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Untyped semantics of kind reference

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1. Introduction

Noun phrases in natural languages can refer not only to individuals, but to certain rigid sets of them, usually referred to as *kinds*. Probably the most characteristic example of kind reference is the generic reading of singular *the* (Carlson 1977), illustrated in (1).

(1) a. The anteater eats ants.

b. The mammoth is extinct.

Neither of the *the anteater* and *the mammoth* refers to a single individual, as we would expect given the Russellian semantics of *the* (Russell 1905) and the Singular (Link 1983). The first refers to every anteater in the world — or, at least, to the predominant part of anteaters. The second refers to the mammoths as a concept — since there are no mammoths in the world, it cannot be said that *extinct* asserts something about individual mammoths — what *extinct* does, it seems, is exactly asserting that the extension of *mammoth* is empty. Predicates like *extinct* are called kind-level predicates (Krifka et al. 1995). Others include *rare*, *evolve*, and *invent*.

It is not only *the* that can participate in kind reference — in fact, any English determiner can (Dayal 2004). The determiners in the examples (2) quantify over subkinds of anteaters, i.e., the set {GIANT ANTEATER, SILKY ANTEATER, NORTHERN TAMANDUA, SOUTHERN TAMANDUA}[1].

(2) a. Every anteater inhabits South America.

b. Some anteaters are extinct.

c. An/one anteater's conservation status says "threatened".

d. The anteaters are divided into two families.

Notice how DPs in (1a) and (2d) have the same extension, in spite of different number marking. This is not how individuals work: singular DPs with *the* do not refer to the totality of individuals, unlike here, where *the anteater* is the totality of subkinds, making *the anteater* and *the anteaters* extensionally equivalent. Apart from this, the behavior of kinds is quite similar to the behavior of individuals.[2]

[1] I follow the tradition established by Chierchia (1998) to spell kinds in small caps.

[2] Languages differ in whether they allow singular nouns for kind reference. Šereikaitė (2017) notes that in Lithuanian bare nouns cannot refer to kinds at all. In Russian, it is considered bureaucratic style with predicates such as 'rare' and is seldom used in colloquial speech. But it is accepted and even preferred in sentences where it is stated to have a particular property as a subkind of a certain kind (3).

(3) a. *Dikobraz redkoje životnoje.*
porcupine rare animal

'The porcupine is a rare animal.'

These entities are more properly referred to as *well-established kinds* (Krifka et al. 1995). Such kinds are inherently given in the common ground, hence allow the usage of *the*. But kind reference is not limited to well-established kinds. First, Chierchia (1998) argues, based on the lack of high scope (4), that bare plurals in English must also denote kinds.

(4) Everyone met anteaters. only ∀ > ANTEATERS, *ANTEATERS > ∀

Obviously, bare plural is available with any noun phrases, not only those that refer to well-established kinds.

(5) a. Everyone met huge enraged anteaters.

b. *The huge enraged anteater inhabits South America.

Second, most kind-denoting predicates are similarly available with non-singular-definite noun phrases (6). *Invent*, which requires the Singular, allows the indefinite article *a* if what is invented is not a well-established kind (Dayal 2004).[3]

(6) a. Blonde people with brown eyes are rare.

b. This morning Fred invented a/*the pumpkin crusher. (Dayal 2004)

Mendia (2019) provides the following minimal pair of a well-established and what he calls an *ad-hoc* kind (7). Both sentences make statements about kinds, but these kinds are different. In (7a), the singular DP refers to some prior known subkind of RAT, for which it is common to transmit leptospirosis, e.g. the BROWN RAT. The plural DP in (7b), on the other hand, does not necessarily have to refer to a single biological subkind — the rats that belong to the kind may only have in common the ability to transmit leptospirosis.

(7) a. The rat that transmitted leptospirosis was just reaching Australia in 1770.

b. The rats that transmitted leptospirosis were just reaching Australia in 1770.

Overall, while being closely related to predicates logically, kinds show notable similarities to individuals linguistically. Still, it is unclear what the onthological nature of kinds is. Starting with (Chierchia 1998), kinds are treated as intensional totalities of

b. *Inžener* *horošaja* *professija.*
engineer good profession

'The engineer is a good profession.'

