Semantics of Nouns and Nominal Number

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Abstract

In the present paper, I will discuss the semantic structure of nouns and nominal number markers. In particular, I will discuss the question if it is possible to account for the syntactic and semantic formation of nominals in a parallel way, that is I will try to give a compositional account of nominal semantics. The framework that I will use is "two-level semantics".

The semantic representations and their type-theoretical basis will account for general cross-linguistic characteristics of nouns and nominal number and will show interdependencies between noun classes, number marking and cardinal constructions. While the analysis will give a unified account of bare nouns (like dog / water), it will distinguish between the different kinds of nominal *terms* (like a dog / dogs / water).

Following the proposal, the semantic operations underlying the formation of the SR are basically the same for DPs as for CPs. Hence, from such an analysis, independent semantic arguments can be derived for a structural parallelism of nominals and sentences - that is, for the "sentential aspect" of noun phrases.

I will first give a sketch of the theoretical background. I will then discuss the cross-linguistic combinatorial potential of nominal constructions, that is, the potential of nouns and number markers to combine with other elements and form complex expressions. This will lead to a general type-theoretical classification for the elements in question. In the next step, I will model the referential potential of nominal constructions. Together with the combinatorial potential, this will give us semantic representations for the basic elements involved in nominal constructions. In an overview, I will summarize our modeling of nouns and nominal number. I will then discuss in an outlook the "sentential aspect" of noun phrases.

1 Theoretical Background

My discussion will be within so-called "two-level-semantics"[1]. What is important for the present discussion, is the definition of the semantic system SEM as an interface between linguistic and conceptual structures. SEM is correlated with the conceptual system CS by an interpretation function *Int* that yields the conceptual representations for semantic constants (⇒ *referential potential*). On the other hand, SEM is correlated with the syntactic system SYN through the argument structure AS that identifies those positions that are occupied in SYN (⇒ *combinatorial potential*). Hence, in this view the semantic representa[tion of] an expression E identifies not only its referential potential, but also the combinatorial potential of E. SEM is correlated with the conceptual system CS by an interpretation function *Int* that yields the conceptual representations for semantic constants. On the other hand, SEM is correlated with the syntactic system SYN through the argument structure AS that identifies those positions that are occupied in SYN. This leads to a strictly compositional approach to semantics; cf. Bierwisch / Schreuder (1992:27ff):

> "AS(E), the argument structure of [a lexical entry] E, is a sequence of (one or more) argument positions specifying the number and type of complements required by E. [...] AS(E) functions in a sense as the interface between the syntactic and semantic information provided by its lexical entry."

From the semantic representation and specifically from the argument structure, the classification in categorial grammar can be derived. Hence, in this framework, the type-theoretical classification of a linguistic item indicates its combinatorial potential.[2]

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1 Cf. Bierwisch (1989); Bierwisch / Schreuder (1992); Lang (1989).

2 Accordingly, I will not differentiate between a "type" <α,β> and a "category" (β/α) in the sense of Montague Grammar here (cf. Montague 1970; 1973).

2 The Combinatorial Potential of Nominal Constructions

2.1 Numeral and Transnumeral Nouns; Terminology

I differentiate two main nominal classes: "numeral nouns" and "transnumeral nouns"[3]. I will use the short forms N_n and N_{tn} for numeral and transnumeral nouns, respectively. The diagnostic for N_n is that they are used obligatorily in their plural form when referring to more than one realization of the corresponding nominal concept, while N_{tn} are not. Hence, wolf is a N_n, and cattle or water are N_{tn}.

For N_{tn}, plural forms do either not occur at all, or are strictly optional. The optionality or non-optionality of transnumeral plural forms is determined language-specifically: for example, English N_{tn} do not get plural marking, while in Chinese, Hungarian, or Persian, trasnumeral plural forms occur.

Within the class of transnumeral nouns, two subclasses can be distinguished: N_{tn} *[+mn]* and N_{tn} *[−mn]*. The feature [± mn] indicates whether or not a noun is a *mass* or *substance noun* in the strict sense: N_{tn} [+mn] are nouns like water; when used as *terms*, they refer to a substances (or a portion of a substance), like in Water is wet. N_{tn} [−mn], on the other hand, are nouns like cattle. The feature [−mn] can be applied to N_n also: in general, all N_n are [−mn], whereas N_{tn} are either [−mn] or [+mn].

In languages that have N_n and N_{tn}, a noun is not necessarily restricted to one of the classes, but can change classes depending on the context. This change corresponds to different interpretations[4] (in general, there is a preference for one class, the noun's occurrence as an element of the other class being more marked.[5]). For the sake of brevity, though, I will henceforth talk about numeral and transnumeral *nouns*, instead of (trans)numeral *occurrences* or (trans)numeral contexts of nouns.

I will call a "bare noun" a noun not only without article, but also without number markers. For example, dog or water are bare nouns, whereas dogs will not be called a bare noun here, but a noun marked for number. Plural markers or singular markers of N_n will be called "number-elements" or short: "*num*-elements". With "singular marker" I understand singular morphological marking, not the absence of any number marking. Hence, while a noun like dogs is marked for plural, dog is not marked for number; there is no singular marker. In languages like English and German, the indefinite article occurs parallel to singular markers in languages like Semitic, Slavic or Bantu-languages that have N_n without having a regular indefinite article (cf. the discussion in 2.2.2 below). Accordingly, I include the indefinite article as a "*num*-element" in my discussion (I will not treat definite constructions here). N_n in combination with *num*-elements will be referred to as "N_n + *num*".

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[3] The term "transnumeral" goes back to Greenberg (1974).

[4] This will be discussed in 2.2.5. For a thorough discussion cf. also Pelletier / Schubert (1989).

[5] Cf. Dölling (1994).

2.2 Data

If we have a look at the data on this basis, we can identify general cross-linguistic features of numeral and transnumeral nouns and nominal number that are summarized in the following paragraphs; type-theoretical classifications will be used to indicate the combinatorial potential of the elements under consideration.

2.2.1 Nominal *Terms*: Basic Form

N_n + *num* and N_{tn} can be used as *terms* (expressions of category *T*):

(1) *A dog* came in the kitchen. (N_n + *num*)

(2) *Wolves* were howling in the forest. (N_n + *num*)

(3) Karen drinks *water*. (N_{tn})

(4) wǒmen yǔ *shū* [6] (N_{tn}) [*Chinese*]
we have book
We have {a book / books}.

(5) *tāws* -m bini (N_{tn}) [*Kurdish (Sorāni)*]
peacock$_{ABS.}$-I$_{1.SG.ERG.(clitic)}$ saw
I saw {a peacock / peacocks}.

2.2.2 N_n-*Terms* in Languages Without Indefinite Article: Singular Marking of N_n

As (6) shows, a bare N_n cannot occur as a *term*; *num*-elements are indispensable:

(6) * *Dog* came in the kitchen. / * *Wolf* was howling in the forest. (bare N_n)

However, there are languages, like Semitic, Slavic or Bantu languages, that have N_n without having an indefinite article. In these languages, N_n seem to occur as *terms* without *num*-elements, the semantics of non-plural numeral NPs implying that of an article; cf.:

(17) Hua *muslimun.* [7] (N_n) [*Arabic*]
he Muslim$_{SG.}$
He is a Muslim.

(16) *Drzewo* rośnie przy drodze. (N_n) [*Polish*]
tree$_{SG.}$ grow$_{3.SG.}$ at street$_{SG.LOC.}$
There is a tree growing near the street.

(18) (yeye) atanunua *kitanda.* [8] (N_n) [*Swahili*]
{he/she} buy$_{3.SG.FUT.}$ bed$_{SG.}$
{He/She} will buy a bed.

However, in these cases, the noun presumably is not without number marking, but rather marked for singularity. This analysis is plausible because the noun's plural form is not derived from the singular, but from a nominal stem that also functions as a basis for the singular form. This stem can thus be regarded as that form of the noun that is not marked for number, parallel to non-plural N_n in languages like English or German that have a regular indefinite article. The singular form, on the other hand, includes a nu-

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[6] Data from Chan (1961^2:4).

[7] Cf. Haywood / Nahmad (1962:25).

[8] Cf. Möhlig / Heine (1993:72).

element, the singular marker, and corresponds to English N_n combined with an article; cf. the following evidence from Swahili, Arabic and Polish:

In SWAHILI, nouns have different prefixes for singular *and* plural, e.g., ki-tanda$_{N_n}$ (singular, "bed", or rather "a bed"), and vi-tanda$_{N_n}$ (plural, "beds"), so that -tanda$_{N_n}$, and not vi-tanda$_{N_n}$, is the form without *num*-elements and the basis for both plural and singular.[9]

In ARABIC, two different constructions for N_n-number marking exist. For so-called *broken plurals*, the nominal "stem" is a consonant frame that is filled with different vowels for the singular and the plural form. For instance, from a stem k-t-b, a singular form kitāb$_{N_n}$, "a book", and a plural kutub$_{N_n}$, "books", is derived. Thus, k-t-b would be the "bare form", while kitāb$_{N_n}$ is marked for singularity. With Arabic "sound plurals", on the other hand, number and case morphemes are fused, and different suffixes are combined with a nominal stem for singular, dual and plural forms. Cf. the three (masculine) nominative forms of muslim-: muslim-un$_{N_n}$ (*a Muslim*), muslim-āni$_{N_n}$ (*two Muslims*), muslim-úna$_{N_n}$ (*Muslims*).

With respect to number marking, POLISH N_n behave like the second Arabic group. Both, singular and plural forms are derived from a nominal stem; case and number is indicated by one suffix, cf. for instance the nominative singular and plural of Polish drzew-, "tree": drzew-o$_{N_n}$ (*a tree*) and drzew-a$_{N_n}$ (*trees*).

