Painting cows from a type-logical perspective[1]

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Abstract. Depiction verbs such as *paint* license i(mage)- and p(ortrait)-readings; for instance, *Ben painted a cow* can convey that Ben produced an image of an unspecific cow or a portrait of a specific cow. This paper takes issue with a property-based intensional analysis of depiction verbs (Zimmermann, 2006b, 2016) and instead argues for an extensional account. Accordingly, the i-reading is rooted in the introduction of worldly representations by the explicit noun *cow* as such, whereas the p-reading is rooted in the interpolation of an implicit representation via coercion. This take on the ambiguity captures the following key traits. On i-readings, only representations are accessible to quantifiers and anaphors; moreover, intensional effects such as substitution failure disappear once ordinary objects and representations are adequately distinguished. P-readings, by contrast, involve representations that depend on the portrayed ordinary objects as particulars; correspondingly, only ordinary objects are accessible to quantifiers and anaphors. The proposal is spelled out in Asher's (2011) Type Composition Logic.

Keywords: depiction verbs, visual representations, intensional transitives, coercion, Type Composition Logic.

1. Introduction

This paper is concerned with the interpretation of depiction verbs such as *paint* (*draw*, *sculpt*, . . .) in combination with a direct nominal object. Examples based on an indefinite noun phrase such as (1) have (at least) two readings (Goodman, 1969; Moltmann, 1997; Forbes, 2006; Zimmermann, 2006b, 2016).

(1)   Ben painted (drew, sculpted, . . .) a cow.

According to the first reading, Ben produced a portrait of a cow of flesh and blood. I will call this the p(ortrait)-reading (following Goodman's suggestion). According to the second reading, Ben produced an image of what cows visually amount to in general (that is, a cow-picture in Goodman's words). I will call this the i(mage)-reading. The indefinite seems to receive a specific (*de re*) construal on the p-reading, as in (2a), and an unspecific (*de dicto*) construal on the i-reading, as in (2b). Correspondingly, directly referring proper names only allow p-readings, as in (3).

(2)   a.   'There is a specific cow that Ben produced an image of.'
        b.   'Ben produced an image of an unspecific cow.'

(3)   Ben painted Bella.

The availability of unspecific readings is usually considered a hallmark of intensional transitive verbs such as *seek*; compare the contrast between *seek* and the extensional verb *meet* in (4). Moreover, on the i-reading, *paint* complies with the second hallmark of intensional transitives, namely, failure of the substitution of extensionally equivalent expressions *salva veritate*, as shown by (5). (On the p-reading, the entailment in (5a) would of course go through.)

(4)   Ben {sought / #met} a baker, but no particular one.

(5)   Let all bakers be joggers and let all joggers be bakers.
     a.   Ben {sought / painted} a baker. $\nrightarrow$ Ben {sought / painted} a jogger.
     b.   Ben met a baker. $\rightarrow$ Ben met a jogger.

Zimmermann (2006b, 2016) distinguishes p- and i-readings from a third reading, which is particularly evident in examples such as (6), where the nouns undoubtedly denote representational artifacts. On the face of it, the third reading contrasts with both the p- and the i-readings by the fact that the noun as such denotes the object produced. I will call it the i(mage)$_N$-reading.[2]

(6)   Ben painted {a portrait of a cow / a circle}.

It is still not settled how to derive the various readings and their properties in a systematic way. I will contribute the following new perspective to this task. In Section 2, I will review the crucial descriptive properties of depiction verb constructions. The upshot will be that, despite initial appearances, depiction verb constructions should be given an extensional analysis. In Section 3, I will develop a corresponding meaning adaption account that builds on Asher's (2011) Type Composition Logic. Specifically, two interacting hypotheses will be proposed. First, nouns presuppose the justification of disjoint types consisting of the object-type and its corresponding representation; that is, *cow* relates to either cows of flesh and blood or their representations. Second, depiction verbs such as *paint* select for representations, but license local coercion from objects to representations if a type-conflict arises. In a nutshell, then, i$_{(N)}$-readings go back to a type-logical ambiguity in the noun itself, whereas the p-reading goes back to the interpolation of an implicit representation. In Section 4, I will defend the adaption account against a property-based intensional alternative as suggested by Zimmermann (2006b, 2016). Section 5 offers a conclusion and a brief outlook.[3]

2. Review of descriptive properties

2.1. Readings and determiners

For the following discussion, some general background information on determiners is in order. Following Milsark (1977), two groups of determiners can be distinguished. Weak determiners such as *a* are grammatical in *there*-constructions (*There is a cow on the street*), whereas

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[2]Zimmermann (2006b, 2016) mentions a fourth reading, which is exemplified by *Ben painted a wall (red)*. Here, *paint* relates to the application of (red) paint to the wall's surface. I will not discuss this reading here.

[3]Depiction verbs trigger the so-called imperfective paradox (known for creation verbs in general); that is, *Ben was painting a circle* does not entail that he painted a circle. As this (putatively) intensional effect does not directly bear on the ambiguity relevant here, I will not address it; see von Stechow (2001) and Forbes (2006) for discussion.

strong determiners such as *every* or *both* are not (*There {*is every cow / are both cows*} *on the street*). This has a discourse-structural correlate. Roughly, weak determiners can yield non-presuppositional interpretations; strong determiners, by contrast, presuppose their domain (see Heim and Kratzer 1998: ch. 6 for an introductory discussion). With this in mind, we will return to *paint* and its readings.

While weak determiners license both p- and i-readings (see the examples in Section 1), strong determiners license p-, but resist (certain) i-readings (Forbes, 2006; Zimmermann, 2016). Correspondingly, (7) can be understood as in (7a), but not as in (7b).

(7)   Ben painted {every cow / both cows}.
       a.   = 'For {every / both} cow(s) of flesh and blood: Ben painted {it / them}.'
       b.   ≠ 'Ben painted an image of the fact that {every / both} cow(s) of flesh and blood {is / are} present.'

For Zimmermann, this restriction is a key argument against a propositional take on i-readings. If one captured the relation between *paint* and its nominal object via some intensionalized predication (the minimal requirement being something like *be present* or *exist*), (7b) should be possible, contrary to fact. This is convincing; however, it is clearly not the full story. Notably, as also pointed out by Zimmermann (2016: 443), strong determiners are compatible with i_N-readings. Crucially, this holds true not only for representational nouns, as in (8), but also for nouns that *prima facie* do not denote representations, as shown by the examples in (9). According to the given contextual information, the relevant presupposed entities are cow pictures instead of cows of flesh and blood.