[3] *Extinct* exhibits more strict selective constraints: it would probably be correct to say it must refer to a biological taxonomic unit.

individuals. This paper aims to confront this view with the data from interaction of classificatory adjectives and relational nouns. It proposes to return to the view of kinds as simple individuals that correspond to nominalized predicates, using the semi-untyped HST* semantic framework developed by Cocchiarella (1974) and Chierchia (1984). It also aims to provide an analysis for relational adjectives and capture the taxonomic readings of noun phrases. It only concerns well-established kinds, although the *ad-hoc* ones are no less of interest.

The paper is organized as follows. Section 2. presents the HST* framework, as well as Chierchia (1998)'s Neocarlsonian onthology. Section 3. presents and analyzes the data from classificatory adjectives. Section 4. explores the idea that well-established kinds can be treated as proper names. Section 5. concludes.

2. Kinds and predicates

The mainstream view on the compositional derivation of kind reference, the Neocarlsonian semantics (Chierchia 1998), is based on Chierchia (1984)'s $^{\cap}$ (*down*) and $^{\cup}$ (*up*) operators. $^{\cap}$ turns predicates into kinds; $^{\cup}$ does the opposite. However, what $^{\cap}$ really yields and what $^{\cup}$ picks up has evolved between (Chierchia 1984) and (1998). This section begins with exploring the early framework, HST*, and proceeds by looking at the reinterpretations introduced by the Neocarlsonian semantics.

*2.1 HST**

Chierchia (1984), building upon Cocchiarella (1974), proposes a semantic framework called HST*, which is, as opposed to Montague (1973), untyped. It draws distinction between singular terms (traditional type e), predicates (type $\langle \alpha, t \rangle$ for any α) and functors (other types). Only singular terms can be used as arguments to other expressions (8).

(8) If β is an n-place predicative expression and $\alpha_1, ..., \alpha_n$ are singular terms, then $\beta(\alpha_1, ..., \alpha_n)$ is a well-formed formula.

The nominalizer $^{\cap}$ allows functions to range over predicates. Following Frege's idea that every property has an individual counterpart, it maps predicates injectively into the domain of individuals. (Chierchia compares it to the English suffix *-ness* and the complementizer *that*.) The opposite operator $^{\cup}$ is a partial function from individuals to n-place predicates.[4]

(9) If β is an n-place predicative expression, then $^{\cap}\beta$ is a singuar term.

This framework is powerful in allowing any expression to take as its argument expressions of different types. E.g., when the syntax allows it, there is no difference between e's, $\langle e,t\rangle$'s and $\langle et,t\rangle$'s as arguments in HST* semantics. Being able to treat predicates as individuals is straightforwardly useful for analyzing the dual nature of kinds.

2.2 The Neocarlsonian view

After nearly fifteen years, in 1998, when untyped theories of natural language semantics are sorely unpopular and type-shifters thrive, Chierchia presents a novel Neocarlsonian theory of kinds. It borrows from his earlier work the $^{\cap}$ and $^{\cup}$ operators, but now in form of type-shifters. At the same time, Chierchia makes an attempt to redefine the property-denoting individuals to be more consistent with contemporary theories of reference.

> It seems natural to identify a kind in any given world (or situation) with the totality of its instances. Thus, the dog-kind in our world can be identified with the totality of dogs, the scattered entity that comprises all dogs, or the fusion of all dogs around. In our framework this entity is modeled by the set of dogs. This means that we can model kinds as individual concepts of a certain sort: functions from worlds (or situations) into pluralities, the sum of all instances of the kind. (Chierchia 1998, p. 349)

Since kinds are now simply intentional pluralities, they relate to proper individuals via standard Linkian semantics for pluralities (Link 1983). The domain of individuals is a join semilattice $\langle E,\oplus\rangle$, where elements at the bottom are singular individuals, and elements above are plural. A single dog d_1 is a part of a plurality of three dogs $D = d_1 \oplus d_2 \oplus d_3$, which is represented as $d_1 \leq D$. Similarly, a single dog is a part of the DOG kind $d_1 \leq {}^{\cap}\text{dog}$.

Kind operators can then be defined by the same means (10). $^{\cap}$ turns a one-place predicate into the maximal plurality of individuals in a situation. $^{\cup}$ turns a kind (a maximal plurality) back into a function that is true for individuals that are parts of this plurality.[5]

[4] HST* also imposes a requirement on its formulas called *homogenious stratification*, which aims to avoid Russell's paradox. A formula is homogeniously stratified iff all expressions in the formula can be assigned natural numbers so that

1. any predicative β and ${}^{\cap}\beta$ are assigned the same number,
2. all arguments of a predicate are assigned the same number,
3. predicates are assigned higher numbers than their arguments.

