *accept* a generic about a group we are familiar with, relatively weak conditions have to be fulfilled. At the same time, Cimpian et al. (2010) have observed that hearers *interpret* generics in a much stronger way: (almost) all Gs are f. This holds especially if this generic is about a relatively unknown group. What could explain this strong interpretation?

Our **proposal** is that this is due to the fact that people generally **confuse** representativeness (or stereotypicality) with probability (or prototypicality). This idea might seem ad hoc, but it is in fact at the heart of the whole Biases and Heuristics program of Tversky and Kahneman (1974), and the confusion between contingency and probability is explicitly argued for in the more recent Associative Theories of Probability Judgement. The first program started with Tversky and Kahneman showing that our intuitions involving probability judgements are not in accordance with the norms given by Bayesian probability theory.

Bayesian probability theory is a *prescriptive* theory. Unfortunately, it doesn't seem *descriptively* adequate. The conjunction fallacy of Kahneman and Tversky (1972) shows that in some situations people assign greater probability to a conjunction than to one of its conjuncts, i.e., $P(B \wedge F) > P(B)$, although this is impossible according to the normative Bayesian theory. For example, a woman (Linda) with liberal political views was judged by most participants to be more likely a feminist bank teller than a bank teller. According to their Biases and Heuristics program (Tversky and Kahneman (1974)), to reach a probability judgement, we often do not reason according to Bayesian probability theory, but use simplifying or shortcut heuristics. These heuristics are mostly approximately correct, but also give rise to systematic biases in certain contexts.

We have seen above that the contingency, or associative strength, between cue C and outcome O is measured by $\Delta P_C^O = P(O/C) - P(O/\neg C)$. The Associative Theories of Probability Judgements (Gluck and Bower, 1988; Lagnado and Shanks, 2002) now make the **further claim** that the subsequent probability judgments are then based on these associations.[15] Although the contingency between C and O might be very different from the conditional probability of O given C, association theories of probability judgements claim that when people are asked a question about probability, they readily substitute this with the closely related question about evidential support, or contingency, which sometimes gives rise to an incorrect response.[16] Lagnado and Shanks (2002) show that the Associative Theory of Probability Judgements can account for the conjunction fallacy. In a similar way, associative theories of probability judgments can explain

[15]Of course, ΔP_C^O can be anywhere between -1 and 1, whereas probabilities need to be between 0 and 1. How can $\Delta P_C^O \times P(O/C)$ be turned into a probability? For such cases, normally a logistic function is used, a transformation function that turns measures from $[-\infty,\infty]$ into $[0,1]$ such that everything below 0 goes to somewhere below $\frac{1}{2}$ and analogously to everything above 0.

[16]To give a telling example from Newel et al. (2007), suppose that a football team is as likely to win as to lose when Johan plays, but that the team much more likely loses when Johan is not playing. In that case, although $P(win/Johan\ plays) = P(\neg win/Johan\ plays)$, still people typically will believe that the team will win if Johan is playing.

other ways people deviate from the normative Bayesian theory, such as the fact that people tend to neglect base rates.

The problem I wanted to account for in this section is to explain why people generally interpret generics of the form 'Gs are f' as holding that $P(f/G)$ is high. Our analysis merely predicts that the sentence is true iff ∇P_G^f is high, which means that $[P(f/G) - P(f/\neg G)] \times Intens(f)$ is high. Given the Associative Theory of Probability Judgements, the gap beween the two can easily be bridged in case all features have the same value. Recall that if the value of the features is irrelevant, high ∇P_G^f reduces to a high contingency. By the Associative Theory of Probability Judgements, however, this is confused with high $P(f/G)$, which explains the common intuition under these circumstances.

What if the intensities of the features might be important, i.e., if the relevant features are 'horrific', 'appalling', or 'peculiar'? According to Tversky and Kahneman (1974) *availability heuristics*, people assess the probability of an event by the ease with which instances or occurrences can be brought to mind. Usually this heuristic works quite well; all things being equal, common events are easier to remember or imagine than uncommon events. Unfortunately, sometimes the general rule of thumb doesn't do its job and leads to systematic biases. Some events are more available than others not because they tend to occur frequently or with high probability, but simply because they are inherently easier to think about. Emotionally-charged events, or horrific or appalling features, can be brought to mind easily. Presumably, the same will hold for other newsworthy events or features, in particular for the peculiar ones. Thus, by the availability heuristics, $P(f/G)$ and $P(f/\neg G)$ are considered higher than they actually are, if $Intens(f)$ is high, and the same will thus be the case for the contingency ΔP_G^f. But this means via the associative theory of probability judgement again that $P(f/G)$ is considered higher than it actually is, perhaps close to 1.

Thus, I have argued that hearers that are unfamiliar with group G interpret a generic of the form 'Gs are f' in a much stronger way than one would expect according to the semantic analysis I defended in the previous section, because they confuse representative features, features f where $P(f/G) - P(f/\neg G)) \times Intens(g)]$ is high, with probable feature, features f where $P^*(f/G)$ is high. In the last formula, P^* models subjective belief rather than objective frequencies or propensities. Obviously, if $P^*(f/G)$ is high, we have explained why the generic 'Gs are f' is interpreted as meaning that almost all Gs are f.

There is yet another reason as to why a high representativeness, or contingency, between G and f increases the felt conditional probability $P(f/G)$, i.e., $P^*(f/G)$. Note, first, that it is, or at least was, quite common among psychologists and philosophers of science to use ΔP_G^f to measure the causal strength of G for f. Second, Tversky and Kahneman (1980) show that if we see a correlation, we tend to interpret it in the preferred (strongest) way: as **causal**. Moreover, they show that an event is seen as **more likely** than it actually is, if it can be understood: if it can be causally explained. This, then, is the causality bias: high representiveness of a feature for G as we measured it, leads to higher subjective probability given G than is justified, because we believe that there exists a causal relation between G and f.

This last reason why high representability leads to high conditional probability is closely related with proposals of Barth (1971), Leslie (2015) and Haslanger (2010), Haslanger (2014) why we (and children in particular) *interpret* generics typically in such a strong way. Haslanger (2014) argues that if we use a generic like 'Women are more nurturing than men', we (wrongly) implicate that there is something about what it is to be a woman and about what it is to be a man that explains their supposed differential capacities to nurture. From this she concludes that the utterance of a generic of the form '*G*s are *f*' will normally add to the common ground of the conversation a claim about *f*'s naturalness for the group, or kind, *G*. The generic is (wrongly) taken to be true because of *G*s essence. Haslanger (2014) and Leslie (2015) argue that this is why it is dangerous to claim 'Muslims are terrorists' but not 'Ticks carry the Lyme disease': while for the latter essentialists belief might be true, this is certainly not the case for the former. Although I agree with Barth (1971), Haslanger (2014) and Leslie (2015) that essentialist beliefs play a pragmatically significant role in why we interpret generic statements in such a strong way, I don't think this is the whole reason: it is only one of the biases singled out by Tversky and Kahneman (1974) that are crucial.

6 Conclusion and outlook

In this paper I have based my analysis of generic sentences primarily on an intuition that some authors over the years have claimed would be natural for at least some examples (e.g. Krifka et al. (1995)): a generic of the form '*G*s are *f*' is true iff *f* is a typical, distinguishing, feature for *G*s. Many analyses of generics have been proposed over the years, and none has come out as the clear winner. This is partly due, I suspect, to the vagueness and context-dependence of what is meant by a generic. I have little doubt that my proposal won't meet universal acceptance either. Still, I hope that this paper at least shows that an analysis in terms of typicality can be pushed much further than is generally assumed. I also argued that such a semantic analysis is naturally extended by pragmatic strengthening, making use of insights from Tversky & Kahneman's Heuristics and Biases approach. This popular approach within social and cognitive psychology (as measured by the selling rates of Kahneman (2011)), has, to the best of my knowledge, never been used so far in pragmatics. I think this is a shame, and I hope this paper will help to change things accordingly.

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Returning to non-entailed presuppositions again[1]

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Abstract. Recent work by Sudo (2012) and Klinedinst (2016) proposes a new perspective on differences between classes of presupposition triggers, with an empirical split roughly mirroring Abusch's (2002) hard vs. soft distinction and related notions. These two authors propose that triggers differ in whether or not their presuppositional content simultaneously affects the calculation of the presuppositions and of the entailments of the sentences in which they appear. Drawing on a proposal by Glanzberg (2005) we formulate the Removability/Independence Hypothesis: triggers that do not affect entailments are triggers that can be left out of sentences without affecting interpretability. We experimentally test the hypothesis by embedding *return*, *(go) again* and *(go) back* in non-monotonic environments, which Sudo argues to elicit differences in presuppositions and entailments. Our results provide clear evidence against the RI hypothesis: whereas only the trigger *return* is crucial for the sake of interpretability, all three triggers produced similar results. At the same time, data for the triggers *stop* and *also*, included as controls, lend further support in favor of Sudo's entailment-contrast proposal.

Keywords: presuppositions, entailment, hard/soft distinction.

1. Introduction

As evident from (1), *start*, *stop* and *too* all trigger a presupposition: while a speaker can ask (1a) and remain agnostic as to whether Mei fought criminals before (and after) she graduated, they make a commitment about her pre-graduation habits when asking (1b), (1c) or (1d). Indeed, despite the interrogative aspect of these sentences, a speaker asking (1b) takes for granted that Mei did not fight criminals before graduating and, likewise, a speaker asking (1c) or (1d) takes for granted that she did fight criminals before she graduated. The presupposition is said to project: it survives embedding under a question operator.[2]

(1) a. Did Mei fight criminals after she graduated?
 b. Did Mei **start** fighting criminals after she graduated?
 c. Did Mei **stop** fighting criminals after she graduated?
 d. Did Mei fight criminals after she graduated **too**?

Since Abusch (2002), it has been standard to assume a division between so-called hard and soft presuppositions. Abusch proposes that there is a categorical difference between presuppositions like those of *start* and *stop* on the one hand, and presuppositions like those of *too* on the other hand. She remarks that even though *start* and *stop* associate with contradictory presuppositions, a speaker can utter (2a) without suffering contradiction, with the resulting interpretation

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[2]The phrase *after she graduated* arguably also introduces the presupposition that Mei graduated. We will ignore this in the rest of this paper.

in (2b). This stands in contrast with (3a), where the presuppositions that *too* triggers (that she fought/supported criminals after she graduated) from each disjunct also stand in a relation of contradiction, thereby making (3a) a contradictory utterance. Abusch's conclusion is that *start* and *stop* are soft triggers whose presuppositions can easily be suspended for the sake of discourse felicity (as in (2)) whereas *too* is a hard trigger whose presuppositions project even when leading to discourse contradiction as in (3).

(2) a. Mei either started fighting criminals after she graduated, or stopped fighting criminals after she graduated.
   b. Mei either [didn't fight criminals before she graduated and] started afterwards, or [fought criminals before she graduated and] stopped afterwards. = (2a)

(3) a. ? Mei either supported criminals after she graduated too, or fought criminals after she graduated too.
   b. Mei either [supported criminals before she graduated and] did so afterwards too, or [fought criminals before she graduated and] did so afterwards too. ≠ (3a)

Granted that presuppositions come either as hard or soft, the problem is twofold: i) what are the characteristics of presuppositions that make them easily suspendable (soft) or more persistent (hard) and ii) what systematic principles, if any, govern the mapping of triggers onto being either hard or soft? Abusch only offers an answer to the first question.[3] She proposes that soft presuppositions are derived through pragmatic means, whereas hard presuppositions are encoded into the semantics of their lexical triggers. The assumption is that contextual factors can block the pragmatic derivation of a presupposition but cannot obviate the constraints that lexical items impose on the compositional computation of a sentence's semantic value.

While Abusch's proposal constitutes an explanatory account of why soft and hard presuppositions differ in terms of suspendability, it leaves the second aspect of the problem unresolved, namely what properties of expressions associate them with soft rather than hard (e.g., *stop*), or hard rather than soft presuppositions (e.g., *too*).[4] In this paper, we consider a proposal by Klinedinst (2016: see also Sudo 2012) that develops an answer to the first question independently from Abusch's analysis, and a proposal by Glanzberg (2005: see also Zeevat 1992) that offers a possible answer to the second question. We consider the possibility of linking the two proposals by formulating what we call the *Removability/Independence Hypothesis* and proceed to experimentally test its predictions. While our results support the existence of a contrast opposing the trigger *stop* to the triggers *also* and *again* along a Sudo-Klinedinst split line, they reveal that the trigger *return* patterns with *also* and *again* rather than with *stop*, contra the predictions of our *Removability/Independence Hypothesis*. As a conclusion, we give a critical review of some of the current theories of presuppositions in light of our results.

[3]Though see her footnote 5 for hints at possible answers to the second question.
[4]From this point on we extend Abusch's terminology of soft vs. hard *presuppositions* in a way that respectively associates them with soft vs. hard *triggers*.

2. Entailing vs. Non-Entailing Presupposition Triggers

2.1. Theoretical Background

In this paper, we will adopt Heim and Kratzer's (1998) notation of semantic values, which distinguishes domain conditions (in boldface, our emphases) from truth conditions (underlined, our emphases). (4) illustrates this notation: (4b) is a formal representation of the semantic value of (4a). The presupposition that Mei used to fight criminals before graduation is represented by the boldface domain condition. The underlined truth conditions represent the proposition about Mei fighting criminals after graduation. Operators like interrogation or disjunction target truth conditions but leave domain conditions unaffected, resulting in presupposition projection.

(4) a. Mei fought criminals after she graduated too.
  b. $[[(4a)]] = \lambda w : \exists \mathbf{t} < \mathbf{t_{grad}}$ **fight-criminals**$(\mathbf{m}, \mathbf{t}, \mathbf{w})$. $\underline{\text{fight-criminals}(m, t_{grad}, w)}$.

In (2), the second disjunct containing the trigger *stop*, repeated in (5a), appears to lack a presupposition. We represent its apparent semantic contribution to (2a) in (5b): what appears as a domain condition in (4b) appears as part of the truth-conditions in (5b).

(5) a. Mei stopped fighting criminals after she graduated.
  b. $\lambda w.\ \underline{\exists t < t_{grad}\ \text{fight-criminals}(m, t, w)} \quad \wedge \quad \underline{\neg\ \text{fight-criminals}(m, t_{grad}, w)}$.

Were we unaware of the presuppositional properties of *stop*, a natural conclusion from the observation of (5a) receiving the interpretation in (5b) would be to say that *stop* conveys only the truth conditions in (6).

(6) $\lambda P.\lambda x.\lambda w.\underline{\exists t < t_0\ \ P(x, t, w)\ \wedge \neg P(x, t_0, w)}$.

However, we have already established with (1c) that *stop* presupposes that its complement predicate was true of its subject at a previous time. A possible refinement would be to say that (7) is a more accurate representation of the lexical entry of *stop*, and posit an operation that can convert domain conditions into truth-conditions, which would derive (6) from (7). Speakers using (5a) in the disjunction (2a) could then apply that operation, and standard rules of composition would associate the *stop* disjunct with the semantic value in (5b).

(7) $\lambda P.\lambda x.\lambda w : \exists \mathbf{t} < \mathbf{t_0}\ \ \mathbf{P}(\mathbf{x}, \mathbf{t}, \mathbf{w}).\ \underline{\neg P(x, t_0, w)}$.

What we just described has been a standard approach since Heim (1983), who introduces this notion of conversion as local accommodation. It facilitates starting from a lexical representation of *stop* as in (7) so as to account for presuppositional uses as in (1c) while also accounting for non-presuppositional uses as in (2a) at the same time.

One pitfall of this approach in light of the contrast elicited by Abusch is that, as things stand, it would predict non-presuppositional uses of *too* to the same extent as there are non-presuppositional uses of *stop*. If local accommodation can convert any domain condition into truth condition, then (4a) should also associate with an alternative version of (4b) where the boldface domain conditions appear as part of the underlined truth conditions, in a way parallel to (5b). A direct, unwelcome prediction is that the *too* disjunction (3a) should receive the non-presuppositional interpretation in (3b) in the same way that the *start/stop* disjunction (2a) receives the non-presuppositional interpretation in (2b). Since this is not the case, the only solution to account for the contrast is to stipulate that *too* resists local accommodation in a way that *stop* (and *start*) do not.

Klinedinst (2016) offers an alternative explanation. Rather than revising (6) as a semantic value for *stop* in favor of (7), Klinedinst proposes to enrich it with a domain condition as in (8).

(8) $[[stop]] = \lambda P.\lambda x.\lambda w : \exists \mathbf{t} < \mathbf{t_0}\ \mathbf{P(x,t,w)}.\ \underline{\exists t < t_0\ P(x,t,w)\ \wedge\ \neg P(x,t_0,w)}.$

Such a lexical entry does not straightforwardly account for apparent non-presuppositional uses of *stop*, and Klinedinst therefore also needs to posit an operation to prevent domain conditions from projecting and giving rise to a presupposition in the case of the *stop-start* disjunction (2a). One could make use of the operation of conversion that we described earlier, but note that that operation of conversion can be described as a two-step process: first make a copy of the domain conditions into the truth conditions, second delete the domain conditions. Only the second step is required when starting from the lexical entry in (8). (9) illustrates the one-step process.

(9)
a. $\lambda P.\lambda x.\lambda w : \exists \mathbf{t} < \mathbf{t_0}\ \mathbf{P(x,t,w)}.\ \underline{\exists t < t_0\ P(x,t,w)\ \wedge\ \neg P(x,t_0,w)}.$
b. $\lambda P.\lambda x.\lambda w : \cancel{\exists \mathbf{t} < \mathbf{t_0}\ \mathbf{P(x,t,w)}}.\ \underline{\exists t < t_0\ P(x,t,w)\ \wedge\ \neg P(x,t_0,w)}.$ DELETION
c. $\lambda P.\lambda x.\lambda w.\ \underline{\exists t < t_0\ P(x,t,w)\ \wedge\ \neg P(x,t_0,w)}.$

In our view, the main advantage of Klinedinst's approach over the standard approach does not come from reducing the complexity of the posited operation. After all, the price to pay for a simpler operation is to posit a richer, somewhat redundant lexical entry for *stop*: the same proposition appears both as a domain condition and as a truth condition. The very welcome consequence of Klinedinst's position becomes evident when one considers non-redundant semantic values, that is, semantic values where domain condition propositions do not appear as part of the truth conditions. Let us compare the alternative semantic values to the one we gave for the *too* disjunct in (4b) after conversion (10) versus after deletion (11).

(10) Mei fought criminals after she graduated too.
a. $\lambda w : \exists \mathbf{t} < \mathbf{t_{graduate}}\ \mathbf{fight\text{-}criminals(m,t,w)}.\ \underline{\text{fight-criminals}(m, t_{graduate}, w)}.$
b. $\lambda w : \cancel{\exists \mathbf{t} < \mathbf{t_{graduate}}\ \mathbf{fight\text{-}criminals(m,t,w)}}.$ CONVERSION
$[\exists t < t_{graduate}\ \text{fight-criminals}(m,t,w)]_{copy} \wedge \underline{\text{fight-criminals}(m, t_{graduate}, w)}.$
c. $\lambda w.\ \underline{\exists t < t_{graduate}\ \text{fight-criminals}(m,t,w) \wedge \text{fight-criminals}(m, t_{graduate}, w)}.$

(11) Mei fought criminals after she graduated too.
a. $\lambda w : \exists \mathbf{t} < \mathbf{t_{graduate}}\ \mathbf{fight\text{-}criminals(m,t,w)}.\ \underline{\text{fight-criminals}(m, t_{graduate}, w)}.$
b. $\lambda w : \cancel{\exists \mathbf{t} < \mathbf{t_{graduate}}\ \mathbf{fight\text{-}criminals(m,t,w)}}.\ \underline{\text{fight-criminals}(m, t_{graduate}, w)}.$ DEL.
c. $\lambda w.\ \underline{\text{fight-criminals}(m, t_{graduate}, w)}.$

It should not come as a surprise that the truth conditions expressed in (10c) correspond exactly to the second disjunct of the unavailable interpretation (3b): the standard approach has to prevent conversion from happening with *too* in order to account for the unavailability of (3b). On the other hand, there is no way to arrive at that interpretation from (11c), since the proposition expressed in the domain condition has been lost in the process of deletion. This result makes Klinedinst's approach a better candidate to explain the contrast between *stop* and *too* than the standard approach. Klinedinst's view directly predicts a split along the lines of the hard vs. soft distinction by exhausting the answers to a question that arises when considering Heim and Kratzer's notation: do the propositions in the domain conditions also appear in the truth conditions? The answer is: when they do, the result is a soft trigger like *stop* and when they do not, the result is a hard trigger like *too*.