Non-plural forms of N_n in these languages can hence be regarded as "singular" nouns in a strict sense, i.e., as nouns marked for singularity, rather than as *bare* forms without number marking. Unlike English or German non-plural N_n, these nouns are not bare N_n, but N_n with a *num*-element, namely the singular marker.

2.2.3 Singular and Plural forms of N_{tn}

N_{tn} often can neither be combined with number markers nor with the indefinite article:[10]

(7) *cattles / *a cattle (N$_{tn}$ with plural marker / N_{tn} with indefinite article)

If transnumeral plural or singular forms exist, N_{tn} occur as *terms* both with and without number markers. Thus, in languages where transnumeral number marking is possible, this does not lead to a difference of the combinatorial potential, but only to a difference in the interpretation of the nominal construction: *plural* forms of N_{tn} are not obligatory when reference is made to more than one instance, but indicate a certain emphasis on the magnitude of the referent in question; *singular* forms of N_{tn} are not obligatory when a single instance is denoted, but underline the referent's "one-ness" or signalize "restriction".[11] (8) through (12) show some evidence from typologically different languages, namely Chinese, Hungarian and

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9 Accordingly, in Sudanese languages, like Gola, that also have nominal class prefixes, but where nouns are N_{tn} in general, the class prefix is optional, the nominal stem itself can expand to a full noun phrase (see the discussion in 2.2.3 below for the optionality of transnumeral number markers).

10 This does not mean that nouns that occur as transnumeral in one context can never be used as N_n (and hence be marked for number); cf. the discussion in 2.2.5. below.

11 Cf. Hincha (1961) for a detailed discussion of Persian data. In certain languages, like Arabic or Hebrew, singulative affixes are used to convert N_{tn} into N_n (cf. for instance Greenberg's (1974) discussion of Omani data).

Persian. (13) gives an example from Bavarian where we can get a construction parallel to singular m[illegible] logical marking, that is, the combination with the indefinite article, for a N_{tn} like gäid, "mon[illegible]

(8) háizi / háizi-men (bare N_{tn} / N_{tn}-PL.) [illegible]
child / child-PL.
*{*child / *children}* / *several children, not only one child* [12]

(9) cigaretta / cigarettá-k (bare N_{tn} / N_{tn}-PL.) *[Hungarian]*
cigarette / cigarette-PL.
{a cigarette / *cigarettes}* / *several cigarettes* [13]

(10) āb / āb-hā / āb-i (bare N_{tn} / N_{tn}-PL. / N_{tn}-SG.) *[Persian]*
water / water-PL. / water-SG.
water / *plenty of water* / *a little bit of water, a certain amount of water* [14]

(11) *mehmān* dāštīm. / *mehmān-hā* dāštīm. (bare N_{tn} / N_{tn}-PL.) *[Persian]*
guest had$_{1.pl.}$ / guest-PL. had$_{1.pl.}$
We had {guests / a guest}. / *We had {many / "all kinds of"} guests.* [15]

(12) *pul* dād. / *pul-i* dād. (bare N_{tn} / N_{tn}-SG.) *[Persian]*
money gave$_{3.sg.}$ / money-SG. gave$_{3.sg.}$
{He/She} gave money / paid. / *{He/She} gave some money / a certain amount.* [16]

(13) à gäid [17] (N_{tn} + "SG.") *[Bavarian]*
a money
some money / a certain amount.

2.2.4 Numeral and Transnumeral *Terms* in Cardinal Counting Constructions

In counting contexts, N_n + *num* are combined with cardinals to form *terms*; transnumeral *terms* [–m[illegible] without number markers occur in cardinal constructions with a classifier (*cl*):[18]

(14) six *dogs* (N_n + *num*)

(15) sechshundert Stück *Vieh* (N_{tn} [–mn]) *[German]*
six hundred "piece" [cl] cattle
six hundred head of cattle

(16) liang tiao chuan (N_{tn} [–mn]) *[Chinese]*
two "bough" [cl] boat
two boats

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[12] Cf. Kaden (1964:106).
[13] Cf. Mikesy (1978:59).
[14] Data and interpretation from Hincha (1961:168) and Windfuhr (1979:32).
[15] Data from Windfuhr (1979:32).
[16] Cf. Hincha (1961:168).
[17] Data from Merkle (1986^3:91).
[18] In Semitic and Slavic languages, some cardinals have a noun-like status and are combined with plural or *singular* geni[illegible] NPs (in Semitic languages sometimes accusative NPs). Cf. Wiese (1996b) for a diachronic analysis of the phenomena. I do not treat abstract N_{tn} here; these can often only in very restricted contexts, like in "two cases of love" be combin[illegible] with cardinals. In languages with a rich classifier system (like Chinese), though, most abstract N_{tn} are treated like concre[illegible] N_{tn}. As the focus of this article is on *nominal* semantics, the semantics of cardinal constructions will be discussed only [illegible] so far as they are relevant for that of N_n and N_{tn}. For a thorough treatment of numeral semantics, including counting a[illegible] measure constructions as well as ordinal and #-constructions (like bus # 4), cf. Wiese (1995; 1996b).

Classifiers are not always compulsory in counting constructions with N_{tn} [−mn]: in some languages, they are optional or absent. In these cases, the cardinal is combined with the noun (without number markers) directly, cf.:

(17) sē (tā) *pēnus* (N_{tn} [−mn]) [*Kurdish: Sorāni*]
three "piece" [cl] pencil
three pencils

(18) beš (tane) elma (N_{tn} [−mn]) [*Turkish*][19]
five "grain" [cl] apple
five apples

(19) öt cigaretta (N_{tn} [−mn]) [*Hungarian*]
five cigarette
five cigarettes

2.2.5 "Transnumeral" Versus "Numeral" Number Marking

In general, the function of number markers is often homogeneous in a language, number marking is either "numeral" or "transnumeral"; it is either used to (systematically) signalize "one-ness" / "many-ness", or has an emphasizing function. This means that, if a language has N_n, N_{tn} are in general not marked for number anymore, since plural marking for N_n referring to more than one instance is obligatory by definition; cf. 2.1 above.

This does not imply, however, that nouns that have transnumeral instances can never be pluralized. As mentioned before, many nouns can occur as N_n in one context, and as N_{tn} (more precisely, as N_{tn} [+mn]) in others. In these cases, the occurrence as N_n or N_{tn} [+mn] is linked to different noun phrase interpretations. Nouns with N_{tn} [+mn]-instances that denote substances as a *term* can in numeral (N_n-) usage expand to noun phrases that denote sorts of the substance or conventional portions ("packages") of the substance. Nouns that are numeral in most contexts and hence refer to objects in *T*-constructions, can occur as N_{tn} [+mn] in noun phrases denoting the substance the objects consist of, cf.:

(20) I don't like *wine.*	(N_{tn} [+mn])	[*substance*]
(21) This is *a wine* that I like.	(N_n + *num*)	[*sort of the substance*]
(22) the queen of *table waters*	(N_n + *num*)	[*sorts of the substance*]
(23) "I'll have *a {beer / whisky / ginger ale / gin and tonic}*"[20]	(N_n + *num*)	[*packages*]
(24) She had two *Martinis.*	(N_n + *num*)	[*packages*]
(25) There's *a chicken* in the yard.	(N_n + *num*)	[*object*]
(26) There's *chicken* in the salad.	(N_{tn} [+mn])	[*substance*]
(27) (A termite mother about her son:) Johnny is very choosy about food. He will eat *book*, but he won't touch *shelf.*[21]	(N_{tn} [+mn])	[*substance*]

[19] Cf. Underhill (1976: 127).
[20] Example from Langacker (1987:67).
[21] Example from Gleason (1965:137).

As these occurrences of nouns in different kinds of noun phrases are linked to an interpretation as "substance" or as "non-substance" (= package or sort of a substance), the variation in question concerns primarily the feature [± mn], and not the classification as "N_{tn}" or "N_{n}". Accordingly, the variation is actually between (i) N_{tn} [+mn] and (ii) N_{n} *or* N_{tn} [−mn]. The second option, "N_{tn} [+mn] ⇔ N_{tn} [−mn]", is realized in languages where nouns are transnumeral in general, i.e., languages that have a large class of N_{tn} [−mn] (while in languages like English and German, nouns [−mn] are mostly restricted to the "N_{n}"-class); cf. the following examples from Kurdish (Sorāni):

(28) *barāz* -m bini (N_{tn} [−mn]) [*object(s)*]
pig$_{\text{ABS.}}$ -I$_{\text{1.SG.ERG.(clitic)}}$ saw
I saw {a pig / pigs}. (cf. (5) above)

(29) kebāb-aka bē *barāz*-a (N_{tn} [+mn]) [*substance*]
kebab-DEFINITE without pig-is$_{\text{3.SG.(clitic)}}$
The kebab is without pork.

On the other hand, there are sometimes co-existing forms of "numeral" and "transnumeral" singular and plural in a language as a result of diachronic change; this is an instance of variation between "N_{tn}" and "N_{n}". For example, if there has been a development from N_{n} to N_{tn} in an earlier stage of a language, some nouns can still have certain N_{n}-features, their plural forms being an instance of "numeral" plural (this applies especially to nouns that have a high position on a scale postulated by Smith-Stark (1974) for "plurality splits", i.e., particularly nouns with [+human]-specification.).

PERSIAN is an example for such a development. Data from Old Persian indicate that nouns [−mn] exhibited N_{n}-characteristics. In counting constructions, nouns occurred in their plural forms, and a (single new discourse referent was introduced by a noun that was combined with the first cardinal (in the function of an indefinite article); cf.:

(30) Viyaxnahya māhyā 𐏓𐏒𐏒 *raucabiš* θakatā āha [22] (cardinal + $N_{\text{PL.}}$)
[name]$_{\text{GEN.}}$ month$_{\text{GEN.}}$ 14 days$_{\text{PL.}}$ gone were
14 days of the month Viyaxnahya were gone. / It was the 15th day of Viyaxnahya.