(8)   [exhibition of {many / two} cow pictures] Ben painted {every / both} cow picture(s).
       =   'For {every / both} cow picture(s): Ben painted {it / them}.'

(9)   a.   [exhibition of {many / two} cow pictures] Ben painted {every / both} cow(s).
             =   'For {every / both} cow picture(s): Ben painted {it / them}.'
       b.   [picture with many cow representations] Ben painted every cow in this picture.
             =   'For every cow representation: Ben painted it.'

In principle, this i_N-reading exists for (7) as well. However, the context-free presentation provokes the accommodation of entities that correspond to the ordinary meaning of the noun, which yields a p-reading. I will not dwell here on the question of whether this default amounts to a linguistically relevant asymmetry. For the time being, the key observation is just that (given contextual support) nouns can denote representations quite generally. Correspondingly, a strong determiner's restriction can relate to the relevant representations as contextually given, fully independently of the depiction verb in its scope. This point of view can be strengthened by the observation that representational readings are in fact independent of a verbal lexical trigger, as shown by (10) (following Partee 2010: fn. 6 and Asher 2011: (9.10b)).

(10)   a.   [picture book] Where is the cow? There is the cow!
       b.   [clothes shop] I like the dress with the flowers.

The obvious follow-up question is whether i-readings are in fact variants of i_N-readings and, thus, rooted in the representational sense of the noun as well. The difference would just be the following. With a weak determiner, the corresponding existential quantification introduces a discourse-new representation; this blurs the fact that it is rooted not in the verb, but in the noun. With a strong determiner, by contrast, the relevant representations are treated as discourse-old such that they can feed the determiner's restrictor; this givenness renders it transparent that the verb in the scope cannot be the source of the representation. Notably, this uniform perspective on i-readings provides an easy explanation for why the putative i-reading with strong determiners in (7b) is out. According to (7b), the representation (or, image) is supposed to be independent of the quantificational force of the determiner and its nominal argument. In other words: as on the p-reading in (7a), the quantification is said to target cows of flesh and blood. However, if i-readings are rooted in the nominal argument itself, the quantifying determiner cannot be independent of the representation, but it must target it. I-readings thus do not build on some intensional relation between depiction verbs and nominal objects, but on ordinary extensional quantification over entities in the world, namely, representations.

This extensional approach can be substantiated from two further angles (and one more will be discussed in the following section). The first relates to the substitution failure repeated in (11).

(11)   a.   Let all bakers be joggers and let all joggers be bakers.
        b.   Ben painted a baker. $\nrightarrow$ Ben painted a jogger.

From the extensional perspective, the explanation for this is simple. The premise in (11a) relates to the identity of joggers and bakers of flesh and blood in a particular situation. Since this does not say anything about the identity of representations in that situation, the entailment in (11b) does not go through on the i-reading. In other words, the putative intensional effect in (11) is based on mixing the non-representational and the representational meaning of the involved nouns. Crucially, the effect dissolves once the distinction between objects and their representations is controlled for. Given a premise that relates to representations as in (12a), (12b) is valid on the i-reading, irrespective of the fact that *cow* and *cow without horns* are intensionally distinct (with the latter being stronger than the former). This observation, which seems to have gone unnoticed so far, is fully expected on an extensional account.

(12)   a.   Let all paintings of cows by Ben be paintings of cows without horns.
        b.   Ben painted a cow $\rightarrow$ Ben painted a cow without horns.

Second, Moltmann (1997) shows that run-of-the-mill intensional verbs such as *need* are not relativized to possible worlds as wholes, but to parts of worlds, namely, situations that minimally obey certain restrictions. This comes out in combination with weak determiners that are not (right) upward monotone such as *exactly two* or *no*.[4] For instance, (13a) is true iff for all minimal situations that satisfy Ben's needs, Ben has {exactly two / no} cows. Crucially, this is compatible with Ben {having more than two / having} cows in non-minimal satisfaction situations and, thus, accounts for the observation that (13a) does *not* entail (13b).

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[4]The monotonicity property is, for instance, indicated by the fact that {*Exactly two cows / No cows*} *are mooing loudly* does not entail {*Exactly two cows / No cows*} *are mooing*.

(13)   a.   Ben needs {exactly two / no} cows.

          b.   In view of Ben's needs, it is necessary that he has {exactly two / no} cows.

Depiction verbs are different. On the i-reading, (14a) is true iff there are exactly two cow representations (be they in one picture or in two separate pictures). That is, (14a) would be false for an image that involves more than two cow paintings and that would thus be non-minimal. Similarly, (14b) enforces the lack of any cow paintings by Ben for a situation it describes truthfully.

(14)   a.   Ben painted exactly two cows.

          b.   Ben painted no cows.

I conclude that, even on i-readings, depiction verbs do not relate to minimal satisfaction situations and are, thus, of a different ilk than intensional verbs. Instead, the explicit quantifying determiner yields a usual extensional quantification over representations.

2.2. Anaphors to representations on i-readings

If i-readings generally build on ordinary extensional quantification, the quantified representations should generally be accessible to definite anaphors. This, however, is disputed by Zimmermann (2016) for i-readings with a weak determiner. His cases in point are given in (15). Crucially, the definite anaphor *it* calls for an explicit reference to pictures in the preceding sentence, which seems to be at odds with the assumption that the noun *camel* as such can introduce pictorial objects.

(15)   a.   Ken painted #(a picture of) a camel. It is exhibited in the Louvre.

          b.   That is #(a picture of) a camel, and I'll put it in my pocket.

              [see Zimmermann (2016), (65)–(66), where (66) is attributed to Kripke (2013)]

I consider this reasoning flawed in two respects. First, (15a) and (15b) suggest anaphoric links to the media on which the representations are displayed. However, the extensional approach merely says that nouns can introduce the representations themselves, but not these media. Once this distinction is controlled for, anaphors to representations are licit; see (16a), where *turn out* selects representations instead of media, or (16b) and (16c), where medium and representation coincide. (I owe (16c) to C. Fortmann.)