In this paper, we will refer to triggers like *stop* whose truth conditions entail their domain conditions as *entailing triggers*, and to triggers like *too* as *non-entailing triggers*.[5] Klinedinst (2016) is not the first author to propose that one should distinguish between entailing and non-entailing triggers. This idea has received direct or indirect support both from the theoretical and the experimental literature.

2.2. Theoretical support

Two studies on the licensing of Negative Polarity Items (NPIs) have made use of the entailing vs. non-entailing distinction. Chierchia (2015: pp. 8–9) cites Gajewski (2011) as offering an analysis of the NPI-licensing contrast between plural and singular *the* illustrated in (12) along the lines of the entailing vs. non-entailing distinction. Gajewski models the plural and singular determiners as sharing an existential and a maximality presupposition, but models only singular *the* as also entailing the existence presuppositions. Gajewski then shows how the Downward-Entailing (DE) context characterizing the entailments of plural *the* gets neutralized by adding the presupposed content to the entailments of singular *the*. Since NPIs are assumed to be licensed only in Downward-Entailing (DE) contexts, only plural *the* licenses NPIs.

(12) a. *Plural:* The clients that had **any** complaint were refunded.
b. *Singular:* * The client that had **any** complaint was refunded.

Drawing on Gajewski's proposal, Chierchia (2015) argues that such an entailing-vs-non-entailing approach can account for a contrast between English and Italian factives: while in English, certain emotive factives, but not cognitive factives, license NPIs (13), in Italian, no factive ever licenses NPIs, no matter whether emotive or cognitive. Chierchia assumes a cross-linguistically uniform semantics for factive verbs where only emotive factives introduce a DE context, thus accounting for their licensing of NPIs in English. He locates the contrast between English and Italian in their different complementizer systems (e.g., English *that* vs. Italian *che*). In the same way that the DE context found in the (non-entailing) plural determiner is neutralized by the (entailing) singular determiner in Gajewski (2011), Chierchia proposes that English

[5] Note that independently of Klinedinst's analysis, one can still conceive of an entailing vs. non-entailing contrast as technically distinct from the soft vs. hard distinction.

and Italian complementizers both trigger the presupposition that the complement is true, but Italian complementizers additionally entail the truth of the complement. As a result, Chierchia shows, the DE context introduced by emotive factives get neutralized in Italian, but is left unaffected in English.

(13) a. *Emotive:* She was surprised that there was **any** food left
b. *Cognitive:* * She was aware that there was **any** food left

Sudo (2012) already hints at Klinedinst's later analysis of the hard vs. soft contrast in terms of an entailing vs. non-entailing split, but his main interest lies in the consequences of such a theoretical split on truth value judgments. He makes a crucial contribution to this question by identifying a linguistic environment where the contrast becomes evident. Sudo observes that embedding *stop* or *again* under non-monotone quantifiers such as *Exactly N* predicts different outcomes in otherwise equivalent contexts. Imagine two Linux computers and two Windows computers: the two Linux computers always crashed at launch last week, but the two Windows computers never crashed. This week, it was one of the two Linux computers and one of the two Windows computers that always crashed at launch. Sudo claims that the sentence (14) is a better description of the situation than the sentence (15), which he attributes to them having the semantic effect paraphrased in (b) for both examples.

(14) Exactly one computer stopped crashing this week.
a. $\lambda w : \frac{|\{\mathbf{x} : \mathbf{computer}(\mathbf{x}, \mathbf{w}) \wedge \exists \mathbf{t} < \mathbf{t_0}\ \mathbf{crashed}(\mathbf{x}, \mathbf{t}, \mathbf{w})\}| \geq \mathbf{1}.}{|\{x : computer(x,w) \wedge \exists t < t_0\ crashed(x,t,w) \wedge \neg crashed(x,t_0,w)\}| = 1.}$
b. ≈ The numbers of computers that went from crashing to not crashing is one

(15) Exactly one computer crashed again this week.
a. $\lambda w : \frac{|\{\mathbf{x} : \mathbf{computer}(\mathbf{x}, \mathbf{w}) \wedge \exists \mathbf{t} < \mathbf{t_0}\ \mathbf{crashed}(\mathbf{x}, \mathbf{t}, \mathbf{w})\}| \geq \mathbf{1}.}{|\{x : computer(x,w) \wedge crashed(x,t_0,w)\}| = 1.}$
b. ≈ The number of computers that just crashed is one

Both *stop* and *again* introduce an existential presupposition about crashing last week. Because *stop* entails its presupposition, evaluating the truth of (14) consists only in counting the number of Linux computers that didn't crash this week, since those are the ones that crashed last week to start with. Since only one of the Linux computers crashed this week, (14) is a true description of the situation. By contrast, *again* does not entail its presupposition and therefore considerations about last-week crashes do not factor in when evaluating the truth conditions of (15). Since more than one (namely two) of the four computers crashed this week (one in each group) (15) fails at giving an accurate description of the situation.

2.3. Experimental support

In a series of experiments testing sentences like (14) and (15) and controlling for various potential confounds, we found that English speakers' judgments align with Sudo's claims (Zehr and Schwarz 2016).[6] We describe the design of these experiments below, as we used the same design for the experiment discussed in this paper. Results from Cummins et al. (2012) and Amaral and Cummins (2015) also provide indirect support for the view that the presuppositions of a subset of expressions make optional contributions at the truth conditional level. These researchers presented their participants with brief dialogues in which one interlocutor affirms a presuppositional question while denying the presupposition. The dialogues were reported to be more natural for some triggers than for others. Djärv et al. (2017) adapted their paradigm to investigate cognitive vs. emotive factives (16) and found that their participants rated the dialogues as more natural when they involved emotives. They offer an analysis where speakers can accept an utterance while denying its presuppositions as long as its truth conditions are met: such an attitude is blocked for cognitive factives, which the authors analyze as entailing their presuppositions, but it is available for emotive factives, which are analyzed as non-entailing triggers (17).[7]

(16) *Q:* Was Nadia **aware**$_{cog}$**/happy**$_{emo}$ that the Patriots won the Superbowl?
A: Yes, although they didn't.

(17) Yes [truth conditions], although [not **presuppositions**].
$\lambda w: \mathbf{win}(\mathbf{Patriots}, \mathbf{w}).\ \underline{win(Patriots, w)} \wedge \underline{\forall w' \in Dox(m,w)\ win(Patriots, w')}$. COG
$\lambda w: \mathbf{win}(\mathbf{Patriots}, \mathbf{w}).\ \underline{happy(m, w)} \wedge \underline{\forall w' \in Dox(m,w)\ win(Patriots, w')}$. EMO

Experimental work on the processing of presuppositions provides us with further evidence that presuppositions come in different types. Domaneschi et al. (2014) invited their participants to memorize figures displayed on the screen for 6 seconds, listen to a recording of a short text, answer a question about the content of the text, and finally indicate which of sixteen figures displayed on the screen they were told to memorize at the beginning. The authors were interested in what happened between the two figure-display steps: the text contained five types of presupposition triggers, and five of the subsequent questions addressed their presuppositions. Having to keep in mind representations of figures for later recall constitutes a cognitive load that, the authors assumed, might unevenly impact the processing of presuppositions as opposed to the processing of entailments/truth conditions. Their participants' answers indicate that they consistently endorsed the presuppositions of definite descriptions and factive verbs: after listening to the text—which contained **the** *zambezi sharks* and *the guide* **explained that** *all the sharks are female*—the participants reported that there were zambezi sharks in the aquarium and that all the sharks were female. By contrast, their participants much less readily endorsed the presuppositions of focus-sensitive particles and iterative triggers: the text contained **even** *the zambezi sharks are taken out of their tanks* and *the* **re-***introduction of a male shark into the tank*, but only slightly more than half the participants reported that other animals were sometimes taken out of the tank and that a male shark had previously been introduced into the tank. Tiemann (2014) and Tiemann et al. (2015) randomly presented each of their participants with

[6]Importantly, judgments in control conditions indicate that our design successfully blocked problematic wide-scope readings of *again* which would yield the following interpretation for (15): *this week again, one computer crashed.*

[7]We give over-simplified truth conditions for *happy*: the crucial point is that they do not entail the domain conditions/presupposition.

one of two versions of a very short story: they both contained *again* and varied in whether they provided explicit support for its presupposition (18). An increase in reading times in the unsupported version indicates that participants were sensitive to the presence of a presupposition, and yet they show no sign of endorsement of the presupposition when probed for it (choosing to report that Linda received one pink lamp, not two).

(18) Last week, Linda bought Judith a pink lamp for a room.
  a. Two days ago, Judith received a pink lamp again. SUPPORT
  b. Two days ago, Linda received a pink lamp again. NEUTRAL

Both groups of authors analyze their results in light of a proposal by Glanzberg (2005) and claim that presupposition triggers pattern in two categories, differing in the optionality vs. necessity to endorse the truth of their presuppositions for successfully processing the sentences in which they appear. This paper proposes to analyze the entailing vs. non-entailing distinction in the same terms. The next section describes Glanzberg (2005)'s proposal and formulates a hypothesis linking it to the entailment properties of presupposition triggers.

3. The Removability/Independence Hypothesis

Glanzberg (2005) argues for a model of utterance interpretation where only a subset of presuppositions have crippling consequences when not supported by context. He illustrates such a situation with cleft constructions (19), which are known to trigger an existence presupposition (19a).[8] Glanzberg proposes that determining the non-presuppositional contribution of cleft constructions necessitates resolving their presuppositional contribution, insofar as the existence presupposition binds a variable that features in the truth conditions (19b).[9] Being unable to instantiate the variable (because the context clashes with the existence presupposition) results in being unable to process the truth conditions.[10]

(19) Was it Shappa who fixed the car?
  a. Someone fixed the car
  b. $\lambda w : \exists \mathbf{x}\ \mathbf{fixed}(\mathbf{C}, \mathbf{x}, \mathbf{w}).\ \underline{x = S}$.

On the other hand, Glanzberg proposes that determining the non-presuppositional contribution of *too* is independent from determining its presuppositional contribution, insofar as it involves no variable bound across the two domains (20b). As a result, even if the context establishes that the presupposition cannot hold (e.g., it has already been settled that Shappa did not fix anything—except possibly the phone) the truth conditions can still be felicitously processed.

[8] One might argue that clefts also carry exhaustivity presuppositions. We ignore this aspect here for the sake of the discussion.

[9] (19b) exhibits non standard conventions for cross-domain anaphora: the x appearing in the truth conditions is to be read as bound by the existential operator in the domain condition.

[10] Our use of the expression *truth conditions* diverges from Glanzberg's, as is our attempt at rendering the interpretation of presuppositional utterances in Heim and Kratzer (1998)'s notation style, since Glanzberg's analyses are termed in a dynamic semantic framework.

(20) Did Shappa fix the phone too?
a. Shappa fixed something else (e.g., the car)
b. $\lambda w : \exists \mathbf{x} \neq \mathbf{P}\ \mathbf{fixed}(\mathbf{x}, \mathbf{S}, \mathbf{w}).\ \underline{fixed(P, S, w)}.$

Glanzberg's approach provides a possible explanation for why a presupposition trigger would fall on one side or the other of Abusch's split, and the view that (part of) the presuppositional and non-presuppositional contents of some triggers would be inextricably intertwined resonates with the view that some triggers entail their presuppositions. At this point, it is a good idea to reiterate our goal: explain Abusch's observations about a contrast in presupposition suspension in terms of the Sudo/Klinedinst entailing vs. non-entailing distinction and explain the entailing vs. non-entailing distinction in terms of Glanzberg's intertwined vs. independent contributions distinction. However, we will depart from the methods Glanzberg uses to probe how each trigger relates its presuppositional and non-presuppositional contributions.[11] Instead, we will formulate the *Removability/Independence Hypothesis*, which we think makes clear and intuitive predictions about which triggers entail their presuppositions and which do not.

(21) **The Removability/Independence Hypothesis**
Presuppositions are NOT entailed if and only if
removing triggering material yields (non-strictly) weaker interpretations of sentences

Let us use (22) to illustrate how this hypothesis predicts that the presupposition of *again* is not entailed. Removing *again* from (22a) results in (22b), which is a grammatical question whose interpretation is equivalent to (22a), minus the presupposition of the latter. According to the Removability/Independence Hypothesis, *again* does not entail its presupposition.

(22) a. Did Aki's PC just crash again?
(i) Presupposed: Aki's PC crashed before
(ii) Questioned content: Aki's PC just crashed
b. Did Aki's PC just crash ~~again~~?
(i) ~~Presupposed: Aki's PC crashed before~~
(ii) Questioned content: Aki's PC just crashed

On the other hand, removing *stop* from (23a) results in (23b). Let alone the crucial syntactic role of *stop* as a matrix verb, no minimal syntactic reconstruction of (23b) (e.g., substituting *is* for *did* or removing *-ing* along with *stop*) would succeed in conveying the contrasting aspect of *stop* and in yielding an interpretation weaker or equivalent to that of the initial sentence.

(23) a. Did Aki's PC stop crashing?
(i) Presupposed: Aki's PC crashed before
(ii) Questioned content: Aki's PC does not crash now

[11] Glanzberg starts from the observation that the flow of a discussion is differently impacted by unmet presuppositions from different triggers, but later refines his view on factive predicates. We will not pursue the same route, but note that results from Djärv et al. (2017), discussed earlier, hint at a contrast between emotive and cognitive factive predicates, which Glanzberg treats as equally intertwining their presuppositional and non-presuppositional contributions (after the necessary application of a complex repair strategy, see his Section V.4).

b. *Did Aki's PC ~~stop~~ crashing?
   (i) ~~Presupposed: Aki's PC crashed before~~
   (ii) Questioned content: ?? Aki's PC ~~does not~~ crash ~~now~~

The two examples above should make clearer the intuition motivating the Removability/Independence Hypothesis: the semantic added value of some triggers, such as *again*, lies entirely in their presuppositions, so that their contribution is ultimately independent from the non-presuppositional content of the sentences in which they appear. Triggers like *stop* on the other hand, besides introducing presuppositions, make crucial contributions to the non-presuppositional content of the sentences in which they appear, in such a way that one cannot identify a presuppositional component next to a non-presuppositional component: the two come as one block. The hypothesis states that triggers of the former type define truth conditions that are independent from their presuppositions, while the presuppositions of triggers of the latter type are entangled in their truth conditions.

It should be noted that the hypothesis refers to triggering material rather than directly to triggers. Such a formulation is particularly adapted to cases like emotive vs. cognitive factives, for which designating factive predicates as triggers is standard, even though some authors propose to locate the source of the presupposition in the complementizer material (Chierchia 2015). We do not commit to a particular position here, but our formulation has the welcome property of categorizing the emotive factive *happy* as non-entailing and the cognitive factive *aware* as entailing, as can be seen in examples (24) and (25).

(24) a. Is Michelle happy that it's raining?
   (i) Presupposed: it's raining
   (ii) Questioned content: Michelle is happy (at the idea that it's raining)

b. Is Michelle happy ~~that it's raining~~?
   (i) ~~Presupposed: it's raining~~
   (ii) Questioned content: Michelle is happy (~~at the idea that it's raining~~)

(25) a. Is Michelle aware that it's raining?
   (i) Presupposed: it's raining
   (ii) Questioned content: Michelle believes that it's raining

b. $^{?}$ Is Michelle aware ~~that it's raining~~?
   (i) ~~Presupposed: it's raining~~
   (ii) Questioned content: ?? Michelle believes ~~that it's raining~~

In contrast to Glanzberg (2005)'s proposal, the Removability/Independence Hypothesis gives a prominent role to the form of triggering material. It is conceivable that two expressions make the same presuppositional and non-presuppositional contributions, but differ in that one but not the other has identifiable (and removable) material introducing presuppositions. As a result, the Removability/Independence Hypothesis expects that there should exist pairs of sentences whose truth conditions only differ in whether they entail their presuppositions.

4. Experiment

We considered the three presuppositional expressions, *go again*, *go back* and *return*, which, paired with a destination, give rise to contextually equivalent effects: They all describe a visit while presupposing another previous visit. The two first expressions, however, differ from the last in a crucial way with respect to our hypothesis: they contain two clearly identifiable parts, one of which communicates about a visit (*go*) and one of which adds a presupposition of a *previous* visit (*again/back*). The contrast becomes evident when we apply the test introduced above: (26b) and (27b) define interpretations equivalent to (26a) and (27a) modulo the disappearance of their presuppositions; removing *return* from (28a) though results in the uninterpretable sentence (28b), where the main predicate is missing.[12]

(26) a. Did Dominique go to the shop again?
 (i) Presupposed: Dominique previously went to the shop
 (ii) Questioned content: Dominique went to the shop

 b. Did Dominique go to the shop ~~again~~?
 (i) ~~Presupposed: Dominique previously went to the shop~~
 (ii) Questioned content: Dominique went to the shop

(27) a. Did Dominique go back to the shop?
 (i) Presupposed: Dominique previously went to the shop
 (ii) Questioned content: Dominique went to the shop

 b. Did Dominique go ~~back~~ to the shop?
 (i) ~~Presupposed: Dominique previously went to the shop~~
 (ii) Questioned content: Dominique went to the shop

(28) a. Did Dominique return to the shop?
 (i) Presupposed: Dominique previously went to the shop
 (ii) Questioned content: Dominique went to the shop

 b. *Did Dominique ~~return~~ to the shop?
 (i) ~~Presupposed: Dominique previously went to the shop~~
 (ii) Questioned content: ?? Dominique ~~went~~ to the shop

Based on the Removability/Independence Hypothesis only *return* should entail its presuppositions. We tested this prediction by embedding the three triggers in an *Exactly N* environment, as discussed in Sudo (2012). As mentioned in Section 2.3, we successfully designed experiments using Sudo's test in the past. The present experiment uses the same experimental design.

[12] A weaker version of the hypothesis analyzing *return* as non-entailing by identifying *re-* as the sole contributor of the presupposition would have to sacrifice transparency, for *turn* cannot be associated with the truth conditions of *return*, and it would ultimately fail at giving a criterion to identify material contributing only presuppositions.

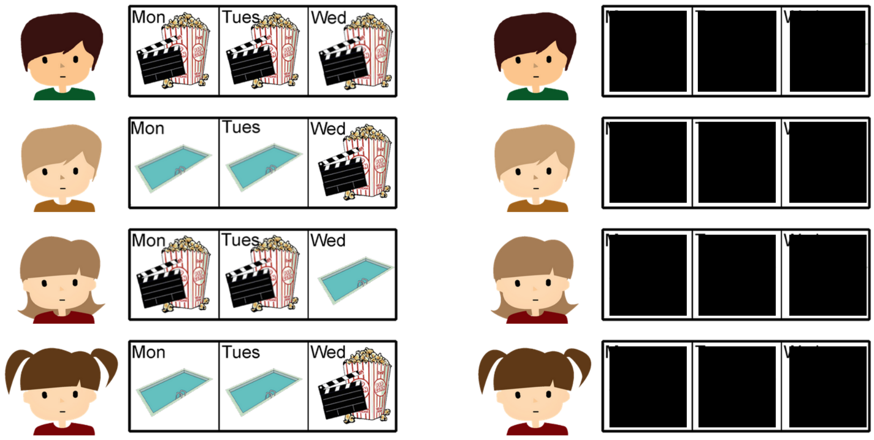

Figure 1: A visible and a covered picture displayed during a critical trial.