(31) 𐏒𐏒𐏒𐏒𐏑 *xšāyaθiyā* agarbāyam [23] (cardinal + $N_{\text{PL.}}$)
9 kings$_{\text{ACC.PL.}}$ captured$_{\text{1.SG.}}$
I captured nine kings.

(32) 𐏑 *Gaumāta* nāma maguš āha hauv adurujiya [24] (indefinite article / "one" + bare noun
1 [name] named magician was who lied
There was a magician named Gaumata who told lies.

From the beginning of the third century BC, there was a general tendency within the Iranian languages from synthetic to analytical noun phrases, nouns lost inflectional endings. In accordance with this tendency since Middle Persian, nouns have moved from N_{n} to N_{tn}. When denoting more than one instance, a noun no longer has to be marked for plurality; nouns in cardinal constructions occur in bare form, optionally com-

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[22] Data from DB (= Darius, inscription of Behistan) I.37f, cf. Kent (1953:81).
[23] Data from DB IV.7, cf. Brandenstein / Mayrhofer (1964:85).
[24] Data from DB IV.7-8, cf. Brandenstein / Mayrhofer (1964:85).

bined with a classifier. Some nouns, however, show less N_{tn}-features than others; particularly nouns with the semantic feature [+human] are in Modern Persian still - more or less regularly - marked for plurality without this adding any emphasis.

GERMAN, on the other hand, can serve as an example for a development in the other direction - though not as radical as for Persian. Whereas in Modern Standard German, most nouns [−mn] are prototypical N_n, for Middle High German, the classification is not that clear. Nouns that behave like N_n in most contexts, sometimes occur without *num*-elements outside copula constructions. In these contexts, the noun denotes a non-specific number of instances,[25] it hence behaves like a typical N_{tn}. With the development of a regular indefinite article, in New High German *num*-elements occurred in these constructions. Thus, while in Middle High German, nouns [− mn] showed certain N_{tn}-features, the great majority of New High German nouns [−mn] is strictly N_n. They are combined with "numeral" plural when referring to more than one instance, and with the indefinite article when referring to one. Cf. the following contrasting data from Old and Middle High German and New High German:

(33a) meistar, uuir uuollen fon thir *zeichan* gisehan [26] (*Old High German*: bare noun)
lord we want from you$_{DAT.}$ sign$_{ACC.}$ see

(33b) Herr, wir wollen *ein* *Zeichen* von Dir sehen. (*New High German*: N+*num*)
lord we want a$_{ACC.}$ sign$_{ACC.}$ from you$_{DAT.}$ see
Lord, we want to see a sign from you.

(34a) dâ stüende ouch niemer *ritters* becher lære [27] (*Middle High German*: bare noun)
there stood also never knight's mug empty

(34b) (i) Nie wäre der Krug *eines Ritters* dort leer. (*New High German*: N+*num*)
never was the tankard a$_{GEN.}$ knight's$_{GEN.}$ there empty
A knight's tankard would never be empty there.

(ii) Nie wären die Krüge von *Rittern* dort leer. (*New High German*: N+*num*)
never was the tankards$_{PL.}$ of knights$_{PL.}$ there empty
The tankards of knights would never be empty there.

Thus, the classification of nouns as N_n or N_{tn}, the characterization of number marking as compulsory or not, cannot always be done without exception. Diachronic change can result in certain co-existing forms of "numeral" and "transnumeral" number marking (like in Persian) as well as in the development of clearer N_n-features and stricter "numeral" plural (like in German).

2.2.6 Predicative (t/e-) Constructions

Nouns can form predicative expressions, that is expressions of type *(t/e)*, in combination with the copula. Unlike N_{tn}, N_n often have to be combined with *num*-elements in these contexts. However, as the examples in (35) show, *num*-elements are not always obligatory for N_n in copula constructions. This is not the place to discuss the restrictions for bare N_n in copula constructions in detail; however, the overall pic-

[25] Cf. Paul et al. (1982^{22}:353).
[26] Tatian (1892^{2}:57;1).
[27] Walther von der Vogelweide (20,15).

ture concerning the occurrence of bare N_n is this: in general, cross-linguistically at least certain N_n can occur in their bare form as a copula-complement; hence, this seems to be a complement-position open for bare nouns, the combination in which nouns in their base-form can form a predicative constituent.

(35a) Karen *is president.* (copula and N_n)

(35b) Nellie *ist Gast.* (copula and N_n) [*German*]
Nellie is guest

(36a) Nellie *is a unicorn.* (copula and N_n + *num*)

(36b) They *are students.* (copula and N_n + *num*)

(37) This *is goat cheese.* (copula and N_m)

In many languages, neither N_n nor N_m occur as *(t/e)*-elements by themselves: as (38) and (39) show, bare nouns - in contrast to intransitive verbs - do not behave as *(t/e)*-elements without copula - at least in languages in which a copula verb exists at all:

(38) * Nellie *unicorn.* / * This *goat cheese.* (bare nouns)

(39) Nellie *dances.* / This *smells.* (intransitive verbs)

In some languages, *(t/e)*-occurrences are possible, nouns combine with *terms* to form "nominal sentences":

(40) On - xorošii *celowek.* [28] (N_n) [*Russian*]
he good man
He is a good man.

(41) Dimašqu *maḥallun* ḥārrun [29] (N_n) [*Arabic*]
Damascus place hot
Damascus is a hot place.

Sentences with *(t/e)*-occurrences of nouns are sometimes constructions containing a clitic element that functions as a copula (e.g., in Persian, cf. (42)), or in which a copula is optional (cf. the Russian example in (43)):

(42a) Reżā *mo'allem* hast. (N_m) [*Persian (Fārsi)*]
[name] teacher $is_{3.sg.}$

(42b) Reżā *mo'allem*-ast. [*Persian (Fārsi)*]
[name] teacher $is_{3.sg.(clitic)}$

(42c) Reżā *mo'allem*-e. [*colloquial Persian(Fārsi): dialect of Tehran*]
[name] teacher $is_{3.sg.(clitic)}$
Reza is a teacher.

(43) W etom gorode (*est*) *aerodróm.* [30] (N_n) [*Russian*]
in this town is airport
There is an airport in this town.

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[28] Data from Müller-Ott (1982:136).

[29] Data from Haywood / Nahmad (1962:32).

[30] Müller-Ott (1982:137).

2.3 Survey of the Combinatorial Potential of Nouns and Nominal Number

On this basis, we can now summarize the basic combinatorial features for nouns and nominal number as follows:

- Numeral nouns
  - form a constituent of category *(t/e)* with the copula;
  - form an expression of category *T* in combination with *num*-elements.
- Transnumeral nouns
  - form a constituent of category *(t/e)* with the copula;
  - form an expression of category *T* by themselves, i.e., without *num*-elements; often cannot be combined with number markers or indefinite article (if they can, they constitute a *term* both with and without number markers).

Hence, numeral as well as transnumeral nouns form a constituent of category *(t/e)* with the copula; N_n form a *term* only in combination with *num*-elements, whereas N_{tn} expand to *terms* by themselves.

Table 1 gives an overview of the subsumtion of nominal constructions under the types *T* and *(t/e)*.

	T (= (t/(t/e)))	**(t/e)**
numeral nouns	N_n + *num*	copula + N_n (+ *num*)
transnumeral nouns	N_{tn}	copula + N_{tn}

Table 1

2.4 Type-Theoretical Classification

How can this combinatorial potential of nouns and nominal number be accounted for by a type-theoretical classification? As the discussion so far has shown, a general classification of nouns and nominal number should in the first place allow for both, (i) N_{tn} and N_n combining with the copula to form *(t/e)*-elements, and (ii) N_n + *num* and N_{tn} occurring as *terms*. In addition, derivations of N_{tn} and N_n to *(t/e)*-elements should be possible for certain languages. Last but not least, a semantic representation of nouns should account for cardinals forming *terms* with classifiers and N_{tn} [– mn] on the one hand and with N_n+*num* on the other hand.

In the following paragraphs, I will first discuss the traditional, "predicative" view of nouns and then suggest an alternative analysis that captures the combinatorics of nouns and nominal number marking cross-linguistically and is in accordance with the compositionality principle for the semantics of complex expressions.

2.4.1 The Traditional View: Nouns As Predicates?

Traditionally, nouns are classified as elements of a predicative type, namely of *(t/e)*. As can be seen from the data in the preceding paragraphs, such a classification cannot capture the combinatorial potential of nouns in natural languages in a straightforward way: if nouns were elements of *(t/e)*, they should form sentences with *e*-elements, for example with proper names. As (38) above shows, this is not the case.

Though this is not the place for a detailed discussion, I will give a short sketch of the problems that arise from such a classification for a strictly compositional approach to semantics.

In the traditional view, nouns are treated as predicative elements that have the same logical status as intransitive verbs; cf. the following examples for standard analyses in predicate logic:[31]

(44) *Nellie is a unicorn.* ⇨ UNICORN (nellie);
(45) *Nellie dances.* ⇨ DANCE (nellie).

On this basis, nouns should be classified as *(t/e)*-elements. However, this classification cannot account for the combinatorial potential of nouns in natural languages; cf. the type operations for (46) through (48):

(46a)	This	is	goat cheese.		
(47a)	Nessy	is	a sea monster.		
(48a)	Karen	is	president.		
type operation:	e ⊕	[copula] ⊕	[noun (+*num*)]	⇒	t
(46b)	* This		goat cheese.		
(47b)	* Nessy		sea monster.		
(48b)	* Karen		president.		
type operation:	e ⊕		[noun]	⇏	t

In recent *(t/e)*-models, nouns - primarily N_n - are classified as elements of a specific subclass CN of *(t/e)*.[32] According to this view, nouns form *T*-expressions (*terms*) in combination with determiners or - if marked for plurality - by application of *type shifting rules*; and "real" *(t/e)*-expressions by combination with the copula.