In a sense, this is similar to assigning types to expressions, but only used for defining possible formulas instead of restricting denotations of predicates.

[5] Chierchia also departs from the original theory by making $^{\cap}$ non-total: only "classes of objects with a sufficiently regular function and/or behavior" are kinds, and non-customary properties expressed by complex noun phrases do not have a corresponding kind. This is confounded by (Mendia 2019), so I do not consider it here.

(10) a. $^{\cap}P = \lambda s\, \iota x \in D_k.\, P_s(x)$

b. $^{\cup}d = \lambda x.\, x \leq d_s$

What can be immediately noticed is that this system is more restrictive than HST*: it only allows one-place predicates to be nominalized. This might seem most adequate for an analysis of kind reference: at a first approximation, kinds characterize individuals and nothing else. However, as I will show in section 3.2, the effects of kind reference are not limited to one-place predicative nouns.

3. Classificatory adjectives and kinds

I will now explore a concept tightly related to kinds: classificatory adjectives. This class is, in a slightly narrower sense, also called relational (McNally and Boleda 2004). For McNally and Boleda, it encompasses adjectives like those in (11a-b). For Rutkowski and Progovac (2005) and Rutkowski and Progovac (2006), these also include those like (11c), which are called 'complex common names' by Gunkel and Zifonun (2009).

(11) a. technical architect

b. pulmonary disease

c. brown bear

The first two are exclusively classificatory, while the third can be both, but with a change in meaning. These adjectives are not plainly intersective: a *technical architect* is not someone who is an architect and — whatever it means — technical; a *brown bear* can be an albino and still remain true to its kin. They do not look like Larsonian event modifiers either: a *good dancer* is one who dances beautifully, but a *brown bear* does not realize its bear-ness in a brown way. The intuititon is that they classify the noun (hence the name): the technical architect is a kind of architect, and the brown bear is a kind of bear.

It might seem that these noun-adjective pairs are non-compositional compounds of some kind, receiving their meaning as a whole; however, classificatory adjectives are available in the predicative position and can therefore be separated from nouns (12). Still, this usage is somehow limited: it is only allowed when the argument is referred to by the noun the adjective is compatible with (13) (cf. Levi 1978, a.m.o.).

(12) a. This bear is brown (although an albino).

b. This architect is technical.

(13) a. {context: Misha is a bear.}
Misha is brown (although an albino).

b. {context: Steve is an architect.}
* Steve is technical.

Structurally, these adjectives are always the closest to the noun (Rutkowski and Progovac 2006). They cannot be separated from it by other, attributive adjectives (14). In Lithuanian, they also follow possessors, contrary to attributive adjectives (15).

(14) a. A smart technical architect

b. * A technical smart architect

(15) a. *žalia Reginos suknelė*
green Regina-GEN dress

'Regina's green dress'

b. *Reginos žalioji arbata*
Regina-GEN green tea

'Regina's green tea'

A number of languages distinguish between attributive and classificatory adjectives structurally. In Polish (Rutkowski and Progovac 2005), attributive adjectives precede the noun, while classificatory follow it. In Serbian (Rutkowski and Progovac 2005), Lithuanian (Rutkowski and Progovac 2006; Holvoet and Spraunienė 2012), and Latvian (Holvoet and Spraunienė 2012) they are marked by a special suffix, usually referred to as "long form" by Serbian and Lithuanian grammars, and as "definite ending" by Latvian (Kalnača and Lokmane 2021). I will further employ examples from Latvian, where such suffix takes the form of *-ai-*[6].

(16) a. Polish:
dyrektor generalny /* *generalny dyrektor*
director general / general director

b. Latvian:
ģenerāl-ai-s direktors /* *ģenerāl-s direktors*
general-DEF-NOM director / general-NOM director

'executive director'

[6] All examples from Latvian are elicited from native speakers.

This suffix is not limited to classificatory adjectives. Both Baltic languages and Serbian, like most Balto-Slavic, do not have definite or indefinite articles: a bare noun might both introduce a new discourse referent and refer to a previously established (17a). But if an adjective is present, the suffix is used to mark definiteness (17b-c)[7]. When used with classificatory adjectives, this effect does not arise: nouns with classificatory adjectives are ambiguous for definiteness, just like bare nouns (17d).