4.1. Design

Our experiment used the *Exactly N* test described in section 2.2 in a Covered Box design. Participants were informed that their task was to associate a sentence with one of two pictures on the screen, one fully visible and one whose content was partially hidden. The pictures in Figure 1 illustrate the type of pictures on the screen during critical trials for the sentences in (29). If participants access an entailing representation of the sentence (i), then they should report the visible picture on the left as a good match, since only one of the four characters is presented as going to the movies both before and on Wednesday. On the other hand, the visible picture on the left does not match a non-entailing representation (ii) since three of the four characters went to the movies on Wednesday, and participants should therefore select the covered picture on the right on the reasoning that the activity schedules obstructed by the black squares must represent a better match for the sentence.

(29) a. Exactly one kid went to the Ore City movie theater again on Wednesday
b. Exactly one kid went back to the Ore City movie theater on Wednesday
c. Exactly one kid returned to the Ore City movie theater on Wednesday

(i) $|\{x : movies(x, beforeW) \wedge movies(x,W)\}| = 1$
(ii) $|\{x : movies(x,W)\}| = 1$

4.2. Materials and Participants

In addition to the triggers *again*, *back* and *return*, we included two other triggers to serve as baselines, *stop* and *also* (30), that we found in a series of previous studies to give rise to responses respectively consistent with an entailing representation and a non-entailing representation (Zehr and Schwarz 2016). We used Prolific.ac to recruit 150 participants, who we randomly assigned to one of the five triggers; they were paid £1.5 for an average duration of 12 minutes. Visual stimuli like that in Fig. 1 defined the *Test* condition: we code them as $ABAB \rightarrow AABA$ to represent the transition from each character's Monday/Tuesday activities to their Wednesday activities (A standing for the activity mentioned in the *Exactly one* sentence).

The code for the visual stimuli in the *Visible Control* condition was *ABAB* → *ABBB*;[13] the code for the visual stimuli in the *Covered Control* condition was *ABAB* → *ABAA*.[14] Each participant saw 36 items, corresponding to 12 repetitions of each condition. We used a latin-square design to create 15 groups so that each of the 36 items would appear in all three conditions for all five triggers but each participant would see each item for only one condition. The items were presented in random order.

(30) a. Exactly one kid stopped going to the Ore City movie theater on Wednesday
b. Exactly one kid went to the Ore City movie theater again on Wednesday

Each trial consisted of a sequence corresponding to the following script. The two visible (left) and covered (right) pictures appear centered on the screen with only the Monday and Tuesday activities visible. An audio recording of a context sentence like that in (31) automatically plays back while participants look at the screen. The Wednesday slots appears at the end of the playback (covered by a black squares for the picture on the right) and an audio recording of one test sentence like the ones in (30) automatically starts playing back. From this point on, participants can select the visible left picture by pressing the *F* key on their keyboard, or the covered right picture by pressing *J*. The screen is cleared and the next trial starts after one of these two keys is pressed.

(31) This week, these kids went to Ore City for the first time. At the beginning of the week, some kids went to the Ore City pool, and some people went to the Ore City movie theater.

The sentences were recorded by a native speaker of English who was instructed to produce the intonation contour on the *also* sentences in such a way that it conveyed an association with *on Wednesday*.[15]

4.3. Predictions

Also and *stop* served as baselines. We reported in Zehr and Schwarz (2016) that *also* sentences yielded covered image choices and *stop* sentences visible image choices in the *Test* condition, as consistent with the predictions made by a view where *stop*, but not *also*, entails its presuppositions. We saw at the beginning of this section how the Removability/Independence Hypothesis analyzes *return* as an entailing trigger and *back* and *again* as non-entailing triggers. It thus predicts that *return* patterns with *stop* in eliciting visible picture choices in the *Test* condition, and that *back* and *again* pattern with *also* in eliciting covered picture choices.

[13] Note that in the *Visible Control* condition two of the four characters engage in the mentioned activity on Monday and Tuesday, thus controlling for potential wide-scope readings of *also* and *again* (see footnote 6).

[14] The codes defining the condition for *stop* were: *ABBA* → *BBBA* (*Test*), *ABBA* → *BAAA* (*Visible Control*) and *ABBA* → *BABB* (*Covered Control*)

[15] An archived version of the experiment can be found at `http://spellout.net/ibexexps/SchwarzLabArchive/PsEntStopReturnBackAgain/experiment.html`.

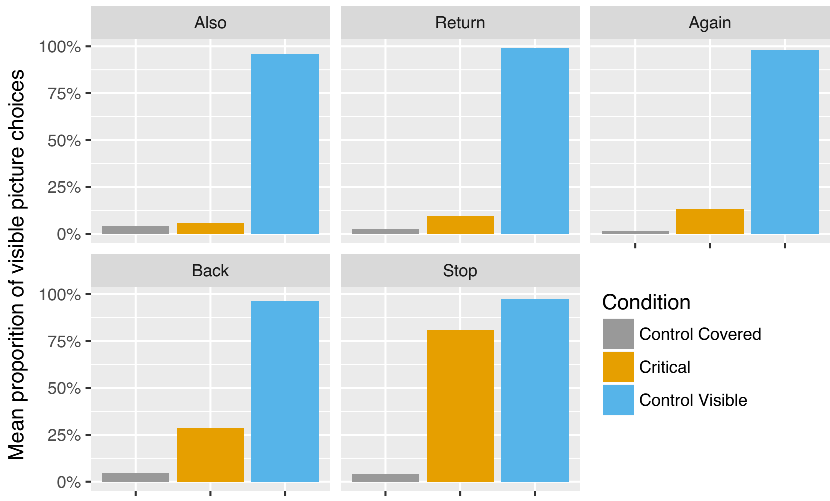

Figure 2: Proportions of visible picture choices per trigger per condition. Visible choices in critical conditions (green) are analyzed as indication of contribution to the entailments.

4.4. Results

Accuracy on controls was good overall, with the exception of a few participants in each group. We excluded from our analyses any participant who chose more than 25% visible or covered pictures in the *Control Covered* or *Control Visible* conditions respectively,[16] for a final set of 128 accurate participants out of 150. The bar plot in Figure 2 reports the mean choice of visible pictures for each trigger in each condition for the accurate participants.

We used the *R* software (version 3.3.3) and the function *lmer* (version $1.1-13$) to fit a logistic regression model on the data, predicting choices of visible pictures as a function of two factors (baselines first): Condition (*Test* vs. *Control Covered* vs. *Control Visible*) and Trigger (*Also* vs. *Return* vs. *Again* vs. *Back* vs. *Stop*). The model tested both for simple effects and interactions between the two factors and included a random intercept per item and per participant as well as a random slope per participant per condition. Following the recommendations of Bates et al. (2015) we started from a maximal random structure and simplified it until we reached the simplest converging model that would not significantly differ in goodness of fit (as reported by ANOVA comparisons of models). Our final model forced a zero correlation in the random slope per participant per condition.

The model reports no significant contrast between *Also-Test* on the one hand and *Return-Test* ($\beta = 1.0181; SE = 1.285; p = 0.428$) and *Again-Test* ($\beta = 1.8218; SE = 1.338; p = 0.173$) on the other hand. *Back-Test*, however, significantly increased the likelihood of a visible picture observation ($\beta = 3.539; SE = 1.349; p < 0.01$) and so did *Stop-Test* ($\beta = 11.2195; SE = 1.849; p < 0.01$). Participants were reportedly more likely to choose the visible picture in *Also-Control Covered* than in *Also-Test* ($\beta = 2.9478; SE = 1.158; p < 0.05$). Note that this effect is opposite of the descriptive summary in Fig. 2. Looking at individual profiles reveals that 9

[16] Distributed across trigger groups as follows: *Also*: -7 ppts; *Return*: -1; *Back*: -3; *Again*: -4; *Stop*: -7.

out of the 24 *Also* participants selected the visible picture at least once (and only once for 7 of them) in the *Control Covered* condition contra only 6 in the *Test* condition (4 of them were also *Control Covered* acceptants). The descriptive flip in the bar plot seems to be entirely due to one participant who selected the visible picture on more than half the *Test* trials, whereas no participant did so on more than a quarter the *Control Covered* trials (which follows from our filtering for accuracy). Two significant interactions are noteworthy: *Also vs. Again* × *Test vs. Control Covered* ($\beta = -2.8881; SE = 1.4239; p < 0.05$) and *Also vs. Back* × *Test vs. Control Covered* ($\beta = -3.4490; SE = 1.3824; p < 0.05$). Looking at individual profiles is again informative: 2 out of the 26 *Again* participants always chose the visible picture in the *Test* condition (while no *Also* participant did) and 9 out of the 27 *Back* participants chose the visible picture more than half the time in the *Test* condition (only one *Also* participant did).

5. Discussion

The results clearly contradict the predictions of the Removability/Independence Hypothesis: *return* did not pattern with the entailing trigger *stop*. Instead, it behaved remarkably similarly to the non-entailing trigger *also*, as did *again* and *back*. At the same time, it is important to note that these results replicate the contrast between *stop* and *also* that we had found in previous studies, which can be explained by a contrast in entailment. The *also* participants rejected visible pictures that depicted more than one character engaging in the mentioned activity on Wednesday (*Test* and *Control Covered* conditions) regardless of their activities on Monday and Tuesday. The entailed presupposition of *stop*, however, factored into the truth conditions of the *exactly one* sentences, so participants considered the Monday and Tuesday activities when counting characters. As a result, they accepted visible pictures that depicted more than one character not engaging in the mentioned activity on Wednesday, as long as only one of them had previously engaged in it on Monday and Tuesday.

Though the *Stop* participants clearly contrasted with the others in overwhelmingly choosing the visible picture in the *Test* condition, a small subset of the latter also consistently chose the visible picture in the *Test* condition. This is not straightforwardly expected if *also*, *again*, *back* and *return* do not entail their presuppositions, as suggested by the majority of participants who rejected the covered picture. In section 2.1 we followed Klinedinst (2016) in introducing the operation of presupposition deletion as a one-step alternative to the two-step operation of presupposition conversion commonly known as *local accommodation*. The two operations are not mutually exclusive, and we analyze (rare) acceptance of the visible picture in the *Test* condition as resulting from local accommodation of the presuppositions of *also*, *again*, *back* and *return*. As a result of this operation, these triggers yield interpretations where the presupposition becomes part of the truth conditions, as is the case lexically for *stop*, and those participants who applied local accommodation accordingly chose the visible picture in the *Test* condition, where only one character engaged in the mentioned activity both on Wednesday and on Monday and Tuesday. The question remains as to what led some of our participants to access local accommodation interpretations of our sentences, and more particularly why such interpretations were more readily available for *back* (and, to a lesser extent, for *again*) than for *also* and *return*. We have to leave this question for future investigations.[17]

[17]Focusing presupposition triggers could favor local accommodation readings, and one could tentatively explain

The Removability/Independence Hypothesis offered an explanatory approach by predicting which triggers entail and which do not entail their presuppositions. That *return* patterned with *also* rather than *stop* strikingly invalidates the hypothesis and leaves us in need of an account for why, out of the five triggers we tested, only *stop* seemed to always factor its presupposition into the process of picture selection. Tonhauser et al. (2013) conducted a series of three experiments showing that prosody influences whether factive presuppositions project outside of entailment-canceling environments, and offered an analysis where prosody serves as a proxy for the contextual information structure, which ultimately determines whether a presupposition is even triggered to start with. Following an analysis of our results along these lines, one would expect our *stop* recordings to manifest specific prosodic cues that distinguish them from our other recordings. We conducted post-hoc analyses focusing on pitch. Our hypothesis was that a high pitch on a trigger draws attention to its contributions so that its presuppositions end up part of the truth conditions of the sentence. The resulting prediction was that higher pitches should increase the likelihood of a visible picture choice (because what happened on Monday and Tuesday becomes more salient). We measured the mean relative pitches on each trigger in our recordings and found a higher average pitch for *back* than for *again*, as consistent with the observation that *back* yielded more visible picture choices than *again*. The mean pitch for *stop* was even higher, but so was the mean pitch for *return* (and to a lesser extent the mean pitch of *also*) which, however, yielded fewer visible picture than both *back* and *again*. Therefore, pitch alone clearly cannot explain our observations, but it could account for some variation in our data (see footnote 17), in line with Djärv and Bacovcin (2017), who conducted an experiment as a response to Tonhauser et al. (2013) and argued that prosody is a real but a small factor influencing the status of presuppositions.

Abrusán (2016) offers an account of presuppositions where temporal reference plays a central role. She proposes a typology where triggers can differ in whether they refer to a single or to multiple reference times. The presuppositions of triggers referring to a single reference time have to be considered jointly with non-presuppositional content because they necessarily refer to the same reference time; other triggers introduce a second reference time in their presuppositions and thus make two distinct, independent contributions. It seems that *stop* refers to a unique time span: stopping consists in reaching an end point on a temporal scale. By contrast, *return*, *(go) back*, *(go) again* and *also (go on Wednesday)* all refer to a distinct past reference time, and impose no continuity relation with their main reference time. As a result, it would be impossible to ignore the presupposition of *stop* when making a decision about how many characters satisfy the description, whereas it would be possible to focus on the salient event of going in the other cases. Data from a pilot and from a new experiment, however, suggest that *continue*, which is a prototypical case of a continuous (and thus single) reference time as in the case of *stop*, patterns along with non-entailing triggers in the *exactly one* test.

Closely related to the idea of (dis)continuity is an explanation in terms of contrastivity. As alert readers may already have noticed, *stop* stands out in being the only trigger that involves a mismatch between the Monday and Tuesday activities and the Wednesday activity. A natural

the higher frequency of local accommodation for *again* and *back* under the assumption that moving them to focus position was easier than moving *also* (which came with a particular association contour in our recordings) and *return* (which is a main predicate). See below for further discussion on the role of prosody in our experiment.

explanation for our results would be that this property of *stop* led the participants in the corresponding group to pay attention to the Monday and Tuesday slots throughout the task, while the participants in the other trigger groups could have decided to exclusively rely on the Wednesday slots to make their decisions.[18] Such a task-and-trigger-specific strategy is highly problematic, since it would undermine our ability to diagnose the entailing properties of a trigger through the *exactly one* design. Initial results coming from a follow-up experiment including a condition where the Monday and Tuesday slots in the visible picture do not even satisfy an existential presupposition reveal that many participants indeed do not pay attention to it (i.e., they choose the visible picture despite no character satisfying the presupposition). But they also reveal clearly different profiles for *stop* and *again* participants: while no participant who paid attention to Monday and Tuesday ever chose the covered picture for *Stop-Test*, some did for *Again-Test*. This suggests that even when *Again* participants are actively looking at Monday and Tuesday (as reflected by rejection of pictures not satisfying the existential presupposition) some of them still are unhappy with pictures in which more than one character engages in the mentioned activity on Wednesday, even though only one also engaged in it on Monday and Tuesday. Moreover, the follow-up experiment also included the triggers *no longer* and *not anymore* which share the contrastivity of *stop*, and yet they did not show a pattern specific of entailing triggers. Our current project is to investigate the possibility that contrastivity might interact with continuity in impacting the truth conditional contributions of presuppositions.

6. Conclusion

By formulating the Removability/Independence Hypothesis, we explored a possible explanatory account of the hard vs. soft split. In doing so, we combined the Sudo/Klinedinst entailing vs. non-entailing account of the contrast in local contribution of soft vs. hard presuppositions, with an approach inspired by Glanzberg, whereby the fulfillment of some presuppositions is a necessary condition to arrive at interpretable utterances. In contrast to competing explanatory approaches, this hypothesis has the particularity of giving a formal, rather than conceptual, identification criterion for hard vs. soft triggers. Consistently, it sorts the presuppositional expressions *return* and *go back* into opposite sides of the split, even though they express nearly equivalent concepts. The results of our experiment allow us to rule out this formal hypothesis, and thus indirectly provide support for conceptual approaches.[19] The question of what determines the typological properties of a presupposition trigger has important repercussions. Perhaps the most important one concerns language acquisition: if each presupposition trigger belongs either to the hard or to the soft category, how do children eventually figure out which box a specific expression should go into? The question appears even more intricate in light of Dudley's (2017) observation that cues that an expression is presuppositional are very scarce in children corpora. Identifying a conceptual source for the split would help shed light on how children arrive at (or maybe start with) a mature representation of presupposition triggers.

[18]Note that, by design, picture selection would be unaffected whether the Monday and Tuesday slots were ignored in the control conditions.

[19]Though formal considerations might still be in order when accounting for the higher rate of readings of *back* in which the presupposition makes a local contribution.

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***Enough*, *too*, and causal dependence**[1]

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Abstract. *Enough-/too*-constructions (E/T constructions) have an **implicative** reading: e.g., *Mary was clever enough to leave early yesterday* entails *Mary left early yesterday*. I argue that this implicative reading is not due to the lexical semantics proper of *enough/too*, but due to its **bi-clausal structure** (e.g., the above-mentioned example is analyzed as *Mary left early yesterday because she was clever enough*). I analyze *enough* and *too* simply as degree modifiers that involve a comparison: *enough* means reaching the lower bound of an interval, while *too* means exceeding the upper bound of an interval. Then inspired by Schulz (2011), Baglini and Francez (2015), and Nadathur (2016), I relate the semantics of E/T constructions to **causal dependence**: due to some sufficiency/excess, the infinitival complement clause in E/T constructions is episodically or generically (depending on its aspect being perfective or imperfective) true/false. I also argue that this infinitive has its tense and aspect marked on the main predicate of sentences, resulting in the seeming correlation between aspect and implication in languages that overtly make a distinction between perfective and imperfective aspects (e.g., French).

Keywords: *enough*, *too*, comparatives, causal dependence, necessary (but not necessarily sufficient) causes, sufficient (but not necessarily necessary) causes, infinitives, implicatives.

1. Introduction

This paper analyzes the semantics of *enough*, *too*, and ***enough-/too*-constructions** (E/T constructions). E/T constructions contain an infinitival complement,[2] and it has been noticed that they have **implicative** inferences and license so-called **actuality entailment** (or **realis reading**) for their infinitival complement (Karttunen 1971). For example, sentence (1a) entails that its complement clause *Mary left early* is true, while sentence (1b) entails that its complement clause *Bill stayed awake* is **false** (i.e., the **negation** of this complement clause is true).

(1) E/T constructions and their actuality entailment:
 a. Mary was clever **enough** to leave early. $\leadsto$ Mary left early.
 b. Bill was **too** tired to stay awake. $\leadsto$ Bill didn't stay awake.

The implicative reading of these sentences is reminiscent of real implicatives (e.g., *manage*, see Karttunen 1971), but the contrast between (2a) and (2b) seems to suggest defeasibility and calls for a pragmatic account for the cases involving *enough/too*.

(2) a. Sue **managed** to finish homework, # but eventually, she failed to finish homework.
 b. (i) John was tough **enough** to win tennis matches, but yesterday, he lost.
 (ii) John was **too** proud to apologize, but Tom made him apologize anyway.

[1]I thank my informants, Alan Bale, Aron Hirsch, Tom Leu, Elizabeth Smith, the audience at the Université du Québec à Montréal (UQÀM), the Semantics Reading Group at McGill University, and the reviewers of *Sinn und Bedeutung 22* for discussions or feedback. Special thanks to Prerna Nadathur! Errors are mine.

[2]However, I will show that **not all** *enough-/too*-sentences containing an infinitive are genuine E/T constructions.

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However, a further complication has been noted by Hacquard (2005, 2006): in French, this defeasibility correlates with the use of **perfective/imperfective** aspect, as shown in (3). When French ***assez***(*enough*)-/***trop***(*too*)-sentences are in perfective aspect (i.e., **passé composé**), their actuality entailment is not cancelable (see (3a)), which is in contrast with the case of those *assez*-/*trop*-sentences in imperfective aspect (i.e., **imparfait**) (see (3b)).