(16)   a.   Ken painted a camel. It$_{repr.}$ turned out very beautifully.

          b.   Ken drew three camels, cut them$_{repr./med.}$ out, and stuck them$_{repr./med.}$ to the wall.

          c.   Ken sculpted a camel and put it$_{repr./med.}$ in his pocket.

The German examples in (17) are even more revealing. They show that the definite anaphor to the relevant representation covaries in gender with its nominal antecedent. This only follows smoothly from tying the introduction of the representation to the noun.

(17)   Ken hat {ein Kamel$_i$ / eine Kuh$_j$ / einen Hund$_k$} gemalt. {Es$_i$ / Sie$_j$ / Er$_k$} ist
        Ken has {a   camel.N / a   cow.F / a   dog.M} painted {it.N / it.F / it.M} is
        sehr schön   geworden.
        very beautiful become
        'Ken painted {a camel$_i$ / a cow$_j$ / a dog$_k$}. It$_{i/j/k}$ turned out very beautifully.'

Second, (15b) involves a further complication. Without a specific context and without *a picture of*, the first part of the sentence suggests the non-representational sense of *camel*, which renders the representational sense inaccessible for the subsequent anaphor (see the further discussion for more on the 'destructive' nature of the disambiguation). As there is no depiction verb, the introduction of a representation cannot be traced back to the selection by the verbal predication, which, however, should be the case on the putatively intensional i-reading (recall the discussion in Section 2.1). Instead, the corresponding referent must be established independently. Once this is warranted by a context such as in (18), (15b) becomes felicitous, as expected under the extensional approach.

(18)   [A grandmother shows her grandson several small sculptures of animals.] That is a camel, and I'll put it in my pocket. Which one would you like to have?

Let me turn to a slightly different source of potential counterevidence. Moltmann (1997: 48–49) argues that i-readings are intensional, as they would prohibit definite anaphors and support only impersonal proforms. (For reasons of space, her considerations of identity conditions will not be discussed here.) Her examples look like those in (19) and (20). In (19), the definite anaphors render the i-reading inaccessible; in (20), proforms and possible readings covary.

(19)   Ben painted {an old man$_i$ / a table$_j$}, and Mia painted {him$_i$ / it$_j$} too.   only p-reading

(20)   a.   What did Ben paint? – An old man.   only i-reading
        b.   Whom did Ben paint? – An old man.   only p-reading
                                                                                              [see Moltmann (1997), (37)/(38)]

I agree with the judgments, but not with the conclusion. The example in (19) is special because it involves the depiction verb twice. This calls for two representations, as the produced object is bound to its agent here. Therefore, Mia cannot paint the representation already painted by Ben, which excludes the i-reading. The p-reading, by contrast, is fine because the very same old man or table can be portrayed several times. Two further observations support this reasoning. For one, the restriction to multiple representations carries over to examples based on representational nouns, as shown by (21a), while these undoubtedly license definite anaphors, as shown by (21b). Thus, the restriction observed in (19) cannot be due to the putative intensionality of i-readings.[5]

(21)   a.   #Ben painted a picture$_i$, and Mia painted it$_i$ too.
        b.   Ben painted a picture$_i$ yesterday. It$_i$ is lying on the kitchen table.

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[5]Notably, anaphors to pictures in cases such as (21b) are also accepted by Zimmermann (2006a: 758–759). In fact, he considers them a problem for the particular intensional analysis of *paint* he provides for such cases.

Moreover, definite anaphors are felicitous once a depiction verb variant is chosen that does not involve a functional relation between agent and theme and thus escapes the proposed restriction. A case in point is (22). *Malen an etwas* ('contribute to the painting of something') in German does not necessarily map the produced representation to the explicit agent alone. Correspondingly, the anaphor is fine on an i-reading.

(22)   Ben malte   an einer riesigen Kuh$_i$. Mia malte   auch an ihr$_i$.
       Ben painted at a   huge   cow.F Mia painted also at it.F
       'Ben contributed to the painting of a huge cow, and so did Mia.'

The evidence drawn from the minimal pair in (20) is not convincing either. Crucially, the restriction to impersonal proforms on i-readings extends to extensional verbs. For instance, given coreference to a representational object, *touch* is equally incompatible with a personal proform; see (23). That is, the ban on *whom* is not rooted in intensionality, but in the nature of representations.

(23)   {What / #Whom} did Ben touch? – (A sculpture of) An old woman. He was interested in the surface feel of its material.

I conclude that, upon closer inspection, anaphoric references clearly support an extensional instead of an intensional approach to i-readings of depiction verbs. Let me finally note that i-readings block anaphors to the ordinary object interpretation, as shown by (24).[6] (I owe (24c) to C. Maienborn.)

(24)   a.   #Ben painted {a cow$_{repr.}$ / an old man$_{repr.}$}. {It$_{animal}$ / He$_{human}$} was called {Bella
            / Paul}.
       b.   #Ben painted a cow$_{repr.}$. It$_{animal}$ had eaten a lot.
       c.   #Ben painted an old man$_{repr.}$. He$_{human}$ was very flattered.

This is again indicative of the fact that the specification to one reading disables the other.

2.3. Specific features of p-readings

On p-readings, the noun seems to convey its ordinary meaning: *a cow* introduces a cow of flesh and blood. However, *paint* is still a creation verb and thus involves a representation (the produced portrait). This begs the question of how this representation comes into play and of how it differs from representations on i-readings. Descriptively, three aspects are noteworthy.

First, while i-readings only support anaphors to representations, p-readings show the reversed pattern: they are only compatible with access to the portrayed objects, as shown in (25). That is, any analysis must assure that the portraits, though conceptually present, are kept anaphorically opaque.

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[6]Of course, a painter could call his work of art Bella and thereby suggest that the depicted object is the cow Bella. Even then, however, the anaphors in (24a) would not directly refer to these objects of flesh and blood.

(25)   Lisa painted {a horse from this farm / every horse from this farm}.
   a.   It was called Lucky. / They were called Lucky, Rusty, and Misty.
   b.   #It turned out beautifully. / They turned out beautifully.
   c.   Then she fed {it / them}.
   d.   #Then she cut {it / them} out and stuck {it / them} to the wall.