(17) a. *skudrlācis*
anteater

'a/the anteater'

b. *skaist-s* *skudrlācis*
beautiful-NOM anteater

'a/*the beautiful anteater'

c. *skaist-ai-s* *skudrlācis*
beautiful-DEF-NOM anteater

'*a/the beautiful anteater'

d. *liel-ai-s* *skudrlācis*
big-DEF-NOM anteater

'a/the giant anteater (*Myrmecophaga tridactyla*)'

Rutkowski and Progovac (2005) propose a unified syntactic account for Polish and Serbian. It is centered around the idea of the N head moving to a higher position, tentatively named ClassP by the authors. ClassP is located above the merge point of classificatory adjectives and below the others. Hence the noun is to the left of the classificatory adjective in Polish, but to the right of the attributive. The Serbian long form is treated as a reflex of such movement, although covert. In definite noun phrases, the marker is licensed by N-to-D movement, a phenomenon suggested by Longobardi (1994) and some others.

This approach has several downsides. First, there is much stipulation: it postulates covert movement to a projection existence of which is not independently motivated. Second, it leaves unexplained the limited availability in predicative position. Most crucially, it says nothing about the definiteness effect the long form creates with attributive

[7]By using the English definite and indefinite articles in translations, I only assume rough similarity of usage contexts, not complete semantic equivalence. It is a matter of discussion whether the notion of definiteness in article and articless languages can be compared (see e.g. Šimík and Demian 2021 for critics), but I believe this will suffice for present purposes. For a detailed research on definiteness effects in Baltic languages see Holvoet and Spraunienė (2012).

adjectives. The correspondence between classificatory adjectives and definites might seem accidental. It will be shown that it is likely not.

McNally and Boleda (2004) argue that classificatory adjectives denote properties of (well-established) kinds. They propose that common nouns are two-place predicates: they pick a kind argument first and an individual argument second and denote that 1) a property is true for the kind, and 2) the individual belongs to the kind (18).

(18) $[\![\text{architect}]\!] = \lambda x_k \lambda y_o.\, \textsc{architect}(x) \wedge R(y, x)$[8]

Technical and other classificatory adjectives are, consequently, predicates over kinds. They combine with the noun via a special compositional principle, after which the kind variable gets saturated contextually (which resonates with the idea that kinds are definites, that is, available from the context). A technical architect is, then, someone who belongs to the kind defined by *architect* and *technical* (19).

(19) $[\![\text{technical architect}]\!] = \lambda y_o.\, \exists x_k[\textsc{architect}(x) \wedge \textsc{technical}(x) \wedge R(y, x)]$

This idea is supported by the fact that the classificatory adjective-noun combinations are always well-established kinds (20). Furthermore, classificatory adjectives are the only tool to denote a well-established subkind of a kind (e.g. *giant anteater*), unless it has its own name (e.g. *tamandua*).

(20) The technical architect is a respected profession.

A reader might notice that this theory does not answer the question of what the semantic nature of classificatory adjectives really is. They modify a kind — but what does it mean to modify a kind? Why can a kind be *technical* if an individual cannot? This stems from the unclarity of the nature of kinds themselves. Still, such treatment of classificatory adjectives might encounter compatibility problems with analyzing kinds as total individuals. If an individual or a group of individuals cannot be *technical*, why would a totality be able to? It is implausible that it is a subcategorization restriction similar to that of *rare* and other kind-level predicates: those can be seen as applying to a plurality, but it is not precisely clear what is so plurality-specific about classificatory adjectives.

The next subsection adapts McNally and Boleda (2004)'s for the current purposes and presents an analysis of *-ai-* and other similar suffixes.

[8] Where R is Carlson (1977)'s realization relation, analogous to Chierchia's $\leq$, that is, $R(x, y) = {}^{\cup}x(y)$.

3.1 The analysis of -ai-

McNally and Boleda's approach can be easily integrated into the framework proposed earlier, with significant simplifications. It also explains — and, even more, predicts — the obligatory usage of the definite ending with classificatory adjectives in Baltic and Serbian. The idea that definite endings are related to kind reference is also pursued by Šereikaitė (2017).

I propose that nouns are one-place predicates ranging over kind-level arguments (21a). One way to do this could be to say that a kind is in a noun N's extension if being a part of the kind means having the property n the noun denotes (i.e. $N(k) \iff \forall x[{}^{\cup}k(x) \implies n(x)]$). I will assume this for now, but will suggest a different approach below.