The problem here is, that strictly speaking, for nominal constructions the parallelism of semantic and syntactic combination is neglected: An entire subclass of *(t/e)*-expressions (CN) does not behave as should be expected from proper *(t/e)*-elements, i.e. they do not form sentences with *e*- or *T*-expressions. The copula must be analyzed as a seemingly superfluous "predication variable" that makes *(t/e)*-elements from *(t/e)*-elements.[33]

The contribution of *num*-elements in predicative noun phrases cannot be accounted for, because as a copula-complement, the NP must be subsumed under *CN* both with and without *num*-elements. Additionally, the contribution of plural markers and their relation to the indefinite article cannot be captured, as *all* determiners and quantifiers are classified as *(T/CN)*-elements. On this basis, on the one hand both non-plural and plural nouns must be treated as *CN*-expressions, because they can equally form *terms* with elements of *(T/CN)* (for instance either with a(n) or with all and many). On the other hand, plural N_n can be

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[31] See also Wiese (1997) for a detailed discussion.

[32] Cf. for instance Lewis (1972), Montague (1973), Chierchia (1985), Dowty (1988).
It is not quite clear to me whether CN can be treated as synonymous to *count nouns* (and hence includes only N_n) or not. In Montague (1973) and Dowty (1988), this seems to be the case as the indefinite article can be applied to *any* $\alpha \in$ CN (the combination with the indefinite article being a feature that distinguishes English count nouns from mass nouns). Chierchia (1985), on the other hand, allows count nouns *and* mass nouns to occur as CN-elements.

[33] Following Partee (1986), for instance, the copula denotes a general predication function that combines a noun's referent (type *(t/e)*) with an object (type *e*). On such an account, the copula seems semantically superfluous: if categorized as *(t/e* nouns should *per definitionem* combine with *e*-elements, without needing additional „glue“.

used as *terms* directly; as this cannot be contributed to the plural marker anymore, additional mapping rules from *CN* to *T* have to be defined for this usage. Plural markers seem in general to be pretty superfluous, whereas the real job is done by additionally postulated mapping functions; cf. for example the definitions in *Chierchia (1985)*:

"(S2)	If $\alpha \in P_{CN}$ and α is not plural, then $F_1(\alpha) \in P_{CN}$, where $F_1(\alpha)$ is the plural of α.
(T2)	If $\alpha \in P_{CN}$ then $F_1(\alpha)$ translates as α'.
(S3)	If $\alpha \in P_{CN}$, then, if α is plural, $F_2(\alpha) \in P_T$, where $F_2(\alpha) = \alpha$.
(T3)	If $\alpha \in P_{CN}$ then $F_2(\alpha)$ translates as $\lambda P^{i}\, {}^{\vee}P^{i}\,(\alpha')$."

Within such an approach, plural is defined as a semantically and syntactically empty mapping function from *CN* onto *CN* (by F_1 in S2 and T2), and an additional function is introduced (F_2), so that plural nouns can be transformed to *terms* by a syntactically empty identity function (S3), whereas their referents are transformed from functions to arguments (T3).

Another way to account for the data, that allows for a closer parallelism of syntactic and semantic analysis, is to modify the classification of nouns. This proposal will be developed in the next paragraph.

2.4.2 Alternative Proposal: A Non-Predicative Approach To Nouns

In this approach, bare nouns without number marking are not classified as *(t/e)*, but as elements of a primitive, non-predicative category. As I hope to show, the introduction of such a basic nominal category provides the basis for a type-theoretical classification that can account cross-linguistically for the combinatorial potential of numeral and transnumeral nouns in predicative and non-predicative constructions and the function of nominal number markers.

I will call this basic nominal category "b" (as *b* is not predicative, *b* could be seen as a proper subset of *e*). On this basis, we can account for the copula's function as the transformation of a non-predicative element into a *(t/e)*-element. Accordingly, the copula's category in constructions with bare nouns can be identified as *((t/e)/b)*. In addition, the copula can be combined with nominal *terms*; in these constructions, it is classified as *((t/e)/e)*.

On the other hand, *b* forms *T* either with the category of *num*-elements or by application of a shifting rule that operates on N_{tn}-referents. Accordingly, *num*-elements as well as this shifting rule can be subsumed under *(T/b)*. This way, indefinite article and (numeral) plural markers can be identified in a unified account as elements that convert numeral nouns from *b*-expressions into *terms*; in this respect, they correspond to the *shifting rule* that occurs in the course of the derivation of transnumeral DPs. As N_{tn} are mapped onto *terms* by a phonologically empty element, transnumeral number markers do not bring about a type change of the noun (cf. the discussion of data in 2.2.3). Accordingly, singular and plural markers of N_{tn} can be classified as *(T/T)*.

Table 2 gives an overview of types and type operations in nominal constructions as suggested so far:

expression	classification	constructions: type operations in combination with nouns	constructions: linguistic example
N_n, N_{tn}	b		*dog; president; water; cattle*
copula	((t/e)/b)	b ⊕ ((t/e)/b) ⇒ (t/e)	*be {president / water}*
	((t/e)/e)	T ⊕ ((t/e)/e) ⇒ (t/e)	*be a dog*
***num*-elements (for N_n)**	(T/b)	b ⊕ (T/b) ⇒ T	*dogs; a dog; a president*
***shifting rule* (for N_{tn})**	(T/b)	b ⊕ (T/b) ⇒ T	*water; cattle*
number markers (for N_{tn})	(T/T)	T ⊕ (T/T) ⇒ T	*mehmān-hā* (cf. (11) above)

Table 2

Following this suggestions, the classification and derivation of the various kinds of nominal constructions is as follows: We have "b" as a general base type for both transnumeral and numeral nouns. From this basis, we can derive *terms* (i) in the case of N_{tn} by a type shifting rule, that is, by combination with a phonologically empty element, and (ii) in the case of N_n by combination with *num*-elements. We can get predicative constructions by combination with the copula both from a "b"- and from a "*term*"-basis.

Table 3 shows the derivation of type-theoretical classifications for N_n- and N_{tn}-constructions:

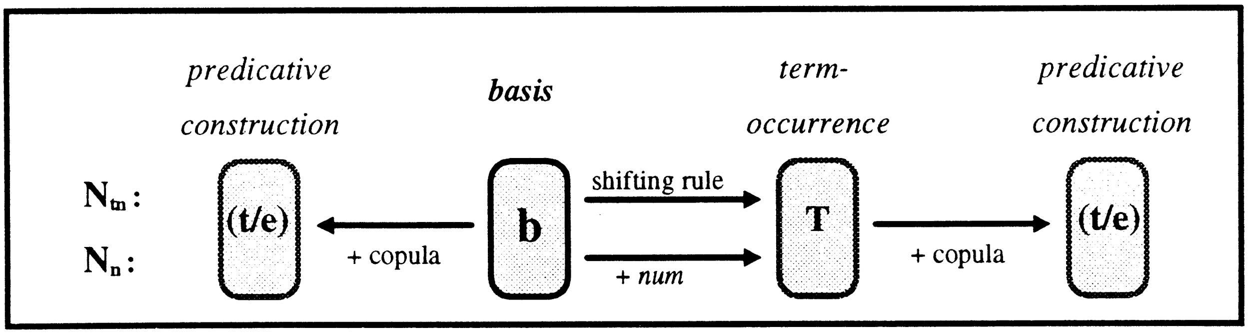

Table 3

2.4.3 Excursus: *b*-expressions and "kinds"

In the present framework, bare nouns as *b*-entities do not provide an open position for an argument; accordingly, *b* could be regarded as a specific subclass of *e* (or as a specific "sort", in the sense of Dölling 1994). Note though, that this does not mean that *b*-expressions should be confused with designations for CARLSONian *kinds* (cf. Carlson 1978; 1991). A kind, although it is (following Carlson) a type *e*-entity, is fundamentally different from an entity referred to by a bare noun in *b*-occurrence. A kind has the status of a *term*-referent: it cannot be designated by a *b*-expression, but only by a nominal *T*-construction; generic sentences always include full DPs; cf. (49) and (50) vs. (51):

(49) *Unicorns* are dangerous animals. (nominal *term*)

(50) *The unicorn* is a dangerous animal. (nominal *term*)

(51) **Unicorn* is a dangerous animal. (bare N_n)

As Krifka (1989:7f) shows, generic transnumeral DPs share certain features with definite DPs. This holds for generic numeral DPs ("bare plurals") also; cf. the English and French parallels:

(52a) *Unicorns* are dangerous animals. (generic plural N_n)

(52b) *Les licornes* sont des animeaux dangereux.

(53a) *Gold* melts at 1063 degrees. (generic N_{tn})

(53b) *L'or* fond à 1063 degrés.

This data could be interpreted as evidence that reference to kinds is not on NP-, but rather on DP-level. I will therefore assume that the *kind*-interpretation is triggered by D-elements, whereas "b" is the type of bare nouns in their basic occurrence.[34]

3 The Referential Potential of Nouns and Nominal Number

We can now characterize the referential potential of nouns and nominal number. In the following paragraphs, I will give a sketch of the referents of the various nominal constructions and identify their conceptual domains; on this basis, the semantic representations will be developed.