The second observation relates to twin scenarios such as (26).

(26)   [Bella and Mia are cow twins that resemble each other to a perfect degree.] Ben painted
         Bella. The portrait would have been the same if he had painted Mia. But he painted
         Bella.

As pointed out by Zimmermann (2006b), such scenarios show that p-readings are feasible in sit-
uations where uniquely identifying properties of the objects portrayed are missing. I conclude
that the representations on p-readings should be made dependent on these referential objects.
Correspondingly, these representations are of a very different nature than representations on
i-readings. Specifically, they are not rooted in the descriptive content of the explicit noun, but
evolve from the interaction between the verb and the referent introduced by the noun phrase as
a whole.

The third observation points in the same direction. Consider a situation with Lucky being a
stocky, short-legged horse with a round belly and Rusty being a rangy, extraordinarily slender
horse. A painter could portray Lucky by painting a circle and Rusty by painting a line. How-
ever, neither circle nor line would be considered truthful horse representations in the sense of
i-readings. In words adapted from Zimmermann (2016: 427) (and Goodman 1969), a portrait
of a horse need not be a horse-picture. This follows smoothly from the suggested distinction
between the source of representations on i- as opposed to p-readings. According to Section
2.1, representations on i-readings are rooted in the noun, which explains why they are closely
linked to the property associated with that noun; they must be reasonably truthful images of the
visual appearance of horses in general (see Section 3.1 for further details). On p-readings, by
contrast, representations depend on the nominal referent and, thus, must be reasonably truthful
images of what this referent is. The underlying noun merely helps in picking out the portrayed
referent; this bears indirectly on what the portrait might look like, but, strictly speaking, the
portrait is independent of the noun chosen.

2.4. Interim conclusions

Combinations of depiction verbs such as *paint* with a nominal object are ambiguous between
i(mage)- and p(ortrait)-readings. Their analysis should comply with the following key traits.
First, both weak and strong determiners license both i- and p-readings. The relevant quantifica-
tion operates on an extensional level: while it targets representations in the world on i-readings,
it targets ordinary objects in the world on p-readings. The choice of weak as opposed to strong
determiners specifies in a regular way whether the representation is newly introduced into dis-
course via the clause under consideration, or, whether it is presented as discourse-old. This

makes for the (wrong) impression that only i-readings based on strong determiners are rooted in the explicit head noun. Second, the accessibility of anaphors to representations as opposed to the objects represented covaries with the given reading. Anaphors to representations are feasible on i-readings, but not on p-readings; anaphors to the objects represented are feasible on p-readings, but not on i-readings. Third, in contrast to representations associated with i-readings, representations associated with p-readings are independent of the given head noun, but dependent on the portrayed object as introduced by the noun phrase as a whole.

3. Adaption analysis

The adaption analysis I will propose builds on Asher's (2011) type-logical approach to semantic composition. In Asher (2011), semantic representations comprise—besides the usual logical forms—rich typing information. In particular, predicates introduce (fine-grained) type presuppositions for their arguments; the composition succeeds if these are either satisfied directly or made satisfiable by non-random adaptive mechanisms. The lexical entry for *bank* in (27) and the example in (28) serve as illustration.[7]

(27) $[\![\text{bank}]\!] = \lambda x \lambda \pi.\text{bank}(x, \pi * \text{ARG}_1^{bank}:\ \text{LOC} \vee \text{INST})$

(28)   I entrust my money to this bank$_{\text{INST}}$ (#although the soil of it$_{\text{LOC}}$ is very sandy).

Predicates come along with arguments for contextual parameters π. These parameters encode the relevant presuppositions, the addition of which is symbolized by $*$. According to (27), the predicate *bank* presupposes that its first argument (= x) is of type location (= LOC) or of type institution (= INST). This disjunctive type captures that x can be either a river bank or a financial institution (but not both). In (28), the predicate *entrust money* selects an object of type INST, which can easily be satisfied by the disjunctive type offered by *bank* via so-called Simple Type Accommodation: $(\text{LOC} \vee \text{INST}) \sqcap \text{INST} = \text{INST}$. Notably, the choice of the type INST disables access to the type LOC. Therefore, the continuation with *soil*, which presupposes the type LOC for the anaphor *it*, is infelicitous. With this general set-up in mind, let us turn to the combinatorics of depiction verbs.

3.1. Adaption analysis: I-readings

The first crucial assumption is that lexical units such as *cow* are ambiguous between an object reading and a representation reading. The hypothesis H1 in (29) captures this in type-logical terms.

(29)   H1: Lexical units such as the noun *cow* presuppose the justification of disjoint types consisting of object type and object representation type; for *cow*: ANIMAL $\vee$ R$_{\text{ANIMAL}}$.

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[7]As this suffices for illustrating the core idea, the typing is simplified; see Asher (2011: ch. 6.3) for details. Specifically, the typing ignores that *bank* can also refer to buildings that host financial institutions.

For the main purpose of this paper, a rough characterization of such lexically given representations suffices. They are artifacts that share visually accessible properties with corresponding ordinary objects in general. The similarities must guarantee that the kind of object represented is recognizable as such according to some contextual standard (for instance, the criteria for what counts as a reasonably truthful artifact is different for a textbook on biology than for a caricature). Notably, this similarity-based characterization closely follows the characterization of images sketched in other approaches such as Forbes (2006) and Zimmermann (2006b, 2016).[8] What sets my approach apart is that these representations are rooted in the fine-grained presuppositional content of lexical units. This begs the question of how general the underlying ambiguity is. The natural assumption is that it extends to all expressions that denote visually accessible entities. In fact, it does not matter whether the object represented is animate or inanimate, whether it is described in simple or complex terms, or whether it is a physical or an eventive entity. An i-reading is possible for all of them, as in (30).

(30)   Ben painted {a cow / a stone / a brown cow with huge ears / a soccer match}.

Therefore, in contrast to the accidental ambiguity observed for *bank*, the ambiguity between representations and ordinary objects must have a systematic source. However, I will not speculate about this source and its repercussions on lexical meaning in general here. Instead, I will consider how far H1 gets us for the interpretation of depiction verb constructions.

For the example in (31) with a weak determiner (see (1) and (16a) from above), the relevant lexical entries are given in (32).