Classificatory adjectives similarly range over kinds and combine with nouns by simple Predicate Modification (21b-21c). This is similar to McNally and Boleda, but without the second argument for the noun.

(21) a. $[\![\text{anteater}]\!] = \lambda k.\, \textsc{anteater}(k)$

b. $[\![\text{giant}]\!] = \lambda k.\, \textsc{giant}(k)$

c. $[\![\text{giant anteater}]\!] = \lambda k.\, \textsc{giant}(k) \wedge \textsc{anteater}(k)$

This is a predicate over kinds, that is, over predicates. But clearly what proceeds further in the derivation of an NP must be a predicate over individuals, that is, a kind. For this, we need a typeshifter or a null determiner — the same tool that turns noun phrases into arguments in articleless languages. This is what, I believe, is the role of *-ai-*. As a suffix of an attributive adjective, it presupposes the definiteness of an individual, the DP referent; when combining with a classificatory adjective, it presupposes the definiteness of a kind.

This is compatible with any theory of definiteness, be it a theory of uniqueness (Russell 1905; Strawson 1950) or familiarity (Heim 1982). (22) demonstrates the mechanism with the simple ι semantics (Partee 1986). The uniqueness presupposition is trivially satisfied because nouns with classifying adjectives always refer to a well-established kind (similar to McNally and Boleda's contextual saturation). The resulting unique kind can then be used predicatively to combine with attributive adjectives, individual-level determiners and any other content of a DP. In languages without adjectival definiteness, this process would be realized via the IOTA type-shifter, again, similar to noun phrases in articleless languages (Dayal 2004).

(22) a. $[\![\text{-ai-}]\!] = \lambda p.$ the only x such that $p(x)$, if defined

b. $[\![\text{-ai-}]\!]([\![\text{liel- skudrlāci-}]\!]) = \iota k.\ \textsc{giant}(k) \wedge \textsc{anteater}(k)$

c. $^{\cup}[\![\text{-ai-}]\!]([\![\text{liel- skudrlāci-}]\!]) = \lambda x.\ (\iota k.\ \textsc{giant}(k) \wedge \textsc{anteater}(k))(x)$

Alternatively, in the spirit of Coppock and Beaver (2015), one can assume that, like English *the*, *-ai-* only introduces the presupposition, while the type shift is then induced by IOTA. Again, this fully corresponds to how DPs behave.

The reader might wonder what is the import of a presupposition that is always trivially satisfied. Indeed, combining *-ai-* with a classificatory adjective would never lead to a presupposition failure because of the nature of classificatory adjectives. Why would a language introduce a presuppositional element that adds nothing to the presupposition of the whole expression?

There are two answers to this question. First, the suffix does not occur at this place for some specific reason. On the contrary, it can combine with any adjective, but only appears when the presupposition is satisfied. The suffix does serve a specific purpose — e.g., resolving anafora — when it combines with an attributive adjective; its appearing with classificatory adjectives is simply a side effect of morphological properties of Latvian adjectives.

Second, the suffix in this position does, in fact, serve a purpose of disambiguating between deep structures of a noun phrase. An indefinite noun phrase, e.g., *some giant anteater*, is ambiguous between one with a classificatory adjective ('some *Myrmecophaga tridactyla*') and with an attributive one ('some very large *Myrmecophaga*'). *-ai-* deals with this ambiguity effectively. Different languages might do it by different means — Polish, in particular, uses different word orders.

3.2 Relational nouns as evidence for predicative kinds

Now that the main properties of classificatory noun marking in Latvian have been discussed, I can move to the main argument against looking at kinds as pluralities. At this point, it is still unclear whether one cannot employ Chierchia (1998)'s model. Suppose nouns are functions over pluralities, and classificatory adjectives restrict the extension to a sub-plurality, in the spirit of Mendia (2019).

However, not all nouns describe pluralities: relational nouns do not. It is unclear what totalities of individuals are the kinds SON, FAN, or AFFILIATION, because the extensions of the corresponding predicates are relative to a possessor. Should we say that we do not expect relational nouns to refer to kinds, then? Or that we first need to saturate its argument?