(3) French *assez*-sentences in **perfective** vs. **imperfective** aspect:

a. Jean a été **assez** rapide pour s'enfuir, # mais il ne s'est pas enfui.
John was-PFV enough quick to escape but he didn't-PFV escape
'John was quick enough to escape, # but he didn't escape.' perfective

b. Jean était **assez** rapide pour s'enfuir, mais il ne s'est pas enfui.
John was-IPFV enough quick to escape but he didn't-PFV escape
'John was quick enough to escape, but he didn't escape.' imperfective

Nevertheless, as noted by Hacquard (2006) and Nadathur (2017), French *assez* and *trop* are still questionable as real implicatives, since the implication of real implicatives (e.g., *réussir*) can never be cancelled, no matter whether they are in perfective or imperfective aspect (see (4)).

(4) a. Juno a **réussi** à gagner la course, # mais elle n'a pas gagné.
Juno succeed-PFV to win the race, but she didn't-PFV win
'Juno managed to win the race, # but she didn't win.' perfective

b. Juno **réussissait** à gagner la course, # mais elle n'a jamais gagné.
Juno succeed-IPFV to win the race, but she didn't-PFV never win
'Juno managed to win the race, # but she never won.' imperfective

Thus we need to explain (i) why sentences in (1) have an implicative reading and (ii) why there seems a correlation between aspect and implication in French.

Previously, this implicative reading has been attributed to a two-way entailment between sufficiency/excess and the event described by the infinitival complement of E/T constructions. In particular, Hacquard (2005, 2006) has proposed that *enough* and *too* are real implicatives and their semantics already contains hidden two-way entailment, and it is the use of a genericity operator (which is overtly reflected by the use of imperfective aspect in French) that is responsible for the non-implicative readings (see Bhatt 1999). However, according to Nadathur (2017), *enough* and *too* are themselves not real implicatives: they only contain hidden modals to express some capacity, which makes them a necessary condition, and an actuality entailment arises due to (i) the use of a sufficiency operator that turns them into a sufficient condition and (ii) 'actualistic' aspectual coercion under perfective aspect (see Homer 2011).

In Section 2, I use a set of data to show that **not all** *enough*-/*too*-sentences contain an infinitival complement, and thus, the lexical semantics of *enough*/*too* should be much simpler, involving neither hidden two-way entailment nor hidden modals. In Section 3, with an interval-based framework for gradable adjectives (see Zhang and Ling 2015, 2017a,b), I analyze *enough* and *too* as degree modifiers: *enough* means reaching the lower bound of an interval (i.e., *not less* (*than*)), while *too* means exceeding the upper bound of an interval (i.e., *more* (*than*)).

Section 4 shows that not all *enough-/too*-sentences containing an infinitive are **genuine E/T constructions**. Genuine E/T constructions are actually **bi-clausal**, and **causal dependence** is involved in their interpretation (see (5)): the meaning of **sufficiency** brought by ***enough*** provides a **necessary but not necessarily sufficient** (i.e., **necessary but potentially insufficient**) cause for its complement clause to be **true**, while the meaning of **excess** brought by ***too*** provides a **sufficient but not necessarily necessary** (i.e., **sufficient but potentially unnecessary**) cause for its complement clause to be **false**. Based on Wurmbrand (2014), Section 5 shows that due to the restructuring-like syntax of genuine E/T constructions, the semantic tense and aspect of their infinitival complement are marked on the main predicate, resulting in the seeming correlation between aspect (or rather episodicity) and implication in languages like French.

(5) The interpretation of genuine bi-clausal E/T constructions involves causal dependence:

a. [[(1a)]] = Mary left early **because** she was clever enough. $\rightsquigarrow$ Mary left early.
b. [[(1b)]] = Bill didn't stay awake **because** he was too tired. $\rightsquigarrow$ B. didn't stay awake.

2. Challenges to previous accounts

Focusing on the actuality entailment for the infinitive in E/T constructions, previous studies (including Meier 2003; Hacquard 2005, 2006; Nadathur 2017) have proposed that (i) this implicative reading is essentially due to a **two-way entailment** between sufficiency/excess and the event described by the infinitival complement, and that (ii) either the lexical semantics of *enough*/*too* contains already hidden two-way entailment (Hacquard 2005, 2006), or it contains hidden modals that partially contribute to the expression of two-way entailment (Meier 2003; Nadathur 2017). Here I use naturally occurring examples to show that infinitives are not necessarily present in *enough*/*too*-sentences. Therefore, those previous accounts all under-generate.

According to Hacquard (2005, 2006), sentence (6) **presupposes** that there is a unique degree of quickness which is a necessary and sufficient condition for John's escape and **asserts** that John meets this condition. Thus, Hacquard (2006) proposes (7a) and (7b) as the lexical entries of *enough* and *too*. Their presuppositional requirement is underlined: there is a unique degree d such that in all possible worlds w' accessible from the actual world w, sentence Q is true (for *enough*) or false (for *too*) iff x reaches the degree d on the scale P in world w'. The assertion is that x reaches this unique degree d on the scale P in the actual world w.

(6) Jean <u>a été</u> **assez** rapide pour s'enfuir.
John was-PFV enough quick to escape
'John was quick enough to escape.' (French *enough*-construction in **perfective** aspect)
a. Presupposition: there is a degree of quickness sufficient & necessary for his escape.
b. Assertion: John had the degree of quickness sufficient & necessary for his escape.

(7) a. $[\![\text{enough}]\!]^w \overset{\text{def}}{=} \lambda P_{\langle d,\langle e,st\rangle\rangle}.\lambda Q_{\langle st\rangle}.\lambda x_e.P(\underline{\iota d: \forall w' \in \text{Acc}(w).Q(w') \leftrightarrow P(d)(x)(w')})(x)(w)$
b. $[\![\text{too}]\!]^w \overset{\text{def}}{=} \lambda P_{\langle d,\langle e,st\rangle\rangle}.\lambda Q_{\langle st\rangle}.\lambda x_e.P(\underline{\iota d: \forall w' \in \text{Acc}(w).\neg Q(w') \leftrightarrow P(d)(x)(w')})(x)(w)$
(P: gradable adjective; Q: the infinitival complement clause; x: subject.)

Under this account, as far as the actual world w is accessible to itself, the two-way entailment in the lexical entries of *enough* and *too* makes them **real implicatives**.

To account for the non-implicative reading of *enough-/too-* sentences in imperfective, Hacquard (2006) adopts Bhatt (1999)'s **genericity operator** (see (8)), which was originally developed to explain the correlation between aspect and implication for French ability modal *pouvoir*.[3] The use of this genericity operator is overtly reflected by the use of imperfective aspect in languages like French. As shown in (9), with the use of GEN, the set of accessible worlds is further restricted (by an overt or contextually-provided p), and the consequence is that the actual world is no longer necessarily one of those highly idealized ones where reaching a unique degree of quickness guarantees John's escape.

(8) $[\![\textsc{gen}]\!]^w \overset{\text{def}}{=} \lambda p_{\langle st\rangle}.\lambda q_{\langle st\rangle}.\forall w'[w' \in \mathrm{Acc}(w) \wedge p(w') \to q(w')]$ (p restricts the set of w'.)

(9) Jean était **assez** rapide pour s'enfuir
John was-IPFV enough quick to escape
'J. was quick enough to escape.' (French *enough*-construction in **imperfective** aspect)
$\textsc{gen}(w)[\lambda w.w$ was relevant$][\lambda w.$ John had the sufficient/necessary quickness to escape in $w]$
In all **relevant** worlds, John had the quickness to escape.

However, real implicatives like *réussir* are immune to the actuality-entailment-cancelling effects of the genericity operator (see (4)), because even in imperfective sentences, their implicative reading is not cancelable. This poses a challenge for Hacquard (2005, 2006).

Alternatively, Bierwisch (1987), Meier (2003), von Stechow et al. (2004), Schwarzschild (2008), Marques (2012), and Nadathur (2017) take the view that *enough* and *too* are **intrinsically non-implicative**, i.e., their lexical semantics does not contain hidden two-way entailment. Nevertheless, *enough* and *too* are analyzed in terms of a comparison involving a hidden modal.

As shown in (10) and (11) (see von Stechow et al. 2004 and Nadathur 2017), *enough/too* relates a predicate Q (typically provided by the infinitival complement), a gradable adjective P, and an individual x. E.g., *Jo was fast enough to escape* means that in **any world** w' where Jo escaped, her speed was not higher than her actual speed in world w; *Jo was too slow to escape* means that in **at least one world** w' where Jo escaped, her speed was higher than her actual speed.

[3] Bhatt (1999) has pointed out that there is also a correlation between aspect and implication for French ability modal *pouvoir*, as illustrated by the contrast in (i). Bhatt (1999) proposes to analyze *pouvoir* as a real implicative like English *manage*: French *pouvoir* **asserts** the realization of its complement clause and **conveys the conventional implicature** that some effort contributes to the realization of the complement clause. Then Bhatt (1999) uses a genericity operator to derive the non-implicative reading of *pouvoir*-sentences in imperfective.

(i) a. Jean a **pu** soulever cette table, # mais il ne l'a pas soulevée.
John could-PFV lift this table but he didn't-PFV lift
'John was able to lift this table, # but he didn't lift it.' *pouvoir* + PFV $\rightsquigarrow$ actuality entailment

b. Jean **pouvait** soulever cette table, mais il ne l'a pas soulevée.
John could-IPFV lift this table but he didn't-PFV lift
'John was able to lift this table, but he didn't lift it.' *pouvoir* + IPFV $\not\rightsquigarrow$ actuality entailment

(10) a. $[\![\text{enough}]\!]^{w} \stackrel{\text{def}}{=}$
$\lambda Q_{\langle e,\langle st\rangle\rangle}.\lambda P_{\langle d,\langle e,st\rangle\rangle}.\lambda x_e.\{d : \forall w' \in \text{Acc}(w)[Q(x)(w') \rightarrow P(d)(x)(w')]\} \subseteq \{d : P(d)(x)(w)\}$

b. $[\![\text{too}]\!]^{w} \stackrel{\text{def}}{=}$
$\lambda Q_{\langle e,\langle st\rangle\rangle}.\lambda P_{\langle d,\langle e,st\rangle\rangle}.\lambda x_e.\{d : \exists w' \in \text{Acc}(w)[Q(x)(w') \wedge P(d)(x)(w')]\} \subset \{d : P(d)(x)(w)\}$

(11) a. $[\![\text{fast}]\!]^{w} \stackrel{\text{def}}{=} \lambda d_d.\lambda x_e.\textsc{speed}(x)(w) \geq d$ $\{d : \text{fast}(d)(x)(w)\} = [0, x\text{'s max. speed}]$

b. $[\![\text{slow}]\!]^{w} \stackrel{\text{def}}{=} \lambda d_d.\lambda x_e.\textsc{speed}(x)(w) < d$ $\{d : \text{slow}(d)(x)(w)\} = (x\text{'s max. speed}, +\infty)$

Based on these lexical entries, Nadathur (2017) proposes an account within Nadathur (2016)'s framework of **causal dependence** (see also Schulz 2011, Baglini and Francez 2015). According to this framework, as shown in (12), actuality entailment X holds if (i) there is a necessary and sufficient causing factor A and (ii) A holds.

(12) Given an **implicative** I and a complement proposition X, then $I(X)$
a. **presupposes** the existence of a **causing factor/event** A so that:
(i) A **is causally necessary for** X,
(ii) A **is causally sufficient for** X;
b. **asserts** that A holds in the world of evaluation. (i.e., the actualization of A.)

Thus, as illustrated in (13), under Nadathur (2017)'s account, the actualization of Jo's escape depends on (i) her speed in the actual world w (here written as 'Jo's maximum speed in w') being a **sufficient and necessary** factor for Jo's escape and (ii) Jo's actually being that fast.

Essentially, the lexical semantics of *enough* makes Jo's speed in the actual world a **necessary** factor, while the use of **a causal sufficiency operator** $\rhd_{\textsc{caus}}$ further makes it a **sufficient** factor. Notice that the use of this causal sufficiency operator $\rhd_{\textsc{caus}}$ requires that (i) the **flavor** of the modal involved in the lexical semantics of *enough* be **circumstantial** and that (ii) the gradable adjective represent **an exercisable capacity**. Finally, the use of **perfective** aspect (which is overtly marked in French) guarantees Jo's actually being that fast (see Homer 2011). Therefore, we get the actuality entailment that *Jo escaped*.

(13) Jo was fast enough to escape.
a. Jo's maximum speed is a **necessary** condition for her escape:
(i) Presupposition: $\exists d_{\text{nec}} : \forall w' \in \text{Acc}(w)[\text{Jo's speed in } w' < d_{\text{nec}} \rightarrow \neg\text{escape(Jo)}(w')]$
(ii) Assertion: Jo's max. speed in $w \geq d_{\text{nec}}$

b.
Jo's maximum speed is a **sufficient** condition for her escape: With (i) a **circumstantial modal** and (ii) a gradable adjective representing **an exercisable capacity**, the sentence backgrounds: $\forall w' \in \text{Acc}(w)[\text{fast}(d_{\text{nec}})(\text{Jo})(w') \rhd_{\textsc{caus}} \text{escape(Jo)}(w')]$

Nadathur (2017)'s account is similar to the account of Hacquard (2005, 2006) in that the implicative reading results from a two-way entailment. However, here this two-way entailment is not entirely due to the lexical semantics of *enough*/*too*, but partially due to the use of the operator $\rhd_{\textsc{caus}}$. This brings some conceptual problems.

First, according to the framework (12), it has to be the same factor (here A) that serves both a necessary and a sufficient condition for X. However, for sentence (13), Jo's being d_{nec}-fast is by itself a necessary condition for Jo's escape, while it is the use of a sufficiency operator that turns this into a sufficient condition. Thus, it is questionable whether the necessary and the sufficient conditions are exactly the same here.[4]

Moreover, in the framework (12), implicative I is distinct from causing factor A. However, under Nadathur (2017)'s account, it remains unclear which element in E/T constructions contributes to the expression of implicative I. If it is the semantics of *enough*/*too*, then how can *enough*/*too* be involved in the expression of both the implicative and the causing factor? What would be the consequences in terms of compositionality? Further explanation is needed here.[5]

In fact, actuality entailment does not necessarily involve causally necessary and sufficient factors, or even causal dependence at all (i.e, actuality entailment might not even involve (i) causally necessary but insufficient or (ii) causally sufficient but unnecessary factors). For example, sentence (14) means that *John made a boat with oak* and entails that *John made a boat*, but no causal dependence is involved here. Thus, any account for the actuality entailment of E/T constructions needs to explain the exact source and the exact nature of their actuality entailment. The framework of (12), which only addresses causally necessary and sufficient factors, might turn out to be irrelevant.

(14) John used oak to make a boat. $\rightsquigarrow$ John made a boat.

Empirically, by including hidden two-way entailment or modals in the lexical semantics of *enough*/*too*, the accounts of both Hacquard (2005, 2006) and Nadathur (2017) rely on the presence of infinitival complements for these degree adverbs and thus suffer from under-generation. Naturally occurring examples from *the Corpus of Contemporary American English* (*COCA*, Davies 2008) show that infinitival complements are not necessary in the use of *enough* and *too*.

(15)
a. The double-bedded room seemed luxury **enough** compared to the farm house. (*Fantasy & Science Fiction*, 1995)
b. The rest of us do count for something, but not **enough** compared with him, since Walter's absence makes us all invisible in our parents' eyes and in our own. (*The Hudson Review*, 2009)
c. He was young **enough** and strong **enough** compared to H. (*CBS: 48 Hours*, 2011)
d. Erdogan and his party won a mere 258 seats, not **enough** even for a parliamentary majority. (*National Review*, 2015)
e. She uses a 2013 Dell laptop: new by government standards, but clunky **enough** compared with the cutting-edge devices of her former life. (*New York Times*, 2015)

[4]Notice also that the use of this sufficiency operator also brings additional stipulations (i.e., its requirements for modal flavor and adjective type), which makes this operator rather *ad hoc*. However, without these *ad hoc* stipulations, presumably, this operator would turn any necessary condition into a necessary and sufficient one.

[5]It seems that real implicatives like *manage* do not play this kind of dual role. According to the analysis of *manage* by Baglini and Francez (2015), *manage* invokes the existence of some necessary but insufficient factors, but does not express this kind of factors itself.

(16) a. The costs of this technology were at that time **too** high compared to diskettes for such applications. (*IBM Journal of Research and Development*, 1998)

b. (...) The U.S. petroleum industry found itself shutting in an extraordinary portion of its domestic production capacity, which was **too** high-priced compared to foreign-sourced oil. (*Journal of International Affairs*, 1999)

c. Perhaps it was **too** expensive compared to similar items. (*Reference & User Services Quarterly*, 2012/2013)

d. They appeared much **too** small compared with the actual Sun (...). (*space.com*, 2015)

e. Property taxes (...) are way **too** high compared with neighboring states. (*Omaha World-Herald*, 2017)

Obviously, the use of *enough*/*too* does not require the existence of infinitival complements. To have a unified account for both E/T constructions as well as the data in (15) and (16), we need much simpler lexical entries for *enough* and *too*. The mechanisms underlying the implicative reading of E/T constructions should not be part of the lexical semantics proper of *enough*/*too*.

3. Proposal: the semantics of *enough* and *too*

Here I propose that *enough* and *too* are simply **degree modifiers** that involve a **comparison** with a certain **interval** on a scale. Essentially, *enough* means **reaching** the **lower bound** of an interval, while *too* means **exceeding** the **upper bound** of an interval (see Figure 1).

To formally implement this proposal, I adopt Zhang and Ling (2015, 2017a,b)'s interval-arithmetic-based framework for the semantics of gradable adjectives and comparatives. This framework is motivated to allow for a **generalized comparison** on a scale and based on two assumptions. First, a comparative (e.g., *5:00 is 1 hour earlier than 6:00*) means a relation among three degree-related items: two positions on a scale — **comparative subject** and **comparative standard** (e.g., the positions marking *5:00* and *6:00* on the temporal scale) — and the distance between them — **differential** (e.g., here *1 hour*). Second, we adopt a generalized view for positions on a scale and represent them as intervals. An **interval** is a range of degrees so that it marks a position in a not-so-precise way. Thus it is a **convex** set of degrees: e.g., $\{x|a \leq x \leq b\}$, which means a position ranging from a to b and can also be written as $[a,b]$.[6] Operations on two intervals result in **the largest possible range** (Moore 1979). As shown in (17), a generalized comparison can be characterized in terms of **interval subtraction**: subtracting the interval representing the **comparative standard** from the interval representing the **comparative subject** results in a third interval — the **differential**.

(17) Interval subtraction:

$$\overbrace{[y_1, y_2]}^{\text{comparative subject}} - \overbrace{[x_1, x_2]}^{\text{comparative standard}} = \overbrace{[y_1 - x_2, y_2 - x_1]}^{\text{differential}} \qquad \text{(Moore 1979)}$$

E.g., $[7,8] - [2,3] = [4,6]$

4 and 6 are the min. and max. **distances** between the **positions** $[7,8]$ and $[2,3]$ respectively.

[6] A convex totally ordered set is a totally ordered set P such that for any elements a and b in the set, if $a \leq b$, then any element x such that $a \leq x \leq b$ is also in the set. Evidently, sets such as $\{x|x \leq 5 \vee x > 8\}$ are not convex.

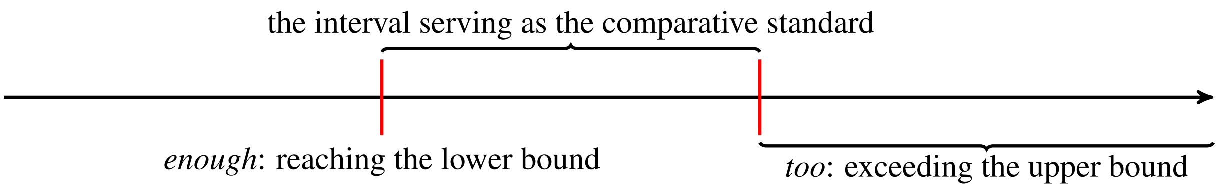

Figure 1: The lexical semantics of *enough* and *too*.
Enough means reaching the lower bound of an interval,
while *too* means exceeding the upper bound of an interval.