(31)   Ben painted a cow. (It turned out beautifully.)

(32)   a. $[\![\text{cow}]\!] = \lambda x \lambda \pi.\text{cow}(x, \pi * \text{ARG}_1^{cow}:\ \text{ANIMAL} \vee \text{R}_{\text{ANIMAL}})$
         b. $[\![\text{a}]\!] = \lambda Q \lambda P \lambda \pi \exists x[Q(x)(\pi) \wedge P(x)(\pi)]$
         c. $[\![\text{paint}]\!] = \lambda \Psi \lambda z \lambda \pi.\Psi(\lambda y \lambda \pi'.\text{paint}(z, y, \pi'))(\pi * \text{ARG}_2^{paint}:\ \text{R})$

Following H1, the entry for *cow* in (32a) says that the first argument of the predicate *cow* must be either an animal or a corresponding representation. The entry for *paint* in (32c) says that the second argument of the predicate *paint* must be a representation; this captures the intuition that *paint* necessarily involves the creation of a representational object and binds this object as its second argument. (In order to keep things simple, requirements regarding the subject argument are omitted.) The entry in (32b) takes *a* to be a usual extensional quantifier (enriched by contextual parameters π). Composing these entries in a regular way yields (33).

(33) $[\![\text{paint a cow}]\!] = [\![\text{paint}]\!]([\![\text{a}]\!]([\![\text{cow}]\!]))$
         $= \lambda z \lambda \pi \exists x[\text{cow}(x, \pi * \text{ARG}_2^{paint}:\ \text{R} * \text{ARG}_1^{cow}:\ \text{ANIMAL} \vee \text{R}_{\text{ANIMAL}})$
         $\wedge \text{paint}(z, x, \pi * \text{ARG}_2^{paint}:\ \text{R})]$

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[8]For instance, Forbes (2006: 72), summarizing Peacocke (1987), writes: "[...] a depiction of, say, a dog, is something which, when viewed in appropriate conditions, is presented in a region of the visual field experienced as similar in relevant respects (for instance, shape) to one in which it is possible for a dog to be presented".

Notably, the contextual parameters are part of the composition and, thus, subject to ordinary λ-conversion. In turn, the percolation of presuppositions follows the compositional path. According to (32c), *paint* assigns its presupposition to the outer parameter π (instead of the inner π'). As this π feeds the respective slot in the quantified argument Ψ, *paint* passes its presupposition on to the context parameter of its object, as shown by the result in (33). Correspondingly, the relevant site for the justification of both verbal and nominal presuppositions is the predication for *cow*, that is, the quantifier's restrictor. For (33), the presuppositions for x can easily be met by Simple Type Accommodation; see (34) and Asher (2011: (4.25)) for the corresponding generalized rule. After application to the subject, this yields the simplified result in (35). In prose: (31) is true iff there is a cow representation painted by Ben.

(34) $\left(\text{ANIMAL} \vee \text{R}_{\text{ANIMAL}}\right) \sqcap \text{R} = \text{R}_{\text{ANIMAL}}$

(35) $[\![\text{Ben painted a cow}]\!] = \lambda\pi\exists x\colon \text{R}_{\text{ANIMAL}}[\text{cow}(x,\pi) \wedge \text{paint}(\text{Ben},x,\pi)]$

This is intuitively correct. More specifically, the derivation introduces a particular cow representation that can be accessed anaphorically, as illustrated by the parenthesized continuation in (31). However, there is no particular cow of flesh and blood introduced, which captures why corresponding anaphors are blocked; recall example (24a), repeated in (36).

(36)   #Ben painted {a cow$_{repr.}$ / an old man$_{repr.}$}. {It$_{anim.}$ / He$_{hum.}$} was called {Bella / Paul}.

This blocking of the alternative lexical meaning is the crucial reason for modeling the ambiguity in terms of disjoint types. Disjoint types allow a simple meet operation as in (34) and, thus, the exclusion of one of the original types. This contrasts with objects that justify so-called dual aspect types; for these, "both constituent types, the types of the aspects, are in some sense present" (Asher, 2011: 132). A prototypical example is *book*, which denotes objects that are both physical and informational objects (type PHYS $\bullet$ INFO). Predicates can select one or the other aspect. However, the corresponding accommodation cannot resort to a meet operation, as dual aspect types and simple types do not have a common meet (for instance, $(\text{PHYS} \bullet \text{INFO}) \sqcap$ PHYS $= \bot$). Instead, the accommodation introduces a new object of the relevant simple type without abandoning the original object bearing a complex type. Correspondingly, anaphors are licit even if the selecting predicates introduce incompatible type requirements, as in (37); see Asher (2011: ch. 5 and 6) for details on dual aspect types and their accommodation.

(37)   I read$_{\text{PHYS}\bullet\text{INFO}}$ *Elements of Symbolic Logic*, did not understand$_{\text{INFO}}$ it and, therefore, threw$_{\text{PHYS}}$ it out of the window.

The composition for i-readings with strong determiners is fully analogous. Based on the standard entry for *every* in (38), the example in (39) (see (9) from above) receives the interpretation in (40). In prose: (39) is true iff for every cow representation, Ben painted it.

(38) $[\![\text{every}]\!] = \lambda Q\lambda P\lambda\pi\forall x[Q(x)(\pi); P(x)(\pi)]$

(39)   [exhibition of many cow pictures] Ben painted every cow.

(40) $[\![\text{Ben painted every cow}]\!] = [\![\text{paint}]\!]([\![\text{every}]\!] ([\![\text{cow}]\!]))([\![\text{Ben}]\!])$
         $= \quad \lambda\pi\forall x\colon \text{R}_{\text{ANIMAL}}[\text{cow}(x,\pi);\text{paint}(\text{Ben},x,\pi)]$

This is adequate for the intuitively given i-reading. Recall from Section 2.1 that there is no i-reading according to which Ben painted an image of the fact that every cow is present. Given that the accommodation within the quantifier's restrictor yields a quantification over cow representations, there is no way to derive this non-existent i-reading, as desired.