But naturally, relational nouns are also compatible with classificatory adjectives. Examples include *older brother*, *personal assistant*, and *executive officer*. In Latvian, classi-

ficatory adjectives with relational nouns are also marked by *-ai-*: in (23), 'older brother' obligatorily carries the suffix even when the uniqueness requirement is not satisfied.

(23) {Context: Anna has two older brothers.}

Anna-s *vec-āk-ais* *brālis* *iegūva* *Nobela* *premiju*
Anna-GEN old-COMP-DEF brother received Nobel's prize

'An older brother of Anna has received Nobel's prize.'

It is implausible to assume that *vecākais* combines with *Annas brālis*: one might be the youngest among Anna's brothers and still be her older brother. And we would not expect it to: the resulting kind would not be well-established.[9]

The suggestion that there is some sort of existential closure — that is, that the kind in question is the totality of anyone's brothers — would not help either, as we must keep the argument unsaturated. The adjective must somehow combine with the noun and ultimatlely yield a two-place predicate. If it is the Neocarlsonian DOWN that turns the resulting kind into a predicate, we can only get a one-place predicate. The untyped system faces no such difficulties. Since the noun ranges over nominalized predicates, their original arity does not matter. It depends on the denotation of the noun: *bear* is only true for one-place kinds, and so is *white bear*, and *older brother* holds only for two-place kinds, which it inherits from *brother*.

This section has looked at the semantics of classificatory adjectives and their morphological behavior. It demonstrated that classificatory adjectives are best treated in terms of kinds. It also showed that classificatory adjectives combine with relational nouns — hence relational nouns must be kind-denoting as well. Relational nouns are unavailable with the singular kind-level *the*, which is likely the reason they have not received attention from researchers of kind reference. They are, however, crucial for understanding the nature of kinds.

4. Kinds and proper names

In the previous section, I raised a problem of the unclarity of classificatory adjectives. In this section, I will suggest a possible explanation based on the treatment of kind-referring

[9] One can argue that the set of Anna's older brothers is, if not contextually salient, then at least unique. But the marker is preserved even with indefinite possessors (24), where the plurality cannot be definite.

(24) *Kād-a* *vec-āk-ais* *brālis*
Someone-GEN old-COMP-DEF brother

'Someone's older brother'

expressions via proper name semantics.

The idea that at least some kinds can be treated as proper names comes from Carlson (1977) and is further explored by Heyer (1985) and Krifka et al. (1995), a.o. Carlson observes that well-established kinds are available in the so-called *so-called* constructions. This construction seems to be available with proper names, but not with definite or indefinite descriptions (25).

(25) a. *Google* is so called because the creators dreamed of parsing a googol of pages.

b. *My neighbour is so called because he is the only living soul in miles.

c. The polar bear is so called because it lives beyond the polar circle.

Well-established kinds and proper names are also conceptually similar (Krifka et al. 1995, p. 65). They are (normally) salient, and their interpretation does not depend on the current world or context. They are *rigid designators* in the sense of (Kripke 1980). One can imagine a world where the *giant anteater* comprises of a different plurality; and one can imagine a world where anteaters do not eat ants; or where it is called *bald echidna*; but looking from our world, one would still refer to the genus as the *giant anteater*.

Burge (1973) proposes a view on proper names, further developed by (Elbourne 2005; Maier 2015, a.m.o.), wherein proper names are metalinguistic predicates that hold of all entities that bear a certain name. That is, *Zachary* is true for any person called Zachary — any person who was baptized, nicknamed, or otherwise assigned the name of Zachary. This idea finds evidence in sentences where names are used predicatively, under quantifiers, etc. (26).

(26) a. I'm Zachary.

b. All Zacharies are psychos.

c. I saw a Zachary today.

d. There are many Zacharies here.

e. The Zachary I told you about is following me. adapted from Burge (1973)

Determiners in these sentences obviously quantify over individuals called Zacharies. As for names in their common Kripkean referring function, as in *Zachary is crazy*, Larson and Segal (1995) and Elbourne (2005) suggest that they have a null *the*-like determiner (alternatively, undergo the IOTA type shift). In a number of languages, such as Ancient Greek and some dialects of German, proper names are preceded by definite articles (Elbourne 2005); in English, there are proper names that require it, like *The Sudan* (Krifka

et al. 1995). Consequently, a proper name, in its normal use, introduces a presupposition that there is a unique most salient individual called by the name.