3.1 Characterization of Referents for Nominal Constructions

The referential potential of predicative and non-predicative nominal constructions can be identified as follows: **bare nouns** as elements of type "b" denote the nominal concept itself and thus identify the reference frame for the DP. To capture their non-predicative status, a nominal concept is to be regarded as a non-predicative entity that I will call a "Begriff". As a *Begriff* in this view is non-predicative, it cannot be combined with its realizations directly, but needs an additional "subsumtion"-function.[35] This function is denoted by the copula: **copula-noun-constructions** denote the subsumtion under a *Begriff* (for example, x is water refers to the proposition that x is subsumed by the concept *water*). **Nominal *terms***, on the other hand, denote realizations of the *Begriff*: numeral *terms* (N_n with *num*-elements) denote sets with either one or with more than one element, namely, singletons or non-singletons of realizations of the *Begriff* (for example, wolves denotes a set of wolves with more than one element, a wolf denotes a singleton of wolves).

[34] If we assume kinds to be referents of bare nouns, several additional rules have to be introduced to make the analysis compatible with the linguistic data. For instance, Krifka (1995), defining kinds as the basic nominal denotations, assumes two different mappings from N_{tn} to NPs, one semantically vacuous, the other one converting kinds into their specimen or subspecies or individual sums of specimen or subspecies. In addition, he has to treat the singular definite article as a (semantically empty) identity function, since a bare N_n is already defined as a kind designation. Finally, as plural and non-plural N_n are treated alike in their basic occurrences, two (phonologically empty) mappings are necessary for generic plural N_n (like bears) from (i) a *kind* to (ii) an *object* that realizes this kind and (iii) back to the *kind* that is realized by this object. It seems that these data can be accounted for in a more straightforward way if reference to kinds is analyzed on the *term*-level, by N_n+*num* and N_{tn} in *T*-usage, and not by nouns in their basic occurrences (cf. also Wiese 1996b). As the focus of this paper is on nouns and nominal number marking, I will not go into further details here though, but restrict my analysis to non-generic, indefinite constructions.

[35] This analysis is in the spirit of Bealer (1979; 1982) who criticizes the definition of properties as functions as "highly unintuitive" (1979:639) and characterizes properties as "real, irreducible entities" (1982:1) that are correlated with other entities *by a predication relation* Δ.

Based on Gupta's (1980) proposal for the semantic differentiation of nouns and verbs, one could, within the present approach, define as the intension of a noun a function that yields for every possible world a set of *Begriff*e that have certain realizations in possible worlds, i.e. the subsumtion function selects for these *Begriffe* objects from possible worlds (Gupta 1980 defines the intension of a noun as an "intensional property" that yields for every possible world a set of functions that select objects from possible worlds).

Transnumeral *terms* denote (portions of) substances or aggregates of *Begriff*-realizations (for example. water as in Karen drinks water, denotes a portion of water; cattle as in Karen owns cattle, denotes an aggregate of realizations of the concept "cattle").

I give a characterization of what an aggregate is in the following excursus; the difference between aggregates and sets will also become clear from the semantic representations below:

Excursus: The Status of "Aggregates"

Aggregates are entities which are not principally homogeneous (in contrast to substances), but composed of elements (like sets), namely realizations of a certain *Begriff* (where the realizations' quantity is not specified). Aggregates can therefore potentially be structured into elements. In contrast to genuine sets, though, they are *not yet individuated*; aggregates are treated "as if they do not consist of discrete parts" (Bunt 1985:45). Hence, in counting contexts, the access to individual elements must given by an individuation function.

I define an individuation function as a function *V* that maps an aggregate *u* onto an enumeration of its individual elements $x_1, \ldots, x_n$:

$$V(u) = \{x_1, \ldots, x_n\}.$$

Such a function is necessary in cardinal counting constructions, where access to individual elements of the counted set must be given. An individuation function is denoted by a numeral classifier in counting constructions with transnumeral *terms*. In counting constructions with numeral *terms*, that is, with N_n + *num*-elements, the individuation function is not designated explicitly, but is implicit in the denotation of the plural noun; cf. the data in 2.2.4 above.

Accordingly, unlike transnumeral *terms* [+ mn], transnumeral *terms* [− mn] can occur not only in measure constructions, but also in counting constructions; unlike numeral *terms* (i.e., N_n + *num*) they are combined with a numeral classifier (as a designation for the individuation function) in these contexts (as cardinal constructions are not in the focus of this talk, I will not go into further details here. though).

As the examples above have shown, transnumeral number markers have an emphasizing function for the referent's magnitude. Following a suggestion developed for Persian by Hincha (1961), I will characterize this by saying that number markers of transnumeral *terms* signalize "amplification" (plural markers) or "restriction" (singular markers).

Table 4 summarizes the referential potential of nouns and nominal number:

bare noun → "Begriff"	**copula + noun → "subsumtion"**

nominal *term* → "realizations":

- **transnumeral *term*:**
  - N_m [− mn] → **"aggregate"**
  - N_m [+ mn] → **"substance"**
  - transnumeral plural markers → "amplification"
  - transnumeral singular markers → "restriction"
- **numeral *term*** (N_n + *num*) → set:
  - singular *term*: **"singleton"**
  - plural *term*: **"non-singleton"**

Table 4

3.2 Conceptual Domains for Nominal Terms

Following suggestions by Bierwisch (1988) and Dölling (1992; 1994), I will assume for the present purpose two CS-domains, namely: A, the domain of "objects", and M, the domain of "substances", where A is divided into the subdomains °A for singular objects, and ^A for plural objects. For the representation of bare nouns, I assume a conceptual domain B of "Begriffe".

On this basis, we can identify the following conceptual domains for representations of nominal *terms*: the referents of numeral *terms* like dogs or a dog, and of transnumeral *terms* [– mn] like cattle are represented by entities in the domain A of "objects". Whereas for numeral *terms*, the referents are differentiated as "singular objects" (°A) or "plural objects" (^A), no such differentiation is given for transnumeral *terms* [– mn]. Referents of transnumeral *terms* [+ mn] like water, on the other hand, have their conceptual representations in the domain M of "substances".

Table 5 summarizes the conceptual classifications suggested for representations of nominal *terms*:

N_n + *num*	A ("objects");	singular: °A, plural: ^A
N_{tn} [– mn]-*terms*	A ("objects");	no specification for °A or ^A
N_{tn} [+ mn]-*terms*	M ("substances")	

Table 5

N_{tn} [– mn] take a medium position between N_n on the one hand and N_{tn} [+ mn] on the other hand: in the morpho-syntactic field, they behave similar as N_{tn} [+ mn]; in respect to the CS-domain for *terms*, they are parallel to N_n. This medium position will be reflected in the semantic representations.

4 Semantic Representations for Numeral and Transnumeral Nouns and Nominal Number

Based on the analysis of the combinatorial and referential potential of nominals in the preceding paragraphs, different semantic representations (SRs) can now be developed for the various constructions of nouns and nominal number markers. The analysis will, amongst others, (i) yield a general basic representation for both N_{tn} and N_n, (ii) distinguish between numeral and transnumeral *terms*, and (iii) consistently differentiate plural and singular nouns, and bare nouns.

4.1 Basis: Representation of Bare Nouns

As a result of the discussion so far, I regard bare nouns in their basic occurrences as elements of type *b* and their referents as non-predicative entities, namely "Begriffe". As *Begriffe* are regarded as primitives, nominal representations consist of the *Begriff* alone in these cases, as shown in SEM 1 (*B* is a variable ranging over *Begriffe*). This is the fundamental SR for both numeral and transnumeral nouns and the basis for all derivations.

SEM 1: General form of the basic entry for nouns		
❑ SR:	B	$Int(B) \in$ B
type:	b	

Examples:[36]

(54) *dog*: Dog (N_n);
(55) *cattle*: Cattle (N_m [−mn]);
(56) *water*: Water (N_m [+mn]).

4.2 Derivation of (t/e)-Constructions: Representation of the Copula

As the discussion so far has shown, an expression subsumed by *b* does not refer to a truth function (like *(t/e)*-expressions), but to a more basic, saturated entity. To form a *(t/e)*-element, a *Begriff* therefore has to be combined with a function correlating it with its realizations. In linguistic structures, this function can be designated by the copula. The copula's type in these constructions is *((t/e)/b)*; copula be in this usage denotes a function mapping *Begriffe* onto their realizations. (57) gives a sample representation for predicative nominal constructions (IST is interpreted in CS by a „realization"-function):

(57) *be water:* λx IST(Water,x).

[I will henceforth use "B'(x)" as an abbreviation for "IST(B,x)", with B $\in$ b.]

The representation for be water in (57) is logically equivalent to one like "λx WATER(x)" where WATER is a one-place predicate as in the traditional analysis of nouns. Hence, the introduction of *b*-elements does not so much induce the postulation of new entities, but rather enables us to identify the *Begriff*-component of nominal predicates, while the predicative component is supplied by the function IST, that is, it is provided by the copula.

As the discussion of the data has shown, nouns can also as *terms* be combined with the copula. In these constructions, the copula does not refer to a predicate over *Begriffe* and objects, but to one over two objects. IST postulates their coincidence (like in Nessy is a sea monster.) or their identity (like in The gardener is the murderer.). This is accounted for in SEM 2 where γ is a variable ranging over *Begriffe* and objects, and the central function IST is interpreted in the conceptual system by subsumtion, coincidence, or identity:

SEM 2: Entry for the copula		
❑	SR:	$\lambda\gamma\lambda x$ [IST(γ,x)]
	type:	((t/e)/α) with {$\alpha \in$ e,b} [or ((t/e)/e), with b $\subset$ e]

IST(γ,x) is defined as follows:

- If γ is a *Begriff* ($\gamma \in$ b), and x $\in$ e, then IST(γ,x) is true iff x is a realization of γ
  (IST is interpreted in CS by a "subsumtion" function: Int(IST) = subs; cf. Wiese 1996b)
  ($\Rightarrow$ *"Karen is president." / "This is water."*).
- If $\gamma \in$ e, and x $\in$ e, then IST(γ,x) is true iff
  - ♦ x coincides with γ ($\Rightarrow$ *"Nessy is a sea monster."*), or
  - ♦ x is identical with γ (γ is [+definite]) ($\Rightarrow$ *"The gardener is the murderer."*).