According to the terminology from the introduction, (31) exemplifies an i-reading, while (39) exemplifies an i_N-reading. In Section 2.1, I argued for treating them on a par. The given derivations implement this by the uniform accommodation of representations via the representational type of the head noun within the quantifier's restrictor. The intuitive difference between both cases follows from the independent observation that strong determiners such as *every* partition contextually given entities, here, representations, and weak determiners such as *a* allow their introduction as discourse-new entities. In other words, only with strong quantifiers is the accommodation of the representational type within the quantifier's restrictor readily identifiable.

Against this background, it is finally worthwhile to reconsider the case where the head noun undoubtedly conveys a representational meaning, as in (41) (see (6) from above).

(41)   Ben painted a portrait.

Interestingly, (41) has two i-readings. It can convey that Ben produces a portrait of, say, Mia; this is the most obvious standard reading, as already discussed in the introduction. In addition, it can convey that Ben produces an image of what portraits visually amount to in general, that is, a portrait-picture in Goodman's terms. This observation might be puzzling, as it seems to bring back the original distinction between i_N- and i-reading and thereby challenge their reduction to one mechanism. However, the given type-logical analysis has a simple explanation for the ambiguity without giving up the uniform treatment. According to H1, *portrait* involves a disjoint type; see (42). This entry is conceptually sound, as it is fully reasonable to assume that there are representations of representations.

(42) $[\![\text{portrait}]\!] = \lambda x\lambda\pi.\text{portrait}(x,\pi * \text{ARG}_1^{portrait}\colon \text{REPRESENTATION} \vee \text{R}_{\text{REPRESENTATION}})$

Crucially, this predicts that the accommodation within the restrictor has two options. It can resort either to the ordinary representational type, as sketched in (43a), or to the secondary representational type, as sketched in (43b).

(43)   a. $\lambda\pi\exists x\colon \text{REPRESENTATION}[\text{portrait}(x,\pi) \wedge \text{paint}(\text{Ben},x,\pi)]$
         b. $\lambda\pi\exists x\colon \text{R}_{\text{REPRESENTATION}}[\text{portrait}(x,\pi) \wedge \text{paint}(\text{Ben},x,\pi)]$

(43a) is the standard reading, and (43b) is the portrait-picture reading. In other words: as the accommodation for *sui generis* representational nouns can use either of both types of the given disjoint type, it triggers an ambiguity not observed for non-representational nouns such as *cow*.

3.2. Adaption analysis: P-reading

The example in (44) (see (7) from above) exemplifies the p-reading. Based on the lexical entries from Section 3.1, the compositional result in (45) is as it would be on a corresponding i-reading.

(44)   [on a farm] Ben painted every cow.

(45) $[\![$Ben painted every cow$]\!]$ = $[\![$paint$]\!]([\![$every$]\!]([\![$cow$]\!]))([\![$Ben$]\!])$
        = $\lambda \pi \forall x [\text{cow}(x, \pi * \text{ARG}_2^{paint}: \text{R} * \text{ARG}_1^{cow}: \text{ANIMAL} \lor \text{R}_{\text{ANIMAL}});$
        $\text{paint}(\text{Ben}, x, \pi * \text{ARG}_2^{paint}: \text{R})]$

However, the satisfaction of presuppositions is different. Crucially, on the p-reading, the given noun relates to (contextually given) cows of flesh and blood. Accordingly, the predication for *cow* within the quantifier's restrictor should use the type ANIMAL for the specification of *x*'s type and, thus, ignore the type requirements brought in by the verbal predicate *paint*. This yields (46).

(46) $[\![$Ben painted every cow$]\!]$
        = $\lambda \pi \forall x: \text{ANIMAL}[\text{cow}(x, \pi); \text{paint}(\text{Ben}, x, \pi * \text{ARG}_2^{paint}: \text{R})]$

Of course, *x* cannot be both a cow of flesh and blood and a painting. Therefore, as it stands, the global commitment to animals in the restrictor yields an unresolvable conflict in the nuclear scope. Nevertheless, the analysis seems to be on the right track. Recall the evidence from Section 2.3: the p-reading renders animals, but not their representations, accessible to anaphors; moreover, portraits can diverge in substance from the content of the explicit noun. So, the global commitment to cows of flesh and blood and the elimination of the representational type of *cow* is correct. Instead, the representation required by *paint* should be made available locally, that is, within the nuclear scope and thus independently of the global type specification in the restrictor. Notably, such locality effects are well known for coercion (see Asher 2011, Bücking 2014, Maienborn and Herdtfelder 2017 for discussion). For instance, *enjoy* selects an event. If the object does not comply with this restriction, a suitable event can be interpolated, as in example (47), which suggests a consumption event. Analogously to the findings for *paint* on p-readings, the interpolation is locally operative: the quantifying determiner *three* counts dishes instead of events. Therefore, (47) cannot convey that there are three consumption events involving just one dish.[9] Furthermore, the anaphor *they* relates to dishes, but not to events.

(47)   Mia enjoyed three dishes. They$_{dish/\#consumption}$ were great.

Given this parallel, I propose to complement hypothesis H1 by hypothesis H2 in (48).

(48)   H2: Depiction verbs such as *paint* license local coercion from objects to their representations.

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[9]This is not a conceptual restriction. Let Mia eat a dish not all at once, but in three stages (morning, afternoon, evening). This is a situation with one dish, but three consumption events. But (47) cannot describe this situation.

In Type Composition Logic, coercion is rooted in the lexicon and thereby constrained by the linguistic system. Specifically, the coercive potential of lexical expressions is captured by so-called polymorphic types. Only these license the interpolation of additional material in order to resolve a pending type conflict. For *paint*, I propose the refinement in (49), which differs from the original entry in (32c) by including the polymorphic type $\rho(\mathrm{HEAD}(\Psi))$. In a nutshell, this says that, if the second argument of *paint* is not a representation, the presupposition can be satisfied by interpolating a representation that is related to the head type of the explicitly given argument.