The main difficulty in approaching semantics of classificatory adjectives problem is the incredible polisemy they undergo. *White* in *white tiger* is not the same as in *white tea*. Of course, it is clear why these subkinds are called so, but it would give us no more than the etymology of these names; the names themselves are rigid and do not seem to be compositionally formed — probably the best answer to the question of why a certain pair of a classificatory adjective and a name refers to a particular kind is because the speakers have decided so.

This rigidity is also what unites kind names with proper names: although there might be a clear explanation to why a person carries a name (a nickname, in particular), the fact that they do is only a result of speakers' decision. In the spirit of (Kripke 1980), I propose that common names *are* proper names, albeit not for individuals, but for predicates (kinds): they are metalinguistically predicative in the sense of (Burge 1973), being true for all kinds that carry a certain name. A classificatory adjective similarly asserts that a subkind is called by that adjective.

Consider *the anteater*. It passes the *so-called* test successfully (27), which points that it asserts something about the name of a kind. There is an anaphoric device *so* in the construction — it must refer to something before it. We would not expect to have, on the level of semantic interpretation, any access to how the sentence is pronounced; hence there must be something in the derivation of the sentence that states that the anteater, as the kind, is called *anteater*. Basically, *anteater* might be paraphrased as *the kind that is called anteater*.

(27) The anteater is so called because it eats ants.

Consider next *the giant anteater*. It also passes the *so-called* test (28). In the similar terms, it can be paraphrased as *the kind of anteater that is called giant*. Notice that the truly intersective interpretation — *the kind that is called anteater and giant* — does not seem legitimate. This asymmetry is a property of classificatory adjectives: the giant anteater is *a kind of anteater*, but it is not **a kind of giant*.

(28) a. The giant anteater is so called because it can be more than two meters long.

This behavior is recursive. The number of classificatory adjectives is not limited to one, and upon adding a new one, the old one loses its name-denoting function and becomes taxonomic. *The Scandinavian red fox*, for example, is *the kind of red fox that is called Scandinavian*.

Furthermore, among the anteaters, there is also *the tamandua*. Its name does not contain its family name at all, although it is undeniable that *the tamandua is an anteater*. Hence the taxonomic relations must be independent from the naming. To sum up,

1. Both nouns and classificatory adjectives are Burgean metalinguistic predicates: they are true of all kinds that carry a certain name;

2. Before combining with a classificatory adjective, a noun (as well as a classificatory adjective-noun pair) becomes a taxonomic predicate, true of all subkinds of a certain kind.

How do we model it compositionally? The easiest way is to say that the IOTA type shift, introduced for kinds in the previous section, is applied to nouns as well. This leads us to the following semantics of classificatory adjective-noun pair (29).

(29) $[\![\text{giant anteater}]\!] = \lambda k.\, \textsc{called}(\text{giant})(k) \wedge {}^{\cup}(\iota k'.\, \textsc{called}(\text{anteater})(k'))(k)$[10]

Now, I argued in the previous section that the kind that results when applying IOTA to a classificatory adjective-noun pair (or simply the noun) is a predicate over individuals. This is needed for further composition of an NP. However, this kind is now used to quantify over subkinds: *anteater* is true of *giant anteater*. Recall, however, that our semantics is now untyped: there is nothing that forbids a predicate from being true both of individuals and other predicates (kinds). This still does not answer why it is exactly so that a kind is *always* true for its subkinds — which seems to be exactly the case. This can be solved by adding the following principle to the onthology (30).

(30) **The Subkind Principle**.
For any predicates p and q, if $\forall x_1, ..., x_n[p(x_1, ..., x_n) \implies q(x_1, ..., x_n)]$, then $q({}^{\cap}p)$[11]

To say that p is a subkind of q is equal to saying that being p means being q. The principle states that a kind is true not only of individuals, but of its subkinds as well. Note that it means that kinds are also true of themselves. This is crucial to explain the taxonomic reference of NPs, which will be discussed later.

Analyzing kinds this way also sheds some light upon the peculiar behavior of classificatory adjectives in predicative position. Consider the following set of sentences (31).

[10] Curiously, this also predicts that, for example, *the northern anteater* can refer to THE NORTHERN TAMANDUA, a subkind of TAMANDUA and hence a subkind of ANTEATER as well. This might probably be dealt with by some informativity requirement.

[11] The principle might be more restricted, however, if we take *ad hoc* kinds (Mendia 2019) into account: it is not the case that *the kind of lion that eats people is a lion*, although *Leo is the kind of lion that eats people* entails *Leo is a lion*. I leave it for further consideration.