[36] To differentiate the various types of semantic constants, I use capital letters for functions, small letters for *e*-type-entities, and write *Begriffe* with a capital letter at the beginning only

In languages that allow "nominal sentences" (cf. the data in 2.2.5 above), nominal constructions can be converted to *(t/e)* by a phonologically empty element, the semantics of the noun phrase implying that of a copula. For these constructions, a type shifting rule IMPLY_COPULA can be defined that maps nouns from *T*- onto *(t/e)*-expressions:[37]

SEM 2': IMPLY_COPULA
❑ SR: $\lambda\gamma\lambda x$ [IST(γ,x)]
type: ((t/e)/e)

4.3 Derivation of T-Constructions: Representations for Nominal Terms and Number Markers

In addition to *(t/e)*-constructions, nouns can form *terms*. As the discussion has shown, we have to distinguish two kinds of derivations for nominal *terms*: N_{tn} can be used as *terms* directly, whereas N_n have to be combined with *num*-elements. Accordingly, we have to assume a phonologically empty function that maps the referents of N_{tn} onto their realizations, whereas for N_n, this mapping is done by *num*-elements.

4.3.1 Transnumeral *Terms*: SR for a Shifting Function REALIZE

I call the shifting function from *b* to *T* that operates on N_{tn} "REALIZE". The semantic representation for REALIZE is given in SEM 3:

SEM 3: Entry for a shifting rule REALIZE for the derivation of transnumeral *terms*		
❑ type: (T/b)		
SR_1: $\lambda B\,\lambda Q\,[\exists x\,(B'(x) \wedge Q(x))]$;	$Int(x) \in \underline{M}$	(for N_{tn} [+mn])
SR_2: $\lambda B\,\lambda Q\,[\exists u\,(\forall x\,(IN(u,x) \rightarrow B'(x)) \wedge Q(u))]$;	$Int(x), Int(u) \in \underline{A}$	(for N_{tn} [−mn])

Examples for transnumeral *terms*:

(58) *water*: $\lambda Q \exists x\,(Water'(x) \wedge Q(x))$;

(59) *cattle*: $\lambda Q \exists u\,(\forall x\,(IN(u,x) \rightarrow Cattle'(x)) \wedge Q(u))$.

The argument structure of the semantic representations in SEM 3 shows an open position for a nominal referent, a *Begriff*. This *Begriff* is mapped onto its realizations, the SRs therefore include the subsumtion function mentioned. As the resulting SR is one for a *term*, not for a predicate, we have an additional empty position for the sentence predicate *Q* in the AS. We have to distinguish two kinds of transnumeral *terms*: (i) transnumeral *terms* [+mn] like water in (58) denote a substance: a single, homogeneous realization of the *Begriff*; (ii) transnumeral *terms* [−mn] like cattle in (59) refer to an entity *u* composed of realizations of the *Begriff*. This is accounted for in the entry for REALIZE by the two options SR_1 and SR_2: REALIZE converts nominal referents from *b* to *T* in two different ways, depending on the subclassification of the noun as [+mn] or [−mn].

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[37] I assume that the standard transformation is from *T*, and not from *b*, to *(t/e)*, as in general, if nominal sentences with N_n are possible, the language in question does not have an indefinite article. This means that the N_n functioning as "predicate" in the nominal sentence is (implicitly or morphologically) marked for number and thus should be regarded as a *T*-expression before conversion (in nominal sentences with N_{tn}, there is no criteria to decide whether the noun should originally be classified as *T* or *b*.).

Henceforth, I will use the following abbreviation for aggregates: $B^*(u) =_{df.} \forall x\, (IN(u,x) \rightarrow B'(x))$.

(60) and (61) show semantic representations for sentences including these *terms*:

(60) *Karen drinks water.*: $\exists e\, (INST((\exists x\, (Water'(x) \wedge DRINK(x,karen)), e))$;
(61) *Frank owns cattle.*: $\exists e\, (INST((\exists u\, (Cattle^*(u) \wedge OWN(u,frank)), e))$.

[e is the event variable, and INST is a function mapping propositions on their instantiations, namely events. For example, (60) can be paraphrased as "There is an event e that instantiates the proposition that there is a realization x of the Begriff "water", and Karen drinks x."]

4.3.2 Numeral *Terms*: SR for *Num*-Elements

The derivation of numeral *terms* is accounted for by an entry for *num*-elements, in SEM 4:

SEM 4: Entry for *num*-elements		
❑ type: (T/b)		
SR_1: $\lambda B \lambda Q\, [\exists V\, \exists u\, (B^*(u) \wedge ANZ(V(u), 1))]$;	$Int(u) \in {}^{\circ}\underline{A}$	(singular marker)
SR_2: $\lambda B \lambda Q\, [\exists V\, \exists u\, (B^*(u) \wedge \neg ANZ(V(u), 1))]$;	$Int(u) \in \underline{{}^{\wedge}A}$	(plural marker)

I will use the following abbreviations: $B^1(u) =_{df.} \exists V\, (B^*(u) \wedge ANZ(V(u), 1))$;
$B^{\otimes}(u) =_{df.} \exists V\, (B^*(u) \wedge \neg ANZ(V(u), 1))$.[38]

(62) and (63) give sample representations for numeral *terms*:

(62) *a dog*: $\lambda Q \exists u\, (Dog^1(u) \wedge Q(u))$;
(63) *dogs*: $\lambda Q \exists u\, (Dog^{\otimes}(u) \wedge Q(u))$.

As the discussion of the data has shown, numeral *terms* occur in cardinal counting constructions without a classifier; unlike transnumeral *terms* they can be combined with a cardinal directly. This is accounted for in SEM 4 by including an individuation function V in the SR of *num*-elements. In addition, the denoted set of realizations is either assigned or negated the numerical quantity "1", numeral *terms* are always marked for singularity or plurality, "one-ness" or "many-ness". This is modeled in the SR with the help of a function ANZ that maps an enumeration of elements V(u) onto a numerical quantity.[39]

Note that SR_1 in SEM 4 is a representation for the indefinite article (or a singular morphological marker), and not for a bare noun. As mentioned already, it is not the bare form of a N_n that is regarded as

[38] This abbreviation and the one for aggregates point to Link's (1983) analysis of "plural predicates" as **P* and "proper plural predicates" as $^{\otimes}P$, where * is an operator that works on a one-place predicate *P* and generates all the individual sums of members of the extension of *P*, and $^{\otimes}P$ is true of exactly the non-atomic sums in the extension of **P*. Hence, the formulas developed here represent in principle the same entities as in Link's approach, the analyses are compatible. Note, though, that in the present framework, the representation of aggregates and plural objects as $B^*(u)$ and $B^{\otimes}(u)$ is a matter of mere conventional convenience and does not imply a definition like Link's. In contrast to Link's framework, in the present approach the representation of plural count nouns is not based on plural predicates **P* that takes both singular and plural objects as their arguments. As a result from defining bare nouns in a unified account as *b*-elements and considering the copula and *num*-elements for the semantic analysis, the presented approach goes beyond the surface of Link's predicates, replacing them by semantic components that have linguistic expressions as their counterparts. As the discussion so far has shown, this has the additional advantage of enabling us to analyze N_n and N_{tn} [+mn] as well as N_{tn} [-mn] and take into account their occurrence in copula constructions (and in different kinds of cardinal constructions).

[39] For a definition of ANZ and a detailed discussion of the elements involved in cardinal constructions cf. Wiese (1995; 1996a; b).

"singular", but the form marked for singularity, either morphologically or by combination with the indefinite article. If we defined bare N_n as semantically singular - as the standard labels suggest - we would amongst others have difficulties to explain (i) why the so-called "singular" is apparently the basis for plural *and* - if possible - singular marking, and (ii) why the indefinite article is compulsory at all.[40]

On the basis of SR_1 and SR_2 above, the mapping of N_n from *b* onto *T* by *num*-elements can be analyzed as actually consisting of two steps. First, the *Begriff* denoted by a N_n is mapped onto an aggregate of its realizations, similar to the conversion of N_m [-mn] by REALIZE. Hence, a type shifting rule "REALIZE_{N_n}" could be assumed to work on N_n in the course of their combination with *num*-elements:

REALIZE_{N_n}:
type: b $\Rightarrow$ (T/n)
SR: B $\Rightarrow \lambda n \lambda Q \exists V \exists u\ (B^*(u) \wedge ANZ(V(u),n) \wedge Q(u))$

Unlike SR_2 in SEM 3 above, the resulting SR in REALIZE_{N_n} includes a component *ANZ* and an open position for a numeral, making the N_n not yet a *T*-, but a *(T/n)*-expression.[41] In the second step, this position is closed by assigning the set in question the numerical quantity "one" or "not one".

4.3.3 A Unified Account of Plural N_n? Implications of the Analysis

I analyze plural markers of N_n in cardinal constructions as semantically identical with those in noun phrases like (63) above ("dogs"), so-called "bare" plurals. Following this approach, the SR of a plural N_n like dogs can in counting constructions be combined with that of a cardinal, cf. the analysis in (64):

(64) *six dogs*: $\lambda Q \exists u \exists V\ (Dog^{\circledast}(u) \wedge ANZ(V(u),6) \wedge Q(u))$.[42]

Approaches like Krifka (1989), on the other hand, distinguish *semantic plural* for "bare plural" nouns that *is* represented semantically, from semantically null *syntactic plural* for N_n in cardinal constructions. A unified analysis of plural N_n does not only carry the advantage of allowing one, general semantic representation for (numeral) plural, but reflects also parallels between singular markers and plural markers. The reason to regard nominal plural in cardinal constructions as a "purely syntactic agreement phenomenon" (cf. Krifka 1989:171;1991:402) is on the one hand the occurrence of non-plural nouns in cardinal constructions in Turkish. On the other hand, in a language like German, N_n without number marking can occur after cardinals ending in undein- (*and one*), and plural N_n after null (*zero*), cf. the Turkish and German data in (65) through (67) (cf. Krifka 1989:20):

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40 For instance, Eschenbach (1993), who represents bare N_n as semantically singular, has to reduce this *singular* feature to a - semantically vacuous - agreement phenomenon in constructions with the indefinite article, to avoid a double representation of singularity in indefinite article *and* noun.