(49) $[\![\mathrm{paint}]\!] = \lambda\Psi\lambda z\lambda\pi.\Psi(\lambda y\lambda\pi'.\mathrm{paint}(z,y,\pi'))(\pi * \mathrm{ARG}_2^{paint}\colon \mathrm{R}-\rho(\mathrm{HEAD}(\Psi)))$

Given (49), the revised compositional starting point for the example in (44) is (50). Notably, in order to render the type conflict local, the typing information as determined for *cow* within the restrictor is mapped onto the contextual parameter for *paint* in the nuclear scope.[10]

(50) $[\![\mathrm{Ben\ painted\ every\ cow}]\!]$
   $=\quad \lambda\pi\forall x\colon \mathrm{ANIMAL}[\mathrm{cow}(x,\pi);$
   $\qquad \mathrm{paint}(\mathrm{Ben},x,\pi * \mathrm{ARG}_1^{cow}\colon \mathrm{ANIMAL} * \mathrm{ARG}_2^{paint}\colon \mathrm{R}-\rho(\mathrm{COW}))]$

The polymorphic type in (50) licenses so-called Type Accommodation with Generalized Polymorphic Types; see (51) adapted from Asher (2011: 225). According to (51), a $\mathscr{D}$-functor such as given in (52) introduces a mediating representation that meets the type requirement imposed by *paint* and that is linked to the given cow.[11] In the revised result in (53), the second argument of *paint* and the first argument of *cow* differ. Therefore, all presuppositions can easily be satisfied, which yields the simplified adapted meaning in (54).

(51) $\dfrac{\psi(v,\pi),\ \pi \text{ carries } \mathrm{ARG}_i^P\colon\mathrm{D}-\delta(\mathrm{SUBTYPE}(\mathrm{A}))*\mathrm{ARG}_j^Q\colon\mathrm{A},\ v\in\mathrm{ARG}_i^P\cap\mathrm{ARG}_j^Q,\ \mathrm{A}\sqcap\mathrm{D}=\bot}{\mathscr{D}(\lambda w\lambda\pi'\psi(w,\pi'))(v)(\pi)}$

(52) $\lambda P\lambda x\lambda\pi\exists y\colon \rho(\mathrm{COW})[\phi_{\rho(\mathrm{COW})}(y,x,\pi)\wedge P(y)(\pi)]$

(53) $\lambda\pi\forall x\colon \mathrm{ANIMAL}[\mathrm{cow}(x,\pi);\exists y\colon\rho(\mathrm{COW})[\phi_{\rho(\mathrm{COW})}(y,x,\pi * \mathrm{ARG}_1^{cow}\colon \mathrm{ANIMAL} *$
   $\mathrm{ARG}_2^{paint}\colon \mathrm{R}-\rho(\mathrm{COW}))\wedge\mathrm{paint}(\mathrm{Ben},y,\pi * \mathrm{ARG}_1^{cow}\colon \mathrm{ANIMAL} * \mathrm{ARG}_2^{paint}\colon \mathrm{R}-\rho(\mathrm{COW}))]]$

(54) $\lambda\pi\forall x\colon \mathrm{ANIMAL}[\mathrm{cow}(x,\pi);\exists y\colon\rho(\mathrm{COW})[\phi_{\rho(\mathrm{COW})}(y,x,\pi)\wedge\mathrm{paint}(\mathrm{Ben},y,\pi)]]$

In prose: (44) is true iff for every cow of flesh and blood, there is a representation that Ben painted of it. This is correct for the p-reading. Furthermore, it complies with all its specific

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[10]The reasoning in favor of local coercion is sound. However, the mapping of the nominal type onto the verbal predication in the nuclear scope does not follow from the composition of contextual parameters. Recall that the lexical entries only facilitate the mapping of the presuppositions of *paint* onto the presuppositions of *cow*. Coercion based on *enjoy* faces the same problem; therefore, Asher (2011: 223) stipulates that the type accommodation pertains to the nuclear scope. I leave this more general computational problem for further research.

[11]I dispense with the detailed derivation here; it follows the steps as given for instance by (45) to (47) in Bücking (2014).

traits. The representations are introduced locally and are thus opaque for anaphors, and they do not depend on the nominal disjoint type, but on the particular objects of flesh and blood they are representations of: y must be a representation of each x as given by the restrictor. This both solves the puzzle with twin scenarios and conforms to the observation that representations on p-readings can be untruthful images of what the nominal property amounts to. Let me conclude with a brief remark on the instantiation of the underspecified predicate variable ϕ for the interpolated representation. As the verbal predication is very specific, ϕ can only be a predicate for paintings.[12]

4. Comparison to intensional approaches: Zimmermann (2006b, 2016)

Zimmermann (2016) distinguishes between three approaches to i-readings: a proposition-based intensional analysis, a property-based intensional analysis, and a non-intensional so-called intentional analysis. He convincingly argues against the propositional approach, which I will not recap here for reasons of space (but recall the remark on it in Section 2.1). Before turning to the property-based intensional alternative, a brief comment on the intentional approach is in order. The adaption account developed here amounts to one implementation of intentionalism; the general characterization in Zimmermann (2016: 445) says: "If the object position of a transitive verb appears to be intensional, the restrictor nouns of its objects need to be suitably reinterpreted so as to make them extensional." I consider my proposal an elaborate defense of such an approach regarding depiction verbs, not least against Zimmermann's own skepticism. Furthermore, in contrast to Zimmermann's rough ideas on how suitable reinterpretations come into play, the present proposal provides specific hypotheses on their roots.

According to the property-based intensional analysis of i-readings, *paint* contributes a "relation between painters and properties that characterize the pictures painted by them" (Zimmermann, 2016: 442). I implement this as in (55)/(56) (which slightly modifies Zimmermann's version).

(55)   a. $[\![\text{paint}]\!] = \lambda P_{\langle e,\langle s,t\rangle\rangle}\lambda y.\exists x[\text{paint}(y,x) \wedge \text{representation of}(x,P)]$
        b. $[\![\text{a cow}]\!] = \lambda z\lambda w.\text{cow}(z)(w)$

(56) $[\![\text{Ben painted a cow}]\!] = 1$ iff $\exists x[\text{paint}(\text{Ben},x) \wedge \text{representation of}(x,\lambda z\lambda w.\text{cow}(z)(w))]$

Contentwise, the representation relation does not differ substantially from its use within the proposed adaption account; in fact, as pointed out in Section 3.1, I basically follow the assumption made by Zimmermann and others that representations build on visual resemblance to possible ordinary objects as introduced by the nominal property. The crucial difference lies in their roots. While representations are introduced by the noun (i-reading) or by coercion (p-reading) in the adaption account, they are invariably rooted in the depiction verb in the property-based account (notably, without coercion in the relevant sense, as the adaption of properties for existential quantifiers underlying (55b) is of a different nature). This, however, poses several problems.