As shown in (18), the semantics of gradable adjectives is analyzed as relations between intervals (of type $\langle dt \rangle$) and entities (of type e). For the absolute use of gradable adjectives, the interval argument is a context-dependent interval I^C (see (18a)), which means 'the context-dependent interval such that it is from the lower to the upper bound of being tall for a relevant comparison class'. Then in (18b), $6'$ can be interpreted either (i) as a singleton set (for the 'exactly 6′' reading) or (ii) as an interval with $6'$ as its lower bound (for the 'at least 6′' reading).

(18) $[\![\text{tall}]\!]_{\langle dt,et \rangle} \stackrel{\text{def}}{=} \lambda I_{\langle dt \rangle}.\lambda x_e.\textsc{height}(x) \subseteq I$

a. $[\![\text{John is tall}]\!] \Leftrightarrow \textsc{height}(\text{John}) \subseteq I^C$ — absolute use of gradable adjectives

b. (i) $[\![\text{John is } 6' \text{ tall}]\!] \Leftrightarrow \textsc{height}(\text{John}) \subseteq [6', 6']$ — 'exactly 6′' reading

(ii) $[\![\text{John is } 6' \text{ tall}]\!] \Leftrightarrow \textsc{height}(\text{John}) \subseteq [6', +\infty)$ — 'at least 6′' reading

More/*-er* is analyzed as the default differential in comparative sentences – $(0, +\infty)$: it refers to the largest possible range of positive degrees (see (19a)). Then, *little* changes the polarity of an interval (see (19b)). Based on the semantics of *more* and *little*, *less* means the default differential in *less-than* comparatives: it refers to the largest possible range of negative degrees (see (19c)). Finally, (*th*)-*an* encodes an interval subtraction (see (17) and (19d)).

(19) a. $[\![\text{more/-er}]\!]_{\langle dt \rangle} \stackrel{\text{def}}{=} (0, +\infty)$ (i.e., the default range of **positive** degrees)

b. $[\![\text{little}]\!]_{\langle dt,dt \rangle} \stackrel{\text{def}}{=} \lambda I_{\langle dt \rangle}.[0, 0] - I$ (see Zhang and Ling 2017b)

c. $[\![\text{less}]\!]_{\langle dt \rangle} \stackrel{\text{def}}{=} [\![\text{little}]\!][\![\text{more/-er}]\!] = (-\infty, 0)$ (i.e., the default range of **negative** degrees)

d. $[\![\text{(th)-an}]\!]_{\langle dt,\langle dt,dt \rangle\rangle} \stackrel{\text{def}}{=} \lambda I_{\text{stdd}}.\lambda I_{\text{diff}}.\iota I[I - I_{\text{stdd}} = I_{\text{diff}}]$

(20) illustrates how to derive the meaning of a comparative sentence. Here the comparative standard denotes a range of values, and the interval-arithmetic-based framework precisely characterizes the sentence meaning and the semantic contribution of the comparative standard.

(20) $[\![\text{Lucinda is taller than every boy is}]\!] = [\![\text{tall}[[\text{-er}] \text{ -an th-}[\text{every boy is (tall)}]][\text{Lucinda}]]\!]$

$\Leftrightarrow \textsc{hight}(\text{Lucinda}) \subseteq \iota I[I - [\![\text{the}]\!][\![\text{every boy is (tall)}]\!] = (0, +\infty)]$ (see (18): $[\![\text{tall}]\!]$)

$\Leftrightarrow \textsc{hight}(\text{Lu}) \subseteq \iota I[I - [\![\text{the}]\!][\lambda I'.[\forall x[\text{boy}(x) \rightarrow \textsc{hight}(x) \subseteq I']]] = (0, +\infty)]$

$\Leftrightarrow \textsc{hight}(\text{Lucinda}) \subseteq (I^{\text{the-interval-including-every-boy's-height}}_{\text{upper-bound}}, +\infty)$ (see (17): interval subtraction)

Based on these, I analyze *enough* as 'not less (than)', and *too* as 'more (than)' (see (21) and (23)): *enough* means reaching the lower bound of an interval I, while *too* means exceeding the upper bound. Similar to numbers (see (18b-i)), *enough* also has an 'exactly' reading (see (22)).

(21) [[John was strong **enough** compared to his classmates]] (see (15c))
= [[strong [**not** [**less -an th**-[his classmates (are strong)]]]] [John]]
$\Leftrightarrow$ $\textsc{strength}$(John) $\subseteq U \backslash \iota I[I - [\![\text{the}]\!][\![\text{his classmates (are strong)}]\!] = (-\infty, 0)]$
$\Leftrightarrow$ $\textsc{strength}$(John) $\subseteq U \backslash (-\infty, I^{\text{the-interval-including-his-classmates'-strength}}_{\text{lower-bound}})$ $\quad U = (-\infty, +\infty)$
$\Leftrightarrow$ $\textsc{strength}$(John) $\subseteq [I^{\text{the-interval-including-his-classmates'-strength}}_{\text{lower-bound}}, +\infty)$
$\therefore [\![\text{enough}]\!]_{\langle\langle dt,et\rangle,\langle dt,et\rangle\rangle} \stackrel{\text{def}}{=} \lambda G_{\langle dt,et\rangle}.\lambda I_{\langle dt\rangle}.\lambda x_e.G\text{-}\textsc{dimension}_{\langle e,dt\rangle}(x) \subseteq [I_{\text{lower-bound}}, +\infty)$
(i.e., *enough* means reaching the lower bound of an interval, the lower bound included.)

(22) The 'exactly' reading of *enough*: reaching the singleton set of the lower bound
$[\![\text{enough}]\!]_{\langle\langle dt,et\rangle,\langle dt,et\rangle\rangle} \stackrel{\text{def}}{=} \lambda G_{\langle dt,et\rangle}.\lambda I_{\langle dt\rangle}.\lambda x_e.G\text{-}\textsc{dimension}_{\langle e,dt\rangle}(x) = [I_{\textsc{lower-bound}}, I_{\text{lower-bound}}]$
E.g., The city hides 3,000 eggs in an annual Easter egg hunt (...), which is **more than enough** for the 200 children who usually show up. (*COCA*, *The Detroit News*, 2017)

(23) [[This laptop was **too** expensive compared to similar items]] (see (16c))
= [[expensive [**more -an th**-[similar items (are expensive)]] [this laptop]]
$\Leftrightarrow$ $\textsc{price}$(this laptop) $\subseteq \iota I[I - [\![\text{the}]\!][\![\text{similar items (are expensive)}]\!] = (0, +\infty)]$
$\Leftrightarrow$ $\textsc{price}$(this laptop) $\subseteq (I^{\text{the-interval-including-similar-items'-price}}_{\text{upper-bound}}, +\infty)$
$\therefore [\![\text{too}]\!]_{\langle\langle dt,et\rangle,\langle dt,et\rangle\rangle} \stackrel{\text{def}}{=} \lambda G_{\langle dt,et\rangle}.\lambda I_{\langle dt\rangle}.\lambda x_e.G\text{-}\textsc{dimension}_{\langle e,dt\rangle}(x) \subseteq (I_{\text{upper-bound}}, +\infty)$
(i.e., *too* means exceeding the upper bound of an interval, the upper bound excluded.)

As illustrated in (24), comparatives (in particular those containing modals in their *than*-clause) and *enough*/*too*-sentences are interchangeable in terms of truth conditions. The current account reflects exactly this interchangeability: *enough* and *too* are analyzed as variations of comparative morphemes *more*/*less*. Intriguingly, this interchangeability also shows that modals are not part of the meaning of *enough*/*too*. Instead, when modals are involved, they are part of the overtly expressed or contextually suggested comparative standard.

(24) Context: Cal wants to be a fighter pilot. Air Force regulations require all pilots to be between 5′4″ and 6′5″ tall.
a. If Cal is 6′6″,
Cal is **taller than** required = Cal is **too tall** (to be a pilot).
b. If Cal is 5′4″,
Cal is **not less tall than** required = Cal is **tall enough** (to be a pilot).

In sum, empirical evidence shows that *enough*/*too* does not always take an infinitival complement. Thus, by reducing *enough*/*too* to degree modifiers, I have excluded hidden modals or two-way entailment from their lexical semantics. In the *enough*/*too*-sentences in (24), it is the optional infinitival phrase *to be a pilot* that involves a modal element and contributes to the expression of comparative standard. In the next section, I show that in terms of syntax and semantics, the infinitival complement of **genuine E/T constructions** (see (1)) is totally different from the phrase *to be a pilot* in (24). Then I further explain the source and the nature of the implicative reading of genuine E/T constructions.

4. Causal dependence in the interpretation of E/T constructions

Having shown that not all *enough-*/*too*-sentences contain an infinitive, now I show that not all *enough-*/*too*-sentences containing an infinitive are **genuine E/T constructions** that have an implicative reading. Essentially, I argue that genuine E/T constructions with an implicative reading have a **bi-clausal** structure, while non-genuine E/T constructions have a **mono-clausal** structure. Section 4.1 presents the diagnostics of these two types of sentences. Then, Section 4.2 shows that the interpretation of bi-clausal E/T constructions involves causal dependence.

4.1. E/T constructions: bi-clausal vs. mono-clausal

At first sight, it seems that sentences (25a) and (25b) (hereafter called the *chess*-sentence and the *party*-sentence respectively) have the same syntactic structure, both containing an infinitive, but intuitively, we feel that only the *party*-sentence has an implicative reading. I will use four diagnostics to show that these two sentences actually have different syntactic structures.

(25) a. Context: Jerry was a talented kid. He wanted to learn to play chess. This club only admitted kids with an IQ of 120 from low-income families. (*chess*-sentence)
Jerry was clever **enough** to join this chess club. $\not\rightsquigarrow$ Jerry joined this chess club.

b. Context: Towards the end of the party last night, the air conditioner stopped working. Those who kept staying there caught cold. (*party*-sentence)
Mary was clever **enough** to leave the party early. $\rightsquigarrow$ Mary left the party early.

First, under the given context, the infinitive in the *chess*-sentence can be omitted (since we can accommodate the comparative standard) or replaced by similar expressions that contribute to the expression of comparative standard (e.g., *for joining this chess club*, etc.), with no difference in meaning. As evidence, all the four sentences in (26a) are natural continuations here. In contrast, for the infinitive in the *party*-sentence, its omission or replacement by expressions like *for leaving the party early* would lead to differences in meaning. As evidence, among the three sentences in (26b), only (26b-i) sounds a natural continuation.

(26) **Diagnostic (I)**: whether the infinitive is omittable or replaceable

a. Jerry was a talented kid. He wanted to learn to play chess. This chess club only admitted kids with an IQ of 120 from low-income families ...
   (i) Jerry was clever enough to join this chess club.
   (ii) Jerry was clever enough. = (26a-i)
   (iii) Jerry was clever enough for joining this chess club. = (26a-i)
   (iv) Jerry was clever enough with regard to the threshold of IQ. = (26a-i)

b. Towards the end of the party last night, the air conditioner stopped working. Those who kept staying there caught cold ...
   (i) Mary was clever enough to leave the party early. a natural continuation
   (ii) ?Mary was clever enough. ≠ (26b-i)
   (iii) #Mary was clever enough for leaving the party early. ≠ (26b-i)
   (This sounds like there's a qualification for leaving early.)

Second, (27a) shows that the *chess*-sentence can be nominalized without a change in meaning: for both the original and the nominalized versions, it is Jerry's cleverness that pleased his mother. In contrast, (27b) shows that the *party*-sentence cannot be nominalized without a change in meaning: for the original *party*-sentence, it is Mary's early leaving from the party that pleased her mother, but for the nominalized one, it seems that it is rather Mary's cleverness that pleased her mother.[7] Intriguingly, the semantic contrast shown in (27b) suggests that semantically speaking, the main information of the original *party*-sentence is not Mary's cleverness, but rather her early leaving from the party.

(27) **Diagnostic (II)**: whether the sentence can be paraphrased with nominalization
- a. Context: Jerry was a talented kid. He wanted to learn to play chess. This chess club only admitted kids with an IQ of 120 from low-income families.
  - (i) Jerry was clever enough to join the club, so his mother was happy. =
  - (ii) Jerry's sufficient cleverness to join the club makes his mother happy.
- b. Context: Towards the end of the party last night, the air conditioner stopped working. Those who kept staying there caught cold.
  - (i) Mary was clever enough to leave the party early, so her mother was happy. ≠
  - (ii) Mary's sufficient cleverness to leave early makes her mother happy.

Third, (28a) shows that the *chess*-sentence cannot be turned into a '*be* adj. *enough so that*' version without a change in meaning. The semantic difference between (28a-i) and (28a-ii) can be shown by adding *but his family was too rich*. Due to its entailment that *Jerry joined this chess club*, sentence (28a-ii) sounds contradictory, but sentence (28a-i) does not have this entailment and does not sound contradictory. In contrast, (28b) shows that the *party*-sentence can be paraphrased with a '*be*-adj.-*enough-so-that*' sentence without a change in meaning: (28b-i) and (28b-ii) have the same meaning.

(28) **Diagnostic (III)**: whether the 'adj.-*enough-to*'-sentence can be paraphrased with a '*be*-adj.-*enough-so-that*' sentence
- a. Context: Jerry was a talented kid. He wanted to learn to play chess. This chess club only admitted kids with an IQ of 120 from low-income families.
  - (i) Jerry was clever enough to join this chess club, but his family was too rich. **– no contradiction**
  - (ii) Jerry was clever enough so that he joined this chess club, but his family was too rich. **– contradiction**
- b. Context: Towards the end of the party last night, the air conditioner stopped working. Those who kept staying there caught cold.
  - (i) Mary was clever enough to leave the party early.
  - (ii) Mary was clever enough so that she left the party early.

[7] The nominalized version in (27b), i.e., (27b-ii), might not even be grammatical. According to Pesetsky (1991) and Pesetsky and Torrego (2001, 2004, 2006) (see Wurmbrand 2014), English infinitives can combine with nominalized irrealis predicates, but not with nominalized propositional, implicative, or factive predicates. Though it is unclear whether most native speakers of English would judge sentence (27b-ii) grammatical or not, it is certain that even if it is grammatical, the semantic contrast shown in (27) holds.

	genuine E/T constructions	non-genuine E/T constructions
example	(25b): Mary was clever enough to leave the party early.	(25a): Jerry was clever enough to join this chess club.
analysis of sentence structure	**bi**-clausal: (i) **comparative**: expressing a **cause** (ii) **infinitive**: expressing a **consequence** Main information of the sentence: the infinitive	**mono**-clausal: a **comparative** (Overt or covert *than*-clauses are not considered independent here.)
infinitive	not part of the comparative; not comparative-standard-related; not modal-related	part of the comparative; expressing **comparative standard**; containing **modal** elements
implicative reading	available	unavailable

Table 1: *Enough-/too*-sentences containing an infinitive can be divided into two categories.

Fourth, modal elements can be inferred from context (29a), and thus, both (29a-i) and (29a-ii) mean that Jerry's cleverness reaches the required value. However, given the context (29b), interlocutors cannot accommodate any requirement, and thus different from the felicitous sentence (29b-i), sentence (29b-ii) is infelicitous. Thus, sentence (29a-i) is interchangeable with a comparative containing a deontic modal in its *than*-clause, but sentence (29b-i) is not. This contrast suggests that while the infinitive of the *chess*-sentence conveys a certain modality, the infinitive of the *party*-sentence is actually irrelevant to the expression of any modality.

(29) **Diagnostic (IV)**: whether the sentence can be interchangeable with a comparative containing a deontic modal in its *than*-clause
  a. Context: Jerry was a talented kid. He wanted to learn to play chess. This chess club only admitted kids with an IQ of 120 from low-income families.
    (i) Jerry was clever enough to join this chess club.
    (ii) Jerry was not less clever than he was **required** to be. = (29a-i)
  b. Context: Towards the end of the party last night, the air conditioner stopped working. Those who kept staying there caught cold.
    (i) Mary was clever enough to leave the party early.
    (ii) #Mary was not less clever than she was **required** to be. ≠ (29b-i)

In sum, these diagnostics suggest that the *party*-sentence (25b) is **bi-clausal**, including a **comparative** and an **infinitive**. Semantically, it is actually this infinitive that carries the main information (see Diagnostic (II)). Thus, this infinitive cannot be optional, and the whole sentence cannot be nominalized or reduced to a comparative. Crucially, this infinitive is not part of a comparative: it is not related to comparative standard, and it does not contribute any modal elements. Therefore, as shown in Table 1, there are two categories for *enough-/too*-sentences involving an infinitive. Only the interpretation of bi-clausal E/T constructions is implicative and involves causal dependence between its two clauses: the comparative part serves as a cause, and the infinitive serves as a consequence.

$$\begin{tikzcd} x_1 \arrow[dr] & & x_2 \arrow[dl] \\ & y_1 & \end{tikzcd}$$

	x_1	x_2	y_1	
s_Σ:	1	1	u	
$\mathcal{T}_D(s_\Sigma)$:	1	1	1	—— s^*_Σ

Figure 2: A dynamics D: $B = \{x_1, x_2\}$. $I = \{y_1\}$. $F(y_1) = \langle Z_{y_1} = \{x_1, x_2\}, f_{y_1} = (y_1 \Leftrightarrow x_1 \wedge x_2)\rangle$. E.g., let Σ be $\{x_1, x_2\}$, and s_Σ be the situation making all formulas in Σ true.

4.2. The semantics of E/T constructions: necessary vs. sufficient causes

Having shown that the implicative reading of genuine E/T constructions is due to its bi-clausal structure, here I further characterize the nature of this implicative reading. Inspired by Schulz (2011), Baglini and Francez (2015), and Nadathur (2016), I propose that **causal dependence** is involved in the interpretation of genuine E/T constructions. As illustrated in (30), bi-clausal E/T constructions can be paraphrased with the use of *because*: their infinitival complement represents a **consequence**, which **causally depends on** the factor expressed by the comparative.[8]

(30) a. [[M. was clever enough to leave early]] = [[M. left early **because** she was clever enough]]
b. [[Bill was too tired to stay awake]] = [[Bill didn't stay awake **because** he was too tired]]

The intuition here is that under a given context (e.g., (25b)), (30a) means that among many other factors (e.g., her willingness to sacrifice fun for health), Mary's cleverness (in decision-making) in this situation was a **necessary** (but not necessarily **sufficient**) one for her early leaving from the party, while (30b) means that among many other factors (e.g., his lack of effort to stay awake), Bill's excessive fatigue was a **sufficient** (but not necessarily **necessary**) one for his not staying awake.

I adopt the framework of Schulz (2011) to formally describe the causal dependence between the two clauses of E/T constructions:

(31) a. A **dynamics** D represents causal relationships over a set of propositions $\mathcal{P}$.
b. D includes
(i) a set of **background variables** B which are causally independent,
(ii) a set of **inner variables** $I = \mathcal{P} - B$,
(iii) the function F that associates every inner variable X with **(I)** a set of propositions Z_X that X directly causally depends on, and **(II)** a two-valued truth function f_X ($f_X : \{0,1\}^n \rightarrow \{0,1\}$) that describes how to calculate the truth value of X from the values of the members of Z_X.
c. A **situation** s is an incomplete valuation of the propositions in $\mathcal{P}$, mapping $\mathcal{P}$ to $\{0,1,u\}$, where u means **undetermined**.
d. **Operator** $\mathcal{T}_D$ maps situations s to new situations $\mathcal{T}_D(s)$, calculating the direct

[8]In fact, this kind of bi-clausal causal-dependence-related constructions are not limited to E/T constructions, as illustrated by (i). (i) means that grass is green, which is a factor contributing to the promotion of photosynthesis.