41 Hence, at this point - but not before - N_n exhibit those characteristics that made Krifka (1991) call them *relational*. I do not assume an open position for a number in the SR of N_n before application of REALIZE_{N_n}, because this would not allow us to give a unified basis representation "B" for N_n, N_m [− mn] and N_m [+mn]. In addition, such an analysis could not account for occurrences of bare N_n like in (35a) and (35b) above.
Krifka (1995) treats plural and non-plural N_n not as relational, but as designations for kinds, and includes the classifier's SR in that of the cardinal. Besides requiring different SRs for plural N_n in cardinal constructions and in "bare plurals", this leads to different SRs for cardinals in combination with N_n and with N_m. As a classifier's semantics is included in that of "bare plural" NPs anyway, such a duplication might be superfluous.

42 The SR of six can be given as: $\lambda Q \lambda V \lambda u\ (ANZ(V(u),6) \wedge Q(u))$. Cf. Wiese (1995; 1996b) for a detailed analysis of cardinals and the derivation of the SR of cardinal (counting and measure) constructions.

4.3.4 Singular and Plural N_{tn}: SR for Transnumeral Number Markers

What we still need, is an entry for transnumeral number markers. This is defined in SEM 5:

SEM 5: Entry for number markers of transnumeral nouns

- ❑ type: (T/T)

  SR_1: $\lambda u\, \lambda Q\, [\exists c\, (QUANT(u, v - c) \wedge Q(u))];\ Int(u) \in \underline{A}$ (singular marker)

  SR_2: $\lambda u\, \lambda Q\, [\exists c\, (QUANT(u, v + c) \wedge Q(u))];\ Int(u) \in \underline{A}$ (plural marker)

As the discussion of the relevant data has shown, N_{tn} occur as *terms* both with number markers and without. Accordingly, transnumeral number markers operate on *terms*, not on *b*-entities, their argument structure shows an open position for a *term*. Unlike numeral number markers, they do not give the numerical quantity "one" or "not one" for a set, but emphasize the large or small quantity of a *Begriff*-realization, that is, of either an aggregate or a portion of a substance. Accordingly, transnumeral number markers operate both on nouns [– mn] and [+ mn]. I use a function QUANT for the analysis that was introduced in Bierwisch / Lang (1989) for the representation of dimensional adjectives. Roughly speaking, QUANT maps an object onto its quantity, i.e., onto an interval of a scale, where "v" is a value of comparison and "c" a degree of difference (see Bierwisch 1989 for detailed definitions).

(69) through (71) give sample analyses for the Persian and - in (70b) - Bavarian examples for N_{tn} with number markers that I have discussed in 2.2.3:

(69)	*mehmān-hā*:	$\lambda Q \exists u\, \exists c\, (Guest^*(u) \wedge QUANT(u, v + c) \wedge Q(u))$	[N_{tn} ("guest") + PLURAL];
(70a)	*pul-i*:	$\lambda Q \exists x\, \exists c\, (Money'(x) \wedge QUANT(x, v - c) \wedge Q(x))$	[N_{tn} ("money") + SINGULAR];
(70b)	*à Gäid*:	$\lambda Q \exists x\, \exists c\, (Money'(x) \wedge QUANT(x, v - c) \wedge Q(x))$	[N_{tn} ("money") + "SINGULAR": indef. article].
(71a)	*āb*:	$\lambda Q \exists x\, (Water'(x) \wedge Q(x))$	[N_{tn} ("water")];
(71b)	*āb-hā*:	$\lambda Q \exists x\, \exists c\, (Water'(x) \wedge QUANT(x, v + c) \wedge Q(x))$	[N_{tn} ("water") + PLURAL];
(71c)	*āb-i*:	$\lambda Q \exists x\, \exists c\, (Water'(x) \wedge QUANT(x, v - c) \wedge Q(x))$	[N_{tn} ("water") + SINGULAR].

4.3.5 Derivation of Nominal *Terms*: Survey

The following survey gives examples for the different kinds of *terms* defined above [the ε-operator is used for the representation of indefinite *terms*: $Q(\varepsilon x\, P(x)) =_{df.} \exists x\, (P(x) \wedge Q(x))$]:

basic representation:	**SR: B**	**type: b**
♦ *water*:	Water	(N_{tn} [+mn]);
♦ *cattle*:	Cattle	(N_{tn} [–mn]);
♦ *dog*:	Dog	(N_n).
***T*-constructions:**	**SR: $\varepsilon x\, (B^{\alpha}(x)\ldots)$**	**type: T**
♦ *water*:	$\varepsilon u\, (Water'(u))$	(N_{tn} [+mn]-*term*);
♦ *cattle*:	$\varepsilon u\, (Cattle^*(u))$	(N_{tn} [–mn]-*term*);
♦ *a dog*:	$\varepsilon u\, (Dog^1(u))$	(N_n + *num*);
dogs:	$\varepsilon u\, (Dog^{\otimes}(u))$	(N_n + *num*).

Following this proposal, we start with the same basic representation for all nouns (in the examples: water / cattle / dog). From this basis, we get different derivations of *terms* via REALIZE (water / cattle) or by combination with *num*-elements (a dog / dogs). This analysis gives a unified account of basic nominal occurrences and can at the same time distinguish between the different kinds of nominal *terms*. This has the additional advantage to capture occurrences of the same noun as transnumeral in one context and numeral in the other context (cf. the discussion of data in 2.2.5 above).

Table 6 shows the derivation of the four different kinds of nominal *terms*: (i) transnumeral *terms* [+mn] like water, (ii) transnumeral *terms* [−mn] like cattle, (iii) plural numeral *terms* like dogs, and (iv) singular numeral *terms* like a dog:

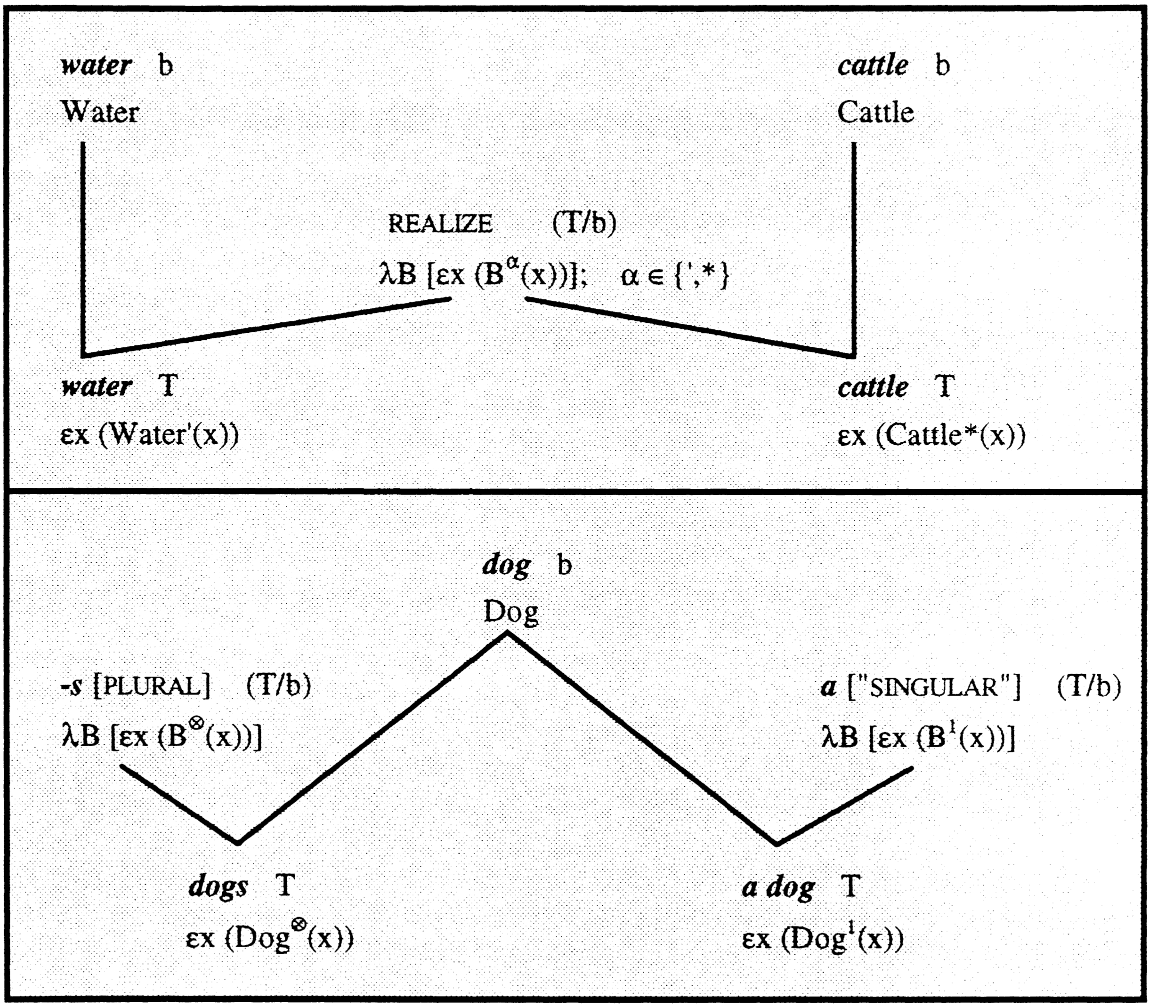

Table 6

5 Overview: Modeling of Nouns and Nominal Number

Table 7 gives an overview of the conceptual and semantic structures of nouns and nominal number, that is, of numeral and transnumeral nominals (and a rough sketch of their syntactic structures[44]): following the analysis proposed here, the generation of *terms* in the semantic system SEM is paralleled by the reference to *Begriff*-realizations in the conceptual system CS, and the constitution of DPs in SYN.