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[12]This is different from event coercion as based on *enjoy*. Here, the specification varies according to the type of object and further contextual information. For instance, for (47) above, I assumed that Mia enjoyed the consumption of the dishes. However, in more specific contexts, she could also enjoy preparing them.

First, Zimmermann (2016: 443) points out that the property-based analysis is at odds with
i-readings based on strong determiners such as *every*, as in (57). It lacks a plausible composi-
tional derivation. Strong DPs are usually considered inappropriate for a shift to properties (as
they are not existential). Moreover, even if the quantified DP could be shifted, this would not
render representations sensitive to *every*; the representation would still be bound by the fixed
existential quantifier in (56).

(57)   [exhibition of many cow pictures] Ben painted every cow here.

This problem can be strengthened. In Section 2.2, I pointed out that anaphors to representa-
tions are compatible even with i-readings based on weak determiners (contra Zimmermann's
assumption). Moreover, these anaphors are sensitive to grammatical features of the preceding
object phrase. For instance, (58) (based on (16a) and (16b)) licenses a plural anaphor to rep-
resentations. This is predicted by tying the representations to the explicit existential quantifier
three camels, but it is fully unexpected once the representation is tied to some implicit exis-
tential quantifier given by the verb. (A similar argument follows from the gender agreement
observed for German.)

(58)   Ben drew three camels. They turned out beautifully.

A second source of trouble relates to the p-reading. Zimmermann (2006b: (13)) offers the
standard *de re*-construal in (59) (again slightly modified). Crucially, the relevant property is
presupposed to uniquely identify the portrayed object.

(59)   ⟦Ben painted a cow⟧
   = $\exists y \exists P[\text{cow}(y) \wedge \text{given qua}(y, \text{Ben}, P) \wedge \exists x[\text{paint}(Ben, x) \wedge \text{representation of}(x, P)]]$

However, as pointed out by Zimmermann himself, this is at odds with twin scenarios as dis-
cussed in Section 2.3, where no such property is given. I conclude that (59) does not properly
capture the link between portrait and portrayed object. The adaption account, by contrast, cap-
tures this link by rendering the representation dependent on the portrayed object as such. One
can add that, according to the property-based analysis, representations are introduced in the
same way on i- and p-readings. This hardly seems to be compatible with their being discourse-
transparent only on i-readings.

Third, examples with ordinary respresentational objects such as *paint a portrait* typically con-
vey that the explicit object is the representation produced by the painting. The lexical entry in
(55a) does not allow for its derivation, as the produced representation is bound existentially,
while the explicit object relates to the property *P* it represents. This enforces a separate entry
for these examples, which is neither economic nor consistent with the commonalities between
i-readings of different flavors. This speaks in favor of a uniform treatment as provided by the
adaption account.

In sum, a property-based approach to depiction verbs such as *paint* faces several serious problems. I conclude that it is not a feasible alternative to the proposed adaption analysis.[13]

5. Conclusion and outlook

Combinations of depiction verbs such as *paint* with nominal objects based on nouns such as *cow* are ambiguous between i(mage)- and p(ortrait)-readings. I-readings involve representations that build on resemblance to corresponding ordinary objects in general. Contrary to first impressions, they are extensional (and in this respect analogous to i-readings based on representational nouns such as *portrait*): both weak and strong determiners license i-readings by quantifying over discourse-new and discourse-old representations in the world, respectively; correspondingly, anaphors to representations are licit. P-readings, by contrast, involve representations that depend on the portrayed ordinary objects as particulars. Here determiners quantify over ordinary objects in the world, while the produced representations are implicit and thus inaccessible to anaphors. I developed a type-logically inspired adaption account that builds on the interaction between two hypotheses. First, nouns such as *cow* presuppose the justification of disjoint types consisting of object type and object representation type. Second, depiction verbs such as *paint* license local coercion from objects to their representations. I argued that this adaption account captures the data considerably better than the property-based intensional alternative.

Finally, I would like to provide an outlook for two key issues worthy of closer scrutiny in future research. For one, the given proposal is well suited for an extension to rarely addressed constraints. For instance, *write* prohibits both p- and i-readings in combination with nouns such as *cow*, as shown by (60a). I-readings are only possible with adequate representational nouns, as in (60b).

(60)   a.   #Ben wrote a cow.
          b.   Ben wrote {a text about / a description of / a poem about} a cow.

The pattern is captured as follows. Representations provided by nouns such as *cow* are based on visual resemblance and thus are not of a propositional nature. Therefore, (60a) cannot receive an i-reading. The examples in (61) provide independent evidence for the constraint.

(61)   [Ben drew a cow and wrote a description of a cow.]
          a.   Ben proudly showed his $\text{cow}_{picture}$ to his mother.
          b.   #Ben proudly read his $\text{cow}_{description}$ to his mother.

Furthermore, *write* can be said to select a physically manifest informational object while lacking a polymorphic type licensing coercion to such objects; see the entry in (62).

(62) $[\![\text{write}]\!] = \lambda\Psi\lambda z\lambda\pi.\Psi(\lambda y\lambda\pi'.\text{write}(z,y,\pi'))(\pi * \text{ARG}_2^{write}: \text{PHYS} \bullet \text{INFO})$

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[13]For reasons of space, I have to defer a thorough comparison to the intensional analysis in Forbes (2006: 138–150) to another occasion. As far as I see, it is also at variance with the full range of extensional effects attested.

Hence, a p-reading is out for (60a) as well; there is simply no lexical anchor for the required coercion. (60b) is fine because the explicit nouns themselves provide the appropriate type.

The second key issue is more general. In its present form, the disjoint type hypothesis is agnostic to the question of whether object type and object representation type have an equal status or are ranked in a linguistically relevant way. For instance, it could be that the representation reading is systematically derived from the object reading and, thus, less readily accessible than its source. One way of approaching the relation between both readings is a thorough comparison to other types of (lexical) ambiguity; a particularly interesting candidate would be the generalized ambiguity between kinds and particulars. In any case, it is open to discussion what implications the proposed type disjunction has for the lexical system as a whole.

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