(i) Grass is green to promote photosynthesis. (Williams 1974) causal effects of the settings in s. After a finite number of applications of $\mathcal{T}_D$, the **least fixed point** s^*_Σ is reached. (see Figure 2 for an example.)

Based on these definitions, Baglini and Francez (2015) defines the notions of **causal sufficiency** (see (32a)) and **causal necessity** (see (32b)). Evidently, when s_Σ is **causally sufficient** for ϕ, then s_Σ **causally entails** ϕ, i.e., $s_\Sigma \vDash_D \phi$. s_Σ is **causally necessary** for ϕ when there is no s' (where ϕ is still undetermined) different from s_Σ that causally entails ϕ, i.e., $s' \vDash_D \neg\phi$.

(32) a. Let Σ be a set of literals and D a dynamics. Then $s_\Sigma \vDash_D \phi$ iff$_{\text{def}}$ $[\![\phi]\!]^{D,s^*_\Sigma} = 1$ (i.e., s_Σ **causally entails** ϕ given D iff ϕ is true on the least fixed point s^*_Σ.)

b. $\phi \lhd_D s_\Sigma$ iff$_{\text{def}}$ $\neg\exists s'$: $\underbrace{s' \neq s_\Sigma}_{\text{in the values of determined variables relevant for } \phi} \wedge \underbrace{s'(\phi) \neq 1}_{\phi=u \text{ in } s'} \wedge \underbrace{s' \vDash_D \phi}_{s' \text{ causally entail } \phi}$

For E/T constructions, the causal dependence between the comparative (C) and the infinitive (X) is formally described in (33). Obviously, as noted by Baglini and Francez (2015), the choice of dynamics (in particular what background and inner variables are under consideration) plays a crucial role in analyzing causal dependence. Thus, following Baglini and Francez (2015), I choose particular contexts to construct dynamics and provide empirical evidence for (33).

(33) The causal dependence between C and X in E/T constructions:

a. *enough*-sentences: $\underbrace{\neg C \vDash_D \neg X}_{C \text{ is causally \textbf{necessary} for } X}$ It is not necessary that C is causally sufficient for X.

b. *too*-sentences: $\underbrace{C \vDash_D \neg X}_{C \text{ is causally \textbf{sufficient} for } \neg X}$ It is not necessary that C is causally necessary for $\neg X$.

In *enough*-sentences, C is causally necessary for X. (34) shows that *enough*-sentences are infelicitous under contexts where $C = 0 \wedge X = 1$. Thus, C has to be causally necessary for X.

(34) Towards the end of the party last night, the air conditioner stopped working. Those who kept staying there caught cold. **Mary was drunk, but Jo took her back early.** – *What happened to Mary?*

a. #– *Mary was clever enough to leave the party early.*
(C = Mary was clever enough. X = Mary left early.)

In *enough*-sentences, C can be causally insufficient for X. For (35), $F(X) = \langle Z_X = \{C, K\}, f_X = (X \Leftrightarrow K \wedge C)\rangle$. The felicitous answer (35a) shows that C can be an insufficient factor for X.

(35) Towards the end of the party last night, the air conditioner stopped working. Those who kept staying there caught cold. **Mary made a wise decision, and since she stayed sober, she drove back early herself.** – *What happened to Mary?*

a. ✓– *Mary was clever enough to leave the party early.*
(*X = Mary left early*, *C = Mary was clever enough*, *K = Mary stayed sober*.)

In *too*-sentences, C is causally sufficient for $\neg X$. (36) shows that *too*-sentences are infelicitous under contexts where $\neg X \not\Leftrightarrow C$. Thus C alone has to be sufficient for $\neg X$. Note that under (36), the answer *Bill was too busy to come last night* sounds misleading, and those who know the whole context have very good reason to claim that this answer misses the crucial point.

(36) If we don't invite Bill, Bill comes only if he is not overly busy. But if we invite Bill, he comes no matter whether he is busy or not. **Last night, we didn't invite Bill, and Bill was overly busy, so he didn't come.** – *What happened to Bill?*
   a. ?– *Bill was too busy to come last night.*
      (X = *Bill came*, C = *Bill was overly busy*, K = *Bill wasn't invited*.)

In *too*-sentences, C can be causally unnecessary for $\neg X$. For (37), $F(X) = \langle Z_X = \{C, K\}, f_X = (\neg X \Leftrightarrow K \vee C)\rangle$. For those who know the whole context, the answer (37a) is still acceptable and truthful, suggesting that C can be an unnecessary factor for X.

(37) Bill does not come if he is overly busy or sick. **Last night, he was both overly busy and sick, so he didn't come.** – *What happened to Bill?*
   a. ✓– *Bill was too busy to come last night.*
      (X = *Bill came*, C = *Bill was overly busy*, K = *Bill was sick*.)

A further prediction of the current account is that since **positive *enough*-**sentences contain a **necessary** (but not necessarily **sufficient**) cause for their infinitival complement to be **true**, **negative *enough*-**sentences should contain a **sufficient** (but not necessarily necessary) cause for their infinitival complement to be **false**; while since **positive *too*-**sentences contain a **sufficient** (but not necessarily necessary) cause for their infinitival complement to be **false**, **negative *too*-**sentences should contain a **necessary** (but not necessarily **sufficient**) cause for their infinitival complement to be **true**. (38) and (39) show that this prediction is perfectly borne out.

(38) a. Mary was clever enough to leave early. $\rightsquigarrow$ Mary left early.
   b. Mary was not clever enough to leave early. $\rightsquigarrow$ Mary didn't leave early.

(39) a. Bill was too busy to come last night. $\rightsquigarrow$ Bill didn't came last night.
   b. Bill was not too busy to come last night. $\rightsquigarrow$ Bill came last night.

This kind of pattern for the implicative reading of positive and negative E/T constructions is actually due to the lexical semantics of *enough*/*too* and their interplay with negation in creating dual relations, as sketched out in (40). Overall, the current account characterizes the nature of the implicative reading of positive and negative E/T constructions in a precise way.

(40) a. [[clever **enough**]] = [[not **too** stupid]] $\rightsquigarrow$ a **necessary** (but not necessarily sufficient) cause for the infinitival complement to be realized
   b. [[not clever **enough**]] = [[**too** stupid]] $\rightsquigarrow$ a **sufficient** (but not necessarily necessary) cause for the **negation** of the infinitival complement to be realized

infinitive type	examples	syntax	episodic interpretation	temporal composition of infinitive
irrealis future	*decide*, *expect* *expect*	control ECM	possible	*woll*
propositional	*claim* *believe*, *expect*	control ECM	impossible	reference time is attitude holder's NOW
non-propositional; no attitude holder	***manage*** *begin*, *seem*	**control** ECM	**dependent on matrix tense**	**reference time is matrix reference time**

Table 2: Wurmbrand (2014)'s framework on tense properties of English infinitives

5. The tense and aspect of the infinitival complement of E/T constructions

According to Wurmbrand (2014), infinitives are not semantically tenseless. As shown in Table 2, her framework for tense properties of English infinitives includes three classes: **(i)** future irrealis infinitives, **(ii)** those expressing propositional attitude reports, and **(iii)** those involving no attitude holder.

Here I argue that the infinitives of bi-clausal E/T constructions fall into the third class. There are at least two reasons for this. First, similar to *manage*-sentences, E/T constructions involve no attitude holders. Second, Faraci (1974) has shown that the infinitives in E/T constructions (even including *for*-phrases, e.g., *Mary runs too fast* ***for me to keep up with her***) are reduced sentential objects (i.e., smaller than CP or even TP), which makes them similar to the infinitival complement of core **restructuring** predicates like *manage* (see Wurmbrand 2001, 2004). Thus, as a consequence, E/T constructions constitute a single temporal domain, and the tense and aspect (or rather **episodicity** in the framework of Wurmbrand 2014) of their infinitival complement are reflected on the syntactically main predicate of the sentence.

Though Wurmbrand (2014)'s framework focuses on English infinitives, it seems generalizable to cross-linguistic data. For example, Marques (2012) notes that for Portuguese implicative E/T constructions, temporal overlap between the main predicate and the infinitive is required. This is a natural consequence if Wurmbrand (2014)'s analysis also works for Portuguese infinitives.

As mentioned earlier, for French E/T constructions, there seems a correlation between aspect and implication. An explanation is easily available if Wurmbrand (2014)'s analysis can be extended to French. In French, imperfective and perfective aspects are used to characterize generic and episodic events respectively. Thus, since the implicative reading of an E/T construction typically describes an episodic event (e.g., *Mary was nice enough* ***to come last night***), its semantic aspect is perfective, leading to a perfective marker on the main predicate in French. In other words, it is the episodicity of the entailed event that dictates the requirement for the aspect of the main predicate, not the other way round. This explains why the aspect of the main predicate is not a perfect indicator for the implicative reading (see the discussion of Hacquard 2006 and Nadathur 2017): a non-genuine E/T construction is a comparative and thus usually in imperfective, but sometimes it can also be in perfective.

6. Summary and outlook

This paper addresses the semantics of *enough*/*too* and E/T constructions. It includes three components: (i) an interval-based account for the lexical semantics of *enough*/*too*; (ii) a causality-based account for the semantics of E/T constructions; and (iii) a brief analysis of the semantic tense and aspect of the infinitival complement in E/T constructions. The conclusion is that ***enough* and *too* are essentially variations of comparatives** (i.e., *enough* means *not less* (*than*) and *too* means *more* (*than*)), but **bi-clausal E/T constructions are real implicatives**. To some extent, I agree with Nadathur (2017) that *enough* and *too* are not implicatives, but I also agree with Hacquard (2005, 2006) that (bi-clausal) E/T constructions are real implicatives. Crucially, by showing that genuine E/T constructions are bi-clausal, I attribute the source of implicative readings to this bi-clausal structure, not to the lexical semantics proper of *enough*/*too*. Moreover, by showing that implicative readings do not necessarily rely on the existence of two-way entailment or a sufficient and necessary condition, the current analysis more precisely characterizes the interpretation pattern of E/T constructions. As mentioned in Section 4, the pattern of causal dependence in the interpretation of positive and negative E/T constructions is related to the lexical semantics of *enough*/*too*, then is there a unified underlying mechanism for the interpretation pattern of the whole inventory of implicatives (see (41))? Syntactically, do implicatives all involve restructuring (cross-linguistically)? These are left for future research.

(41) Implicatives
   a. Involving a **necessary** cause for the infinitival complement to be realized: **French *pouvoir*** (e.g., *Jean a pu aller* means *John went because he could*, see Bhatt 1999), ***enough to***, ***not too to***, ***manage to*** (see Baglini and Francez 2015), ...
   b. Involving a **sufficient** cause for the **negation** of the infinitival complement to be realized: ***too to***, ***not enough to***, ***fail to*** ...

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An analysis of the semantic variability of weak adjuncts and its problems[1]

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Abstract. This paper addresses the question of how to account for the semantic variability of weak free adjuncts. Weak free adjuncts are non-clausal adjuncts that associate with an argument of the main predicate, contribute propositional content, and can interact with temporal or modal operators, which leads to different, adverbial-clause-like interpretations. I focus on a specific type of weak adjuncts, non-clausal *as*-phrases, and propose a unified semantic analysis for the full range of interpretational possibilities that takes into account the interpretational contingency on different syntactic positions. I show that this analysis improves on Stump's (1985) original analysis of weak adjuncts. I then go on to discuss the limitations of both Stump's account and the unified account. Both accounts fail to capture that the interaction of weak adjuncts with modal operators underlies certain restrictions on the properties of the modal operators—an observation that has not been discussed in the literature so far.

Keywords: weak free adjuncts, semantic variability, *as*-phrases, temporal/modal operators.

1. Introduction

Free adjuncts are non-clausal adjuncts that associate with an argument of the main predicate (the "associated constituent") and contribute propositional content about the denotation of that argument (the "associated individual"). Types of free adjuncts are, for instance, nominal, non-clausal *as*-phrases, see (1), and non-clausal phrases headed by gerunds, see (2).[2] While all free adjuncts fall under the above description, Stump (1985) notes that some free adjuncts give rise to an ambiguity in the case that they co-occur with a temporal or modal operator, see the *as*-phrases in (1). Stump calls free adjuncts of this kind "*weak (free) adjuncts*" and free adjuncts that do not give rise to such an ambiguity "*strong (free) adjuncts*".

(1) a. **As a child**, <u>Peter</u> got in for free. (past tense operator)
(Possible: When Peter was a child, he got in for free.)
(Possible: Since Peter is/was a child, he got in for free.)
b. **As a child**, <u>Peter</u> would get in for free. (*would*, modal operator)
(Possible: Since Peter is a child, he would get in for free.)
(Possible: If Peter were a child, he would get in for free.)

Sentences that contain a weak adjunct and a temporal/modal operator can be interpreted in such a way that the weak adjunct contributes causal-clause-like content (paraphrasable by a *since*-clause) and/or either temporal-clause-like or conditional-antecedent-like content (de-

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[2]The *as*-phrases discussed in this paper are Class 4 *as*-phrases following the classification of English non-clausal *as*-phrases in Zobel 2016, 2017a.

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pending on the co-occurring type of operator), compare (1a) and (1b). For weak adjuncts in episodic sentences in the present tense (e.g., *as a child, Peter is getting in for free*), only the causal-clause-like interpretation is available. For strong adjuncts, by contrast, the presence of a temporal/modal operator has no effect. They always contribute causal-clause-like content, see *being a child* in (2).

(2) **Being a child**, Peter would get in for free. (strong)
(Only possible: Since Peter is a child, he would get in for free.)
(Not possible: If Peter were a child, he would get in for free.)

Stump (1985) proposes the first formal semantic account for the semantic variability of weak adjuncts in the context of Montague grammar. His main strategy for capturing the range of observed contributions is to derive them using tailor-made semantic transformations. The first major aim of this paper is to present an analysis of weak adjuncts and their semantic variability that (i) retains Stump's general intuitions about the semantic contribution of weak adjuncts but (ii) derives these from a unified proposal for the semantics of weak adjuncts without recourse to semantic transformations. The second major aim is to address the predictions and limitations of Stump's proposal and this unified account. A closer look at the interaction of weak adjuncts and modal auxiliaries will yield further desiderata for an adequate analysis of weak adjuncts, which are not met by either proposal.

The paper is structured as follows. Section 2 provides a brief characterization of Stump's formal proposal. In Section 3, I present an alternative, unified analysis of weak adjuncts that takes their semantic variability to be a result of the relative flexibility of weak adjuncts with respect to their syntactic adjunction sites. The limitations of both Stump's and the alternative account are discussed in Section 4. There, I show that the interaction between weak adjuncts and modal operators is much more restricted than previously assumed, and that these restrictions are also in effect with other semantic phenomena. Section 5 concludes the paper.

2. Stump's (1985) analysis of the semantic variability of weak free adjuncts

In his dissertation, Stump (1985) presents a fully worked out Montague fragment[3] of English that is designed to deal specifically with the semantics of free adjuncts. The fragment is comprised of (i) a categorial grammar, (ii) an intensional logic, and (iii) a syntax-semantics-interface (i.e., a list of interpretation rules) that translates syntactic structures into logical expressions. For each node in a syntactic structure, the syntax-semantics-interface provides a category-specific interpretation rule. These rules are sensitive to the semantic type and features of the node's daughter expressions (i.e., the argument expression(s) of the rule), and the result of applying these rules in a step-wise manner are λ-expressions that are part of the intensional logic. In addition to effecting composition of their arguments, the interpretation rules may introduce additional, potentially underspecified material (e.g., free variables) into the resulting λ-expressions, which are valued subsequently via a pragmatic process.[4]

[3] A Montague fragment is a formal system for the analysis of natural language in the spirit of the work of Richard Montague, e.g., modelled after Montague 1973.
[4] For a more elaborate exposition of Stump's system, I ask the interested reader to directly refer to Stump 1985.

The main tenet of Stump's proposal for weak adjuncts is that they are semantically variable because their semantic contribution in each specific instance can parallel that of the adverbial clause with which they are paraphrased. Formally, this is implemented by dedicated interpretation rules that transform the basic semantic contribution of weak adjunct *as*-phrases in such a way that the resulting semantics mirrors the contribution and compositional behavior of the corresponding adverbial clauses. The basic semantic contribution of weak and strong free adjuncts, according to Stump, describes a set of times; (3) provides the basic semantics for *as a child*.[5]

(3) $\lambda t.\ \mathrm{AT}(t, \exists x^s[\mathrm{R}(x^s, y^i)\ \&\ \exists z^i[\mathrm{R}(x^s, z^i)\ \&\ \mathrm{child'}(z^i)]])$ (type $\langle i,t\rangle$)
$\Leftrightarrow \lambda t.\ \mathrm{AT}(t, \exists x^s[\mathrm{R}(x^s, y^i)\ \&\ \mathrm{child'}(y^i)])$
IN PROSE: The set of times t such that y's stage x at t is a child-stage.[6]

Notably, this basic meaning never directly combines with other expressions to derive the various interpretations observed for weak adjuncts. In each specific instance, it is first transformed (guided by the "right" syntactic categories) into expressions that parallel the corresponding adverbial clauses. This means, of course, that the semantic contribution of one and the same weak adjunct can differ quite radically depending on its use. Example (4) shows the result of applying the relevant rules to (3) to capture the causal-clause-like and the conditional-antecedent-like uses exhibited by *as a child* in (1b).

(4) a. *As a child* interpreted as a causal clause: (type $\langle\langle i,t\rangle,\langle i,t\rangle\rangle$)
$\lambda P.\lambda t.\mathscr{K}(\mathrm{L})(\exists t'[\mathrm{M}(t,t')\ \&\ \mathrm{AT}(t', \exists x^s[\mathrm{R}(x^s, y^i)\ \&\ \mathrm{child'}(y^i)])])(P(t))$
b. *As a child* interpreted as a conditional antecedent: (type t)
$\exists t[\ \mathrm{AT}(t, \exists x^s[\mathrm{R}(x^s, y^i)\ \&\ \mathrm{child'}(y^i)])]$

The expression in (4a) denotes a modifier that takes the contribution of the main clause as an argument (P) and relates the proposition $P(t)$ via some contextually determined (typically, causal) relation L to the proposition built from the basic contribution of the weak adjunct (first argument of $\mathscr{K}(\mathrm{L})$). In contrast, the expression in (4b) simply denotes a proposition (i.e., there is a time t at which the content contributed by the weak adjunct holds). The conditional-antecedent-like interpretation, Stump proposes (following Kratzer 1977), arises from using (4b) as the first argument/restrictor of a co-occurring modal quantifier.

In the introduction, we have seen that weak adjuncts can also interact with past tense in episodic sentences, see (1a). Stump does not discuss this case. Given the proposed parallelism between weak adjuncts and adverbial clauses, he arguably would have suggested an analysis that parallels that of temporal adverbial clauses, which are of type $\langle\langle i,t\rangle,\langle i,t\rangle\rangle$. To analyze this case adequately, new interpretation rules are needed, though.[7]

[5] Stump proposes a semantics for *as*, but never explicitly analyzes full *as*-phrases. The analyses in (3) and (4) are the result of applying Stump's rules to his denotation for *as* and indefinite NPs. I also slightly modernize Stump's notation. The superscripts on x, y, and z indicate whether a variable ranges over individuals (i) or stages (s) and R is the relation that relates individuals and their stages in the sense of Carlson 1977.

[6] The variable y is contextually identified with the associated individual.

[7] Even though (4a) has type $\langle\langle i,t\rangle,\langle i,t\rangle\rangle$, it would not provide the right semantic contribution for the temporal-clause-like cases given Stump's own analysis of temporal adverbial clauses.

While Stump's proposal manages to capture the semantic variability of weak adjuncts, his analysis is ultimately dissatisfying. As described above, his main strategy is to introduce tailor-made interpretation rules to capture each of the interpretational possibilities of weak adjuncts. This results in an analysis that only restates the main observation—i.e., weak adjuncts are flexible with respect to which relation is understood to hold between their contribution and the content contributed by the main clause.