	CS	⇦ **SEM**	⇨	**SYN** *(sketch)*
	domain of conceptual representations	SR	category	projection
bare noun	$\underline{B}$	B	b	NP
"*term*-maker": • *num*-elements • REALIZE		$\lambda B\ [\varepsilon x\ (B^{\alpha}(x))]$ • $B^{\alpha} \in \{B^{1}, B^{\otimes}\}$ • $B^{\alpha} \in \{B^{*}, B'\}$	(T/b)	 "$Term^{0}$" "$Term^{0}$"
nominal *term*: • N_n + *num* • N_{tn} + REALIZE	$\underline{A} \cup \underline{M}$ $\underline{°A}$ $\underline{\wedge A}$ $\underline{A}$ $\underline{M}$	$\varepsilon x\ (B^{\alpha}(x))$ • $B^{\alpha} = B^{1}$ • $B^{\alpha} = B^{\otimes}$ • $B^{\alpha} = B^{*}$ • $B^{\alpha} = B'$	T	DP [DP [D^0 TermP [$Term^0$ NP]]] [DP [D^{zero} [D^0 $Term^0$] NP]]
	reference to Begriff-realizations	*term-generation*		*DP-constitution*

Table 7

[44] The sketch of syntactic structures is given to indicate how the semantic structures of nominals could be paralleled in SYN within the model presented here (the category "Term" stands for those elements that convert a bare noun into a *term*; "TermP" is that layer between NP and DP that is identified as "Number Phrase" in approaches like Ritter 1992, for instance). See Wiese (1996b) for a more detailed discussion.

6 Outlook: The "Sentential Aspect" of Noun Phrases - Parallels in the Semantic Structures of Nominals and Sentences

If the presented analysis is correct, then there are not only syntactic, but also semantic arguments for the "sentential aspect of noun phrases"; it can be shown that we have basically the same semantic operations for DPs and for CPs in the formation of their semantic representations. I will give a short sketch of this in the present paragraph.

Following the analysis developed here, we have mainly two semantic operations in the generation of nominal *terms*: on the first level (in NP), the lexical content is given by a *Begriff B* that identifies the reference frame for the nominal. On the next level (that I have abbreviated as "TermP"), *B* is realized by an object (= an aggregate or a set) or a substance.

These semantic operations have parallels in the generation of sentences: in the VP, the reference frame for the sentence is identified by a proposition *F(a)*. It is sometimes suggested that an event *e* be combined with the sentence predicate and its arguments by a function *INST(F(a),e)* that maps a proposition *F(a)* onto its instances (cf. Bierwisch 1988). If we follow this suggestion, we get the next semantic operation, the *instantiation*, on a level above VP (presumably in T^0). Where we have the subsumtion function IST for nominals, we get the instantiation function INST in the sentential area.

I have not discussed a third semantic operation here, as I have not treated definite constructions. In short, I assume that on the next level, that is, in DP or CP, for nominals or sentences respectively, we can have a [+ definite]-specification, that is, the transformation into a definite *term*. Semantically, the referent (= an object or a substance for nominals, an event for sentences) is identified as the most salient instance.

What we get within the present approach, is then a three-level structure for nominals and sentences on the semantic-conceptual side; the semantic operations paralleling CP- and DP-constitution can be characterized for sentences and nominals in a uniform way:

(i) reference frame: providing of the lexical content (proposition or *Begriff*);

(ii) realization: instantiation (via INST: by an event; via IST: by an object or a substance);

[**(iii) transformation into a definite *term*** / [+ definite]-specification:
the entity is identified as the most salient instance].

In a rough sketch, the derivation of the SR for sentences and nominals can then be represented as follows (ignoring additional components like tempus specifications; the ι-operator is used for the representation of definite *terms*)[45]:

nominal:	B	➡	∃x (IST (B,x) ...)	[➡	ιx (IST (B,x)...)	]
sentence:	F(a)	➡	∃e (INST(F(a),e) ...)	[➡	ιe (INST(F(a),e)...)	]

---

[45] I did not treat definite constructions here. In Wiese (1996b), I give an analysis of the definite article that sit compatible with the present approach to nouns and nominal number. As the formula shows, I assume that a [+definite] specification leads to a type change of the sentence from *t* to *T*. This analysis is in the spirit of Chierchia's definition of a nominalization operator ∩ for sentential arguments; cf. his analysis of believe that *Q(x)*: believe'(∩[Q(x)]). (Chierchia 1985:422).

These parallels can be extended to counting constructions, the data suggesting that *quantification* is a semantic operation that takes place between levels (ii) and (iii). Sentences like Karen calls. behave similar to transnumeral nominals [−mn] in this respect: in the sentential section, the argument of *ANZ* is an aggregate of events that, in order to be quantified, is combined with an individuation function denoted by a classifier like times.[46] (72) and (73) show sample analyses for nominal and clausal counting constructions:

(72) *three head of cattle*: $\varepsilon u\ (\forall x(IN(u,x) \rightarrow IST(Cattle,x)) \wedge ANZ(Head(u), 3))$;

(73) *Karen calls three times*: $\exists u\ (\forall e(IN(u,e) \rightarrow INST(CALL(karen),e)) \wedge ANZ(Time(u), 3))$.

7 Conclusion

The presented analysis allows a compositional view of nominal semantics that captures - as I hope to have shown - the characteristic features of nouns and nominal number marking in natural languages and can account for their referential and their combinatorial potential. Because all elements of the analyzed constructions are given compatible semantic representations, the semantics of a complex expression can always be derived from that of its constituents in a regular way, being on each level in accordance with the compositionality principle. Accordingly, I understand the analysis presented here as a contribution to a semantic theory that advocates a close correlation between syntactic and semantic analysis.

Similarities and differences between the two main nominal classes have been accounted for by characterizing N_n and N_{tn} as expressions that, while subsumed by the same basic type, underlie different derivation rules. According to the analysis presented here, elements of both classes serve basically as expressions of type *b*, designations for a *Begriff*. In addition, they can form *T*-expressions and refer to realizations of the *Begriff*. Whereas for N_{tn}, this transformation is done by a type shifting rule REALIZE, N_n have to be combined with *num*-elements. The different ways of "*b*-to-*T*-evolution" result in different kinds of *terms*. REALIZE converts a *Begriff* either into a (portion of a) substance (for N_{tn} [+mn]) or into an aggregate of its realizations (for N_{tn} [−mn]), N_n+*num* refer to a set with the quantity "one" or "not one".

This analysis on the one hand accounts for the fact that, unlike N_{tn}, N_n cannot expand to *terms* in their bare form, without number markers. On the other hand, it captures the fact that N_n as *terms* (i.e., combined with *num*-elements) always indicate if reference is made to one realization or more than one, while for N_{tn} the opposition "one versus many" is not marked. Moreover, these facts can be correlated with the occurrence of N_n and N_{tn} in different types of cardinal constructions. As transnumeral *terms* [−mn] refer to aggregates, their denotations have to be individuated in counting contexts; N_{tn} [−mn] thus occur in cardinal constructions with classifiers. N_n+*num*, on the other hand, denote discrete sets, implying an individuation function, and can be combined with cardinals directly. N_{tn} [+mn], finally, cannot occur in counting constructions, as their SR does not provide the grounds to retrieve individual elements at all.

[46] Cf. Greenberg (1974) for the characterization of times and corresponding expressions in other languages as measures for events.

The mutual classification of plural and indefinite article as *num*-elements reflects their distributional parallels and shows why plural N_n, but not non-plural N_n can expand to full DPs without an article (in other words, why in languages with indefinite article so-called "bare plurals" of N_n exist, but no "bare singulars").[47]

On the other hand, the analysis of nouns as *b*-expressions explains the semantic contribution of the copula in "predicative" nominal constructions. As *b*, unlike *(t/e)*, is not a function, but a primitive type, *b*-expressions cannot be combined with *terms* directly, but have to form predicates first. This is done by combination with the copula. Thus, within this approach, the copula does not have to be regarded as a strange, semantically superfluous expression, but can be analyzed as a specific predicate. Its mainly "instrumental" status as opposed to other two-place predicates is accounted for by defining as the interpretation for its central semantic constant IST a "subsumtion"-function that merely combines a *Begriff* and its realizations. Thus, in an open sentence "IST(B,_)" (where *B* is a *Begriff*), the main content is given by *B*, while IST only establishes a relation between *B* and the second argument. As nouns are subsumed by *b*, the necessity of such an additional, "glue-like" element in predicative constructions is obvious. If, on the other hand, nouns are categorized as *(t/e)*, as within the traditional view, the regular co-occurrence of the copula in these constructions is difficult to explain.

To sum up my results, I hope to have shown that this approach to nouns and nominal number allows us

- to capture the *cross-linguistic* characteristics of nouns and nominal number;
- to account for interdependencies between noun classes and number marking;
- to give a unified account of basic nominal occurrences
  and differentiate between *T*-constructions for N_n + *num*, N_{tn} [– mn], and N_{tn} [+ mn];
- to show the correspondence of nominal plural and indefinite article by grouping them as "*num*-elements", and capture the restriction on N_n-occurrences without *num*-elements;
- to account for the semantic contribution of the copula in predicative nominal constructions.

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[47] For languages without indefinite article cf. 2.2.2.

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