In the following section, I use the case of weak adjunct *as*-phrases to show that in a system that follows the general principles outlined in Heim and Kratzer 1998, the central observation that weak adjuncts can behave like different adverbial clauses can be captured without recourse to specialized interpretation rules. The main assumption underlying this account is that weak adjuncts are flexible with respect to *where* they are base generated and interpreted.[8]

3. A unified analysis of the semantic variability of weak adjunct *as*-phrases

3.1. The semantic contribution of *as*-phrases

To start out, I propose a basic analysis of weak adjunct *as*-phrases. Following Emonds (1984), Stump (1985), and Jäger (2003), I assume that *as* serves a function similar to that of the copula in predicational copular sentences.[9] Recent analyses of predicational copular clauses assume that the copula takes only one argument, a *Small Clause* (i.e., a phrase that contains both a non-verbal predicate and its subject; see e.g., Matushansky and Spector 2005). Consider (5).

(5) a. Peter is a child.
b. [$_{vP}$ is [$_{SC}$ Peter [$_{DP}$ a child]]]

I directly adopt this idea for my proposal for the syntactic structure of *as*-phrases in (6).

(6) [$_{asP}$ as [$_{SC}$ PRO [$_{DP}$ a child]]]

Unlike the Small Clauses in copular sentences, a Small Clause in the complement of *as* does not have an overt subject but contains the covert pronoun PRO. The semantic value of PRO is provided by the associated constituent (i.e., the argument of the main predicate with which the *as*-phrase associates; see the introduction). Following Williams (1992), Adler (2006), and Flaate (2007), I assume that this association dependency can be captured formally by assuming that PRO is non-obligatorily controlled by that associated argument.

Semantically, *as*, just like the copula, contributes an identity function over propositions (cf. Matushansky and Spector 2005). That is, *as* takes a propositional argument p (type $\langle i, \langle s,t \rangle\rangle$) and returns it unchanged, see (7).[10]

[8]Stump employs categorial grammar to analyze sentences close to their surface. Hence, the avenue to link the observed semantic flexibility to an underlying structural difference that is resolved by movement (see below) is not open to him.
[9]Emonds (1984) calls *as* a/the "prepositional copula".
[10]This analysis ignores the differences between *as* and the copula. For a discussion of these differences see Stump 1985 and Jäger 2003.

(7) $[\![\text{as}]\!]^{w_0,t_0,g} = \lambda p_{\langle i,\langle s,t\rangle\rangle}.p$ (type $\langle\langle i,\langle s,t\rangle\rangle,\langle i,\langle s,t\rangle\rangle\rangle$)

The Small Clause in the complement of *as* contributes propositional content, see (8); for the purposes of this analysis, I assume that the referent of PRO, which is determined via non-obligatory control, is assigned by the variable assignment g.[11]

(8) $[\![[_{SC}\ \text{PRO}_i \text{ a child}]]\!]^{w_0,t_0,g} = \lambda t.\lambda w.\text{child'}(g(i))(t)(w)$ (type $\langle i,\langle s,t\rangle\rangle$)

To derive the contribution of the full *as*-phrase in (6), we need to combine (7) with (8). Given that *as* contributes an identity function, the result of this combination in (9) is identical to (8).

(9) $[\![\text{as } [_{SC}\ \text{PRO a child}]]\!]^{w_0,t_0,g} = \lambda t.\lambda w.\text{child'}(g(i))(t)(w)$ (type $\langle i,\langle s,t\rangle\rangle$)
IN PROSE: The proposition that is true for a world w and a time t iff the associated individual $g(i)$ is a child at t in w.

The proposal in (9) directly mirrors Stump's basic meaning in (3). In contrast to Stump, I argue that (9) suffices to capture the full range of interpretations given one basic assumption: weak adjunct *as*-phrases can be base generated wherever they are interpretable (i.e., wherever they can be composed with their sister nodes). The sentence-initial position found for the full range of possible interpretations of *as a child* in (1) is the result of movement from different underlying base positions. This movement is later reconstructed at LF prior to interpretation.[12]

Which positions are viable base positions for weak adjuncts is determined by the syntactic and semantic status of weak adjuncts. Since they are modifiers, I assume that they combine with the denotations of their sister nodes via a generalized form of Predicate Modification (Heim and Kratzer 1998). Hence, *as*-phrases can adjoin to any node of type $\langle i,\langle s,t\rangle\rangle$.

Which nodes are of type $\langle i,\langle s,t\rangle\rangle$? For the basic syntactic structure of a sentence, I adopt the sequence of functional projections in Beck and von Stechow 2015, see (10). Furthermore, I follow their assumption that the lexical material below AspP jointly builds up a time- and world-independent eventuality description. Unlike Beck and von Stechow (2015), however, I assume that, after existential closure of this eventuality description by the head of Asp, the branching nodes along the functional spine have a uniform semantic type; they are all time- and world-dependent (i.e., of type $\langle i,\langle s,t\rangle\rangle$).[13]

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[11] To my knowledge, there is no established semantic proposal for how to model non-obligatory control into adjuncts that attach high in the syntactic structure. For a discussion of the properties of this type of control see Adler 2006. For the moment, I assume that the value assigned by g is fixed by some independent mechanism.

[12] This predicts that the sentence-initial position is not the only position in which weak adjunct *as*-phrases are found. This is borne out: they can also occur in sentence-final position.

(i) ?Peter gets in for free as a child.

The slight marginality of (i), I suggest, arises because sentence-final *as*-phrases are preferably read as *as*-phrases of Class 3; these are *as*-phrases that specify the role or function in which the associated individual participated in the eventuality described by the main predicate (see Zobel 2016, 2017a).

[13] I diverge from Beck and von Stechow (2015) in how I model intensionality because, unlike these authors, I do not assume that time/world variables and their binders are syntactically represented.

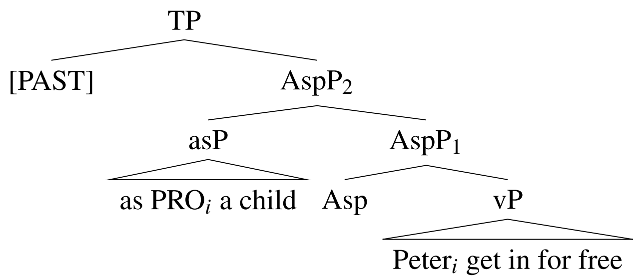
(10) CP – TP (tense) – IP (modals) – AspP (aspect) – vP/VP
<— potential adjunction sites —><– no adjunction –>

The semantic variability of weak adjuncts can now be reduced to the different adjunction sites occupied by different weak adjuncts. Specifically, the choice of adjunction site will determine which of the operators introduced in the functional heads along this spine will be able to interact with the content contributed by the weak adjunct. Any operator that has scope over the weak adjunct will have an effect on the time or world of evaluation of its content. For operators that sit in a position below the base-generation site of the weak adjunct, though, the adjunct and its time and world of evaluation will be "out of reach". What this means for specific cases is made explicit in the upcoming subsections.

3.2. The temporal-clause-like interpretation

The temporal-clause-like interpretation of weak adjuncts arises from the interaction of their content with a temporal operator. In the case of (1a) (i.e., *As a child, Paul got in for free*), for instance, the temporal-clause-like interpretation arises from the *as*-phrase being adjoined to a node in the scope of the temporal operator [PAST], see (11).

(11)



To derive the semantics of (11), I start out by assuming that AspP_1 has the denotation in (12).

(12) $$[\![[_{AspP_1} \text{ Asp Peter}_i \text{ get in for free}]]\!]^{w_0,t_0,g} = \lambda t'.\lambda w.\exists e[e \text{ in } w \;\&\; t' \supseteq \tau(e) \;\&\; \text{get-in-for-free'}(\text{Peter})(e)]$$

Since AspP_1 is of type $\langle i, \langle s,t\rangle\rangle$, its contribution in (12) and the contribution of the *as*-phrase in (9), which is also of type $\langle i, \langle s,t\rangle\rangle$, can be composed using Generalized Predicate Modification, which results in the denotation of AspP_2 in (13).[14]

(13) $$[\![[_{AspP_2} \text{ as a child} \ldots \text{free}]]\!]^{w_0,t_0,g} = \lambda t'.\lambda w.\ \text{child'}(g(i))(t')(w) \;\&\; \exists e[e \text{ in } w \;\&\; t' \supseteq \tau(e) \;\&\; \text{get-in-for-free'}(\text{Peter})(e)]$$

Next, the denotation of [PAST], given in (14), is applied to (13). This results in the final proposal for the denotation of (11) in (15).

[14]The effect of applying Generalized Predicate Modification to two functions of the same type $\langle \alpha_1, \ldots \langle \alpha_n, t\rangle \ldots\rangle$ is (i) identification of the arguments of matching types in the order in which they are given and (ii) conjunction of the descriptive material. The resulting expression also has the type $\langle \alpha_1, \ldots \langle \alpha_n, t\rangle \ldots\rangle$.

(14) $[\![[\text{PAST}]]\!]^{w_0,t_0,g} = \lambda p_{\langle i,\langle s,t\rangle\rangle}.\lambda t.\lambda w.\exists t'[t' \leq t \ \&\ p(t')(w)]$

(15) $\lambda t.\lambda w.\exists t'[t' \leq t \ \&\ \text{child'}(g(i))(t')(w) \ \&\ \exists e[e \text{ in } w \ \&\ t' \supseteq \tau(e) \ \&\ \text{g-i-f-f'}(\text{Peter})(e)]]$
IN PROSE: (15) holds for a world w and a time t iff there is a time t' preceding t such that Peter is a child at t' in w and t' includes the runtime of an event e of Peter getting in for free in w.

The effect of [PAST] is to shift the time t' (i.e., the reference/topic time of the clause) into the past of the overall time of evaluation t of the sentence. One result of the composition step illustrated in (13) is the identification of the temporal argument of the *as*-phrase content with the temporal argument of the denotation of AspP_1. As a result of this identification, the *as*-phrase content further specifies the reference/topic time t' in (15). Since further specifying the reference/topic time t' is the task that is usually served by temporal adverbials, the present proposal manages to capture the temporal-clause-like interpretation of weak adjunct *as*-phrases that arises as a result of the semantic interaction with temporal operators like [PAST].

3.3. The conditional-antecedent-like interpretation

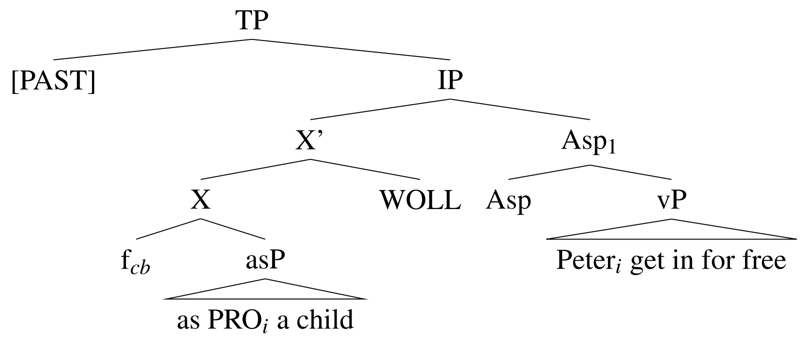
The conditional-antecedent-like interpretation observed for weak adjunct *as*-phrases arises as a result of their interaction with modal operators. For instance, the conditional-like interpretation of (1b) (i.e., *If Peter were a child, he would get in for free*) can be attributed to the interaction of the *as*-phrase content with the modal operator contributed by *would*.

To capture this interpretation of (1b), I adopt Stump's basic idea that if an *as*-phrase co-occurs with a modal auxiliary, it can restrict the modal quantifier contributed by this auxiliary in the same manner as an *if*-clause. Instead of taking *if*-clauses to be arguments of modal auxiliaries (see Stump's proposal in Section 2), however, I adopt the basic syntactic and semantic analysis of conditionals in von Stechow 2004. Following von Stechow, I assume that *if*-clauses modify a free variable f_{cb}, which is an argument of the modal auxiliary and contributes its *conversational background* (i.e., the restrictor). The value of f_{cb} is a proposition (type $\langle i,\langle s,t\rangle\rangle$); it is the conjunction of all contextually determined background assumptions with respect to which the necessity or possibility expressed by the corresponding modal auxiliary is determined (see Kratzer 2012). Since *as*-phrases can be adjoined to any node of type $\langle i,\langle s,t\rangle\rangle$ (see Section 3.1), they can also adjoin to f_{cb}.

For (1b), the conditional-antecedent-like interpretation arises as a result of the *as*-phrase modifying the value assigned to the variable f_{cb}, which contributes the restrictor of the co-occurring modal operator contributed by *would*, see (16).[15]

[15] Following Ippolito (2013) among others, I take *would* to spell out the universal modal operator WOLL in the scope of [PAST]. Since the question whether [PAST] in this context expresses regular temporal precedence or so-called "fake past" is orthogonal to my concerns (but see the discussion in Ippolito 2013), I arbitrarily assign to [PAST] its regular temporal interpretation.

(16)



To start out, let us first derive the contribution of the modal restricted by f_{cb} after it has been modified by the *as*-phrase (i.e., the denotation of the X'-node). First, I assume that WOLL expresses universal quantification over worlds. It takes two propositional arguments: its restrictor q and its scope p, see (17).

(17) $[\![\text{WOLL}]\!]^{w_0,t_0,g} = \lambda q_{\langle i,\langle s,t\rangle\rangle}.\lambda p_{\langle i,\langle s,t\rangle\rangle}.\lambda t.\lambda w.\forall w' : q(t)(w')[p(t)(w')]$

Second, the denotation of the X-node, which contributes the modified restrictor for WOLL and fills its first propositional argument, is derived by applying Generalized Predicate Modification to f_{cb} and the *as*-phrase content, see (18).

(18) $[\![[_X \text{ f}_{cb} \text{ as a child}]\!]^{w_0,t_0,g} = \lambda t.\lambda w.\ f_{cb}(t)(w)\ \&\ \text{child'}(g(i))(t)(w)$

After applying (17) to (18), we obtain the denotation in (19) for the X'-node. The X'-node denotes a modal operator that takes a proposition p, a world w, and a time t as its arguments and outputs true iff for all worlds w' in which f_{cb} is true at t and $g(i)$ is a child at t, the proposition p is true at t in w'.

(19) $[\![\text{X'}]\!]^{w_0,t_0,g} = \lambda p_{\langle i,\langle s,t\rangle\rangle}.\lambda t.\lambda w.\forall w' : f_{cb}(t)(w')\ \&\ \text{child'}(g(i))(t)(w')[p(t)(w')]$

The propositional argument slot of (19) is filled in the next composition step by the denotation of AspP$_1$ in (20) (repeats (12)). The result is given in (21).

(20) $[\![[_{AspP_1} \text{ Asp Peter}_i \text{ get in for free}]]\!]^{w_0,t_0,g} =$ (= (12))
$\lambda t'.\lambda w.\exists e[e \text{ in } w\ \&\ t' \supseteq \tau(e)\ \&\ \text{get-in-for-free'}(\text{Peter})(e)]$

(21) $[\![[_{IP} \text{ f}_{cb} \ldots \text{for free}]]\!]^{w_0,t_0,g} = \lambda t'.\lambda w.\forall w' : f_{cb}(t')(w')\ \&\ \text{child'}(g(i))(t')(w')[$
$\exists e[e \text{ in } w'\ \&\ t' \supseteq \tau(e)\ \&\ \text{get-in-for-free'}(\text{Peter})(e)]]$

In the last composition step, the denotation of [PAST] (see (14) in Section 3.2) is applied to (21). By this, we obtain the final proposal in (22) for the denotation of (16).

(22) $\lambda t.\lambda w.\ \exists t'[t' \leq t\ \&\ \forall w' : f_{cb}(t')(w')\ \&\ \text{child'}(g(i))(t')(w')[$
$\exists e[e \text{ in } w'\ \&\ t' \supseteq \tau(e)\ \&\ \text{get-in-for-free'}(\text{Peter})(e)]]]$

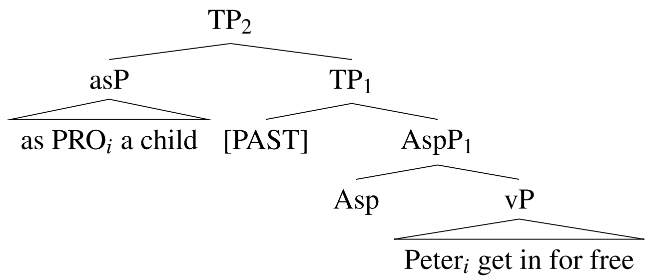
IN PROSE: (22) holds for t and w iff there is time t' preceding t such that for all worlds w' in which f_{cb} holds at t' and Peter is a child at t', there is an event e at t' of Peter getting in for free.

As in Section 3.2, the desired interpretation is ensured by the assumption that *as*-phrases can be base generated and interpreted in any position in which they are sister to a node of type $\langle i, \langle s,t \rangle \rangle$. Hence, the conditional-antecedent-like interpretation and the temporal-clause-like interpretation are captured in an entirely parallel fashion.[16]

3.4. The causal-clause-like interpretation

The causal-clause-like interpretation has a special status among the potential interpretations of weak adjuncts. It is the only interpretation that is always available, regardless of any co-occurring temporal or modal operators; and it is the only interpretation that is also available for strong free adjuncts (see the introduction).

Recall the strategy that was pursued in the previous subsections to model the interaction with temporal/modal operators: the *as*-phrase was argued to adjoin in a position where it directly modifies the restrictor or scope of a given operator. This ensures that the time and/or world argument inside the *as*-phrase content becomes dependent on this operator. Hence, to capture the independence of the causal-clause-like interpretation, I assume that the *as*-phrase adjoins to a position in the clause that is outside the scope of any temporal/modal operator.[17] In what follows, I discuss this idea based on the example of the causal-clause-like interpretation of (1a) (i.e., *As a child, Paul got in for free*), see the syntactic structure in (23).

(23) 

To derive the interpretation of (23), the temporal operator [PAST] (see Section 3.2) first composes with the denotation of AspP$_1$ (= (20)). This results in the denotation of TP$_1$ in (24).

(24) $[\![[_{TP_1} \text{ [PAST] Asp Peter get in for free}]]\!]^{w_0,t_0,g} =$
$\lambda t.\lambda w.\exists t'[t' \leq t \;\&\; \exists e[e \text{ in } w \;\&\; t' \supseteq \tau(e) \;\&\; \text{get-in-for-free'}(\text{Peter})(e)]]$

[16] The analysis provided in this subsection could in principle be adapted for an analysis of modal auxiliaries that utilizes a *modal base* and an *ordering source*: all steps that involve f_{cb} have to be performed for a variable of type $\langle i, \langle s,t \rangle \rangle$ that brings in the modal base of the corresponding modal auxiliary (see Kratzer 2012).

[17] This is not to say that *strong* free adjuncts can only adjoin to positions outside the scope of temporal and modal operators. There might be other reasons for why strong free adjuncts and these operators do not interact. Stump (1985), for instance, argues that strong free adjuncts are *individual level predicates*, while weak free adjuncts are *stage level predicates*. This distinction, Stump suggests, has an impact on their semantic behavior and prevents strong free adjuncts from scoping under temporal and modal operators. Jäger (2003) translates this into the idea that weak free adjuncts can take small situation-sized arguments, while strong free adjuncts can only be predicated of world-sized arguments and, hence, cannot restrict temporal/modal quantifiers. I remain agnostic regarding the difference between weak and strong free adjuncts as this question is orthogonal to the present concerns.

The denotation of TP_1 is of type $\langle i, \langle s,t\rangle\rangle$. Hence, (24) can be composed with the denotation of the adjoined *as*-phrase via Generalized Predicate Modification. The result is given in (25).

(25) $\lambda t.\lambda w.$ child'$(g(i))(t)(w)$ & $\exists t'[t' \leq t$ & $\exists e[e$ in w & $t' \supseteq \tau(e)$ & g-i-f-f'(Peter)$(e)]]$
IN PROSE: (25) holds for w and t iff Peter is child at t in w, and there is a time t' preceding t that includes the runtime of an event e in w of Peter getting in for free.

Since the *as*-phrase is adjoined in a position above TP, the time and world of evaluation for the *as*-phrase content are the time t and world w of evaluation of the entire sentence, which are pragmatically identified with the time t_0 and world w_0 of utterance.

How does (25) capture the causal-clause-like interpretation of (1a)? The short answer is: it doesn't. As it stands, the result in (25) of the step-wise interpretation procedure is semantically equivalent to *Peter is a child, (and) he got in for free*. I assume, following Jäger (2003), that the explanation relation between the first and the second conjunct in (25) is inferred pragmatically using the same mechanism that allows us to infer similar *discourse relations* between independent utterances, as in (26) (see Asher and Lascarides 2003).

(26) Peter got in for free. He is a child.

The two sentences in (26) are preferably understood such that the second sentence provides an explanation for the validity of the first sentence. Similarly, the content contributed by the *as*-phrase is understood as providing an explanation for the validity of the content contributed by the remaining material in the clause.

Of course, this parallel between (1a) and (26) is only suggestive. A fully worked-out proposal has to be left for future work. I will, however, discuss two observations that concern the optionality of the explanation relation, which supports the decision not to hard-code an explanation relation into the denotation of weak adjunct *as*-phrases.

First, we observe that the explanation relation understood in the context of the causal-clause-like interpretation is not obligatorily present in the temporal-clause-like interpretation. Example (27), for instance, does not convey that Peter's being a child explains his being blond—only that Peter was blond when he was a child. If an explanation relation were an integral part of the semantics of *as*-phrases, this strict temporal contribution could not be explained.[18]

(27) As a child, Peter had blond hair.

Second, the explanation relation only seems to be the default link that is inferred to connect the propositional *as*-phrase content and the proposition expressed by the remainder of the sentence. In the right supporting contexts we can also infer a concessive relation, see (28).

(28) I was shocked by Peter's confession. As a doctor, he smokes 50 cigarettes a day!

[18]The same, in fact, holds for the conditional-antecedent-like interpretation, but this may be harder to see because of the rule-like connection between the restrictor and the scope that is established by the modal operator.

In the given context, the second sentence in (28) is most naturally understood as conveying that Peter smokes 50 cigarettes a day *even though* he is a doctor (i.e., doctors usually do not smoke 50 cigarettes a day). Crucially, we do not interpret his being a doctor as an explanation for his smoking habits.

At the moment, the exact conditions that underlie the causal-clause-like and the concessive-clause-like interpretations are unclear to me. What is clear, though, is that the relation that is to be understood cannot be attributed to the semantics of the *as*-phrase or any co-occurring operator. I need to leave the missing details for further investigation.

3.5. Comparing Stump's original account to the present proposal

The aim for the proposal outlined in Sections 3.1–3.4 was to capture the same range of interpretations as Stump's account. The resulting proposal is, however, not "just" a translation of Stump's account into another system. In this subsection, I show that the two accounts differ in their predictions, and that the present proposal captures patterns in the data that Stump's account fails to predict. The present analysis, therefore, must be seen as a refinement of Stump's.

The relevant data concerns the possible interpretation of sentences that contain two *as*-phrases (one sentence-initially and one sentence-finally, see fn. 12) and a co-occurring temporal or modal operator, as in (29).

(29) a. **As a shy person**, Peter was quiet **as a child**. ([PAST])
b. **As a runner**, Peter would have fun **as a participant of this course**. (*would*)

We observe that the relative positions of the two *as*-phrases in a clause constrain the possible interpretations of the two occurrences. Even though (29a) contains two *as*-phrases that could in principle both interact with [PAST], only the second *as*-phrase, *as a child*, can (and indeed must) interact with it. The first *as*-phrase, *as a shy person*, can only be given a causal-clause-like interpretation. Analogously in (29b), only the second *as*-phrase, *as a participant of this course*, can (and must) interact with *would*; the first *as*-phrase, *as a runner*, can again only be understood as causal-clause-like.

The present proposal can straightforwardly account for the data in (29). The causal-clause-like interpretation results from a higher syntactic position than either the temporal-clause-like or the conditional-antecedent-like interpretation. Assuming that the height of syntactic attachment is reflected in the surface position of an expression, we expect the relative linear order of co-occurring *as*-phrases to affect the range of available interpretations.

Stump's account, in contrast, does not predict the relative order of two co-occurring *as*-phrases to constrain their interpretational possibilities. For any of the two *as*-phrases in (29b), for instance, their contributed content could be transformed into either the content that underlies the causal-clause-like interpretation (see (4a) in Section 2), or the content that underlies the conditional-antecedent-like interpretation (see (4b) in Section 2). Hence, Stump's account predicts (29b) to be ambiguous, contrary to fact.

4. Limitations of Stump's account and the present account

In the previous section I presented an account for the semantic variability of weak adjunct *as*-phrases that aimed at capturing the various interpretations that were observed for weak adjuncts in the literature, notably Stump 1985. I proposed that the observed variability is the result of different attachment sites to which weak adjuncts can adjoin. In this respect, my proposal differs from Stump's proposal, who assumes semantic transformations of basic underlying content. In this section, I present data that is problematic for both Stump's and the current proposal. The aim is to identify which of the assumptions about the data need to be revised, and which patterns ultimately need to be captured.

The main problem for both accounts is connected to the conditional-antecedent-like interpretation. The analysis in both accounts predicts that weak adjuncts can behave *just like* conditional clauses (e.g., *if*-clauses). Despite some parallels between weak adjuncts and conditional clauses[19], this is not borne out. In fact, closer examination of the data shows that the interaction between weak adjuncts and modal operators is restricted to a specific subset of modal operators (*pace* Stump 1985) that can be shown to pattern together in other respects, as well.[20]

4.1. Differences between *if*-clauses and weak adjunct *as*-phrases

The first difference between *as*-phrases and *if*-clauses is that *as*-phrases depend on the presence of an overt modal operator for their conditional-antecedent-like interpretation. *If*-clauses, in contrast, can also restrict covert modals (see Kratzer 2012). Compare (30a) to (30b).

(30) a. If Peter is an administrator, he has his office on the third floor.
b. As an administrator, Peter has his office on the third floor.

Even though the main clause in (30a) does not contain an overt modal, the *if*-clause is interpreted as a conditional antecedent. This is attributed to the presence of a covert epistemic universal modal, similar to overt *must*, that is restricted by the *if*-clause. In contrast, the *as*-phrase in (30b) can only be understood with a causal-clause-like interpretation; the conditional-antecedent-like interpretation is, crucially, unavailable.

Neither Stump's account nor the present account can capture this difference. Stump's interpretation rules are designed to assimilate weak adjuncts to *if*-clauses so that exactly the same combination rules can apply to the two types of expressions. Whether the modal operator involved is overt or covert should not make a difference for the applicability of these rules. The same holds for the present account. The adjunction site that allows an *as*-phrase to modify f_{cb}

[19]For instance, *as*-phrases in their conditional-antecedent-like interpretation can conjoin with *if*-clauses, see (i).

(i) As an adult and if he had had enough money, Peter could have watched the movie.

[20]For reasons of simplicity, I will restrict the subsequent discussion to *if*-clauses. Similar observations can be made for conditional clauses introduced by other subjunctors (e.g., *when* or *whenever*).

is available whenever a modal operator is present and does not depend on its (c)overtness.

The second difference between *as*-phrases and *if*-clauses regards the types of overt modal operators that they can restrict. Stump (1985: 53–57) argues that weak adjuncts can restrict *any* modal with *any* interpretation, just like *if*-clauses. This is in fact not the case. Closer inspection shows that weak adjunct *as*-phrases are able to restrict future-oriented *will*, future-oriented *might*, *would*, and other subjunctive marked modals. They, however, do not interact with modals in the indicative with an epistemic or root interpretation (i.e., deontic, bouletic, teleological, or ability; see Portner 2009). Compare (31)–(33) to (34)–(36).

(31) [**Context:** Peter's aunt loves caviar, but she could never afford to buy it. Last week, she learnt that she was going to inherit a lot of money from a rich, distant relative when they were going to die.]
Peter: As a millionaire, she will eat caviar every day. (future-oriented *will*)

(32) [**Context:** Mary asks Susan whether it would be a good idea to have Peter join the day cruise on the Charles River.] (future-oriented *might*)
Susan: As a participant, Peter might annoy the other passengers on the boat, and the trip would not be as nice.

(33) [**Context:** Peter was murdered. He died from a blow to the head. The detective knows that the cook is innocent because she has an alibi for the time of the murder. Nevertheless, he considers how the cook would have killed Peter.] (*would*)
Detective: As the culprit, the cook would have used her favorite frying pan.

Examples (31)–(33) contain future-oriented *will/might* and *would*, and in these examples, the contribution of the *as*-phrases can be paraphrased with the corresponding *if*-clauses. This is, in fact, the only available interpretation of (31)–(33) given the contexts that are provided: the causal-clause-like interpretation requires it to be established (based on what the speaker knows) that the property contributed by the *as*-phrase applies to the associated individual at the time of utterance; this is not the case in any of the scenarios.[21] Hence, the observation that the utterances in (31)–(33) are coherent in the given contexts allows us to conclude that the conditional-antecedent-like interpretation is in fact available. Matters are different in (34)–(36).

(34) [**Context:** Peter was murdered. He died from a blow to the head. The detective believes that either the gardener or the butler did it.] (intended: epistemic *might*)
Detective: #As the culprit, the gardener might have used his spade. The spade fits with Peter's injuries.

(35) [**Context:** Peter was beaten up. The main suspect at this point in the investigation is Peter's cook, who has a criminal record.] (intended: deontic *have to*)
Detective: #As the culprit, the cook has to go to jail.

[21]This follows from the observation that *as*-phrases in their causal-clause-like interpretation pattern with *since*-clauses; see Iatridou 1991 and Charnavel 2017.

(36) [**Context:**] The candidates for the local election will be announced today. Peter knows that Susan was considering to run for office, but he doesn't know what she decided to do in the end. (intended: bouletic/teleological *must*)
Peter: #As a candidate, Susan must overcome her awkwardness (to have a chance).

Examples (34)–(36) were constructed using the same strategy as in (31)–(33) to exclude the causal-clause-like interpretation. Hence, the conditional-antecedent-like interpretation would be the only plausible interpretation for these *as*-phrases. Since the native speakers I consulted uniformely judge the utterances in (34)–(36) as odd in the given contexts, I conclude that the conditional-antecedent-like interpretation is unavailable for the *as*-phrases in (34)–(36).

In sum, we find that the conditional-antecedent-like interpretation depends on the presence of an overt modal that is not an indicative modal with an epistemic or root interpretation. Neither Stump's analysis nor the proposal in Section 3 can account for these restrictions; in the two analyses, the availability of the conditional-antecedent-like interpretation is fully independent of the properties of the co-occurring modal operator.

4.2. Modals allowing for the conditional-antecedent-like interpretation

What is the property that future-oriented *will*, future-oriented *might*, *would*, and other subjunctive-marked modals share that might be decisive for the availability of the conditional-antecedent-like interpretation? Looking at the assortment of modals, one might suspect that the factor that decides which modals interact with weak adjuncts is future *temporal orientation*. Future-orientedness, however, turns out not to make the right distinction: root interpretations are assumed to be uniformely future-oriented but do not show any interaction with weak adjuncts (see Rullmann and Matthewson 2017).[22]

Closer inspection reveals that future-oriented *will* differs from future-oriented *might*, *would*, and other subjunctive-marked modals and has to be considered independently. The decisive difference between *will* and the other modals in this group is that the conditional-antecedent-like interpretation with *will* cannot be subject to "iffiness" (i.e., the speaker has to be relatively certain that the *as*-phrase content will apply to the associated individual, see von Fintel and Iatridou 2002). This lack of "iffiness" is reflected in the observation that with future-oriented *will*, the *as*-phrase has to be paraphrased with a *when*-clause instead of an *if*-clause; compare (31) to (32) and (33). This suggests that the interaction of weak adjuncts with *will* is closer to the interaction with temporal operators than the interaction with the other modals. For reasons of space, the necessary details need to be left to future work.

The remaining modal operators (i.e., future-oriented *might*, *would*, and other subjunctive-marked modals) are all *irrealis modals*. They share the ability to occur in different varieties of past- and future-oriented subjunctive conditionals (see Iatridou 1991 for an overview). In addition, they all (at least diachronically) feature some form of morphological irrealis marking

[22] Similarly, the decisive factor cannot be *temporal perspective*, either. All modals can have either past or present temporal perspective. For a discussion of these notions see Rullmann and Matthewson 2017.

(i.e., some form of past tense and/or subjunctive marking).

Semantically, irrealis modals differ from all other modals and modal flavours, which I will call "realis" modals/flavors, in that irrealis modals can access various linguistically or contextually provided material to "build" their restrictors in case these are not provided by overt material. This ability of irrealis modals is reflected in the following two ways. First, irrealis modals in *simple subjunctives* are able to extract their restrictors from topic-marked, presupposed, and presumed material (see Kasper 1992, Schueler 2008). The modal *would* in (37a), for instance, can be restricted by a precondition of Peter's passing the test—i.e., that Peter takes part in the test. In contrast, the deontically interpreted modal *have to* in (37b) cannot be understood as restricted in the same way.

(37) a. Peter would have passed the test. (irrealis *would*)
(≈ If Peter had written the test, he would have passed it.)
b. Peter has to pass the test. (deontic/realis *have to*)
(Cannot mean: If Peter writes the test, he has to pass it.)

Second, irrealis modals, in contrast to realis modals, allow for *modal subordination* (see a.o. Roberts 1989, 2015). The third person singular pronoun *it* in (38a), which features irrealis *might*, can be anaphoric to the indefinite NP *a bar of chocolate* in the preceding sentence. No such anaphoric dependency is available for *it* in the parallel (38b), which contains realis *can*.

(38) I could leave a bar of chocolate for you in the fridge.
a. My brother might eat it, though. (irrealis *might*)
(≈ If I leave a bar of chocolate in the fridge, my brother might eat it.)
b. #My brother can eat it, though. (realis *can*)
(Cannot mean: If I leave a bar of chocolate in the fridge, my brother can eat it.)

I argue that it is this property of irrealis modals—the property that allows us to reconstruct their restrictor and that renders modal subordination possible—that underlies the possibility of weak adjuncts to restrict these modals. By assuming this general characteristic, I make two predictions: (i) other temporal/modal operators that allow for contextual restriction allow for modal subordination and vice versa, and (ii) weak adjuncts can have a conditional-antecedent-like interpretation with operators of this kind.

Grounding my judgment on the discussion in the literature about simple subjunctives and modal subordination, prediction (i) seems to be borne out. Other temporal/modal operators that have been argued to pattern with irrealis modals with respect to both phenomena are adverbs of quantification and the generic/habitual operator (see a.o. von Fintel 1994, Krifka et al. 1995, Roberts 1989, 2015). For both adverbs of quantification and the generic/habitual operator, we find that they also interact with weak adjuncts to give a conditional-like interpretation (see Stump 1985). This is illustrated in (39), where the weak adjunct *as*-phrase is shown to interact with and restrict the adverb of quantification *often* and the generic/habitual operator. Hence, the second prediction in (ii) is also borne out.

(39) a. As a passenger of Lufthansa, Peter often compliments the flight attendants.
(≈ Often, when Peter flies with Lufthansa, Peter compliments . . .)
b. As a passenger of Lufthansa, Peter orders as many beverages as possible.
(≈ Whenever Peter flies with Lufthansa, he orders . . .)

In sum, we see that the modal operators in the restricted class that allows for the conditional-antecedent-like interpretation of weak adjuncts share a property that is also decisive with respect to the availability of other interpretational phenomena. What all of these phenomena have in common is that the temporal/modal operators that are involved in them need to be restrictable by material from the linguistic and extra-linguistic context. The conditional-antecendent-like interpretation of weak adjuncts, hence, illustrates a general distinction among temporal/modal operators, which needs to be addressed further. Since this investigation is beyond the scope of this paper, though, it has to be left for future work.

4.3. Implications for the account of weak adjunct *as*-phrases

The discussion in Sections 4.1 and 4.2 has direct implications for Stump's account and the account presented in Section 3: the conditional-like-interpretation *cannot* be the result of either a direct semantic transformation (as in Stump 1985), or of weak adjuncts restricting the free restrictor variables provided by temporal/modal operators directly (as in the present account). Instead, the modal facts point us towards an indirect mechanism.

The first step towards this indirect mechanism is to realize that, contrary to what is assumed in Stump 1985 and in Section 3, the content contributed by weak adjunct *as*-phrases is presuppositional. Example (40) shows that the content contributed by *as a child* (i.e., that Peter is a child) projects from under entailment cancelling operators: it is neither affected by negation nor interpreted inside questions or conditional antecedents.

(40) a. It's not the case that as a child, Peter likes sweets. (negation)
b. Does Peter, as a child, like sweets? (question)
c. If Peter, as a child, likes sweets, he is. . . (conditional antecedent)
$\gg$ Peter is a child.

This is not an entirely new observation. Jäger (2003) shows for a different type of *as*-phrases (Class 3 in Zobel 2016, 2017a), that they are presuppositional. He, however, indirectly also argues for a presuppositional analysis of weak adjunct *as*-phrases because he conflates Class 3 *as*-phrases with weak adjunct *as*-phrases (Class 4 in Zobel 2016, 2017a). Even though Jäger's choice to conflate Class 3 *as*-phrases with weak adjunct *as*-phrases is problematic (see Zobel 2017a), (40) shows that his observation that some *as*-phrases contribute presuppositional content extends to weak adjunct *as*-phrases and, I suggest, to weak adjuncts in general.

This observation has, of course, direct consequences for the temporal-clause-like and the causal-clause-like interpretation of weak adjuncts. In fact, most aspects of Stump's account and the account presented in Section 3 need to be reconsidered. One aspect of the present account should, however, be preserved. From the discussion of the advantages of that account in Section 3.5, we have learnt that the linear order (or rather the hierarchical configuration) of two co-occurring *as*-phrases has an impact on the interpretational possibilities of sentences with two *as*-phrases. Hence, any proposal that aims to capture the behavior of weak adjuncts in general and weak adjunct *as*-phrases in particular should combine a presuppositional analysis of their contribution with the observation that the interpretational differences are connected to different syntactic positions. A sketch of an implementation that combines these two desiderata is given in Zobel 2017b. A full account that captures the wider implications discussed above has to await another occasion.

5. Conclusion

In the first part of this paper (Sections 2 and 3), I presented and discussed two proposals that aim to account for the semantic variability of weak adjuncts that results from the interaction of weak adjuncts with temporal or modal operators: (i) the proposal put forth in Stump 1985 and (ii) a new, alternative account that aims to capture the full range of interpretational possibilities of weak adjuncts by connecting the different interpretations to different adjunction sites. I argued that the latter account is to be preferred because it allows us to capture the lack of ambiguity of sentences that contain more than one weak adjunct *as*-phrase.

In the second part of the paper (Section 4), I showed that the interaction between weak adjuncts and modal operators is much more restricted than previously assumed, which leads to problems for both accounts presented before. We observed that the conditional-antecedent-like interpretation of weak adjuncts is only available with a subset of modal expressions: future-oriented *will*, future-oriented *might*, *would*, and other subjunctive-marked modals. I connected this subset to two other phenomena, simple subjunctives and modal subordination, and argued that the central, shared characteristic of these expressions is their ability to access certain contextually given material to "construe" missing restrictors. Weak adjuncts, I argued, provide material of the necessary kind—they contribute presuppositional content.

Together, these two parts identified two general desiderata for an adequate analysis of weak adjuncts: a proposal for the semantics of weak adjuncts should assign to them presuppositional content and be sensitive to their syntactic adjunction site.

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