(31) a. This bear is polar.

b. This bear is called polar.

c. *Misha is polar.

d. *Misha is called polar.

The availability of a classificatory adjective corresponds to the availability of *called*. This is exactly what we would expect, considering that classificatory adjectives assert their argument has a certain name. The exact implementation of this — in particular, how the adjective manages to assert something about the kind, bypassing the individual — is to be developed outside of this work, but I believe this is the right way to go.

4.1 Taxonomic NPs

Let us now look at how taxonomic readings of DPs arise. The data is repeated below (32). Determiners and nominals may quantify not only over individuals, but over subkinds as well (32).

(32) a. The anteater inhabits South America.

b. Every anteater inhabits South America.

c. Some anteaters are extinct.

d. An/one anteater's conservation status says "threatened".

e. The anteaters are divided into two families.

The *the*-DP in (32a) refers to the whole kind ANTEATER. (32b-d) involve quantification over subkinds of anteaters. Finally, in 32e, *the* used with a plural noun produces the same totality of ANTEATER subkinds as (32a), but allows for a distributive reading.

Dayal (2004) argues that this behavior can be derived compositionally. When nouns quantify over kinds, "context determines what level of the hierarchy will be relevant to the interpretation in a particular case". That is, the denotation of *anteater* in the kind-referring function can be either {GIANT ANTEATER, SILKY ANTEATER, NORTHERN TAMANDUA, SOUTHERN TAMANDUA} or simply {ANTEATER}. In the first case, interpretations like (32b-e) are achieved. *The* in (32e) picks, by maximality, the totality of anteater subkinds. In the second case, *the* picks the only kind in the extension of the predicate — the ANTEATER.

The Subkind Principle captures this ambiguity. It follows from it that each kind holds both of its subkinds and of itself. When a quantifier like *some* or *a* are used, it is interpreted as quantifying over subkinds due to a scalar implicature: if it were to quantify

over the singleton set {ANTEATER}, it would necessarily receive the total interpretation, which would be blocked by *the* according to the Maximize Presupposition principle.

The necessarily receives the total interpretation, even when used in the Singular. The maximal plurality of kinds of ANTEATER, the GA ⊕ SA ⊕ NT ⊕ ST, is extensionally equal to the kind ANTEATER itself. And, since the predicate holds of the kind ANTEATER and ANTEATER is a single kind, the Singular is available. If we employ the theory of Sauerland, Anderssen, and Yatsushiro (2005), wherein the Singular introduces the singularity presupposition and the Plural is used elsewhere, we can explain why the singular is heavily preferred in sentences like (32a). The singular is, however, unavailable in distributive contexts like in (32e), since it does not denote a totality of subkinds, as opposed to singulars like *team*, so the plural is used.

In this section, I have suggested that nouns and classificatory adjectives should be analyzed as proper names. When a classificatory adjective combines with a noun, the former is interpreted as a predicate over kinds somehow named, while the latter is shifted to a predicate over individuals and subkinds of a particular kind. To capture the individual-subkind ambiguity, I have introduced the Subkind Principle which states that a kind is true of its subkinds. This principle allows for an elegant account of the taxonomic quantification and the singular kind-level *the*.

5. Conclusion

This work pursued two goals. The first is negative: to claim that the Neocarlsonian semantics, developed by Chierchia (1998), is incompatible with an important fact about kind reference: that it is available with relational nouns. I proved this fact by appealing to definiteness marking on classificatory adjectives in languages like Latvian. I first showed, reflecting on previous work, that classificatory adjectives are best analyzed as kind-referring and the suffixes as marking definiteness of a kind, and then demonstrated that it is compatible with relational nouns, proving that relational nouns can refer to kinds. This poses a serious problem for totality-based approaches to kind reference, since relational nouns are true not of individuals but of pairs of individuals, and hence do not have a corresponding totality.

This also means that untyped lambda calculus is still of use in modern formal semantics. Given how little evidence there is to type mismatches leading to ungrammaticality, it might even turn out preferrable, provided more explanations of linguistic phenomena find it useful.

The second goal is positive: to provide a semantics that would capture, first, the behavior of classificatory adjectives, and second, the taxonomic interpretations of kind-referring nominals. I formalized the intuition of Carlson (1977), a.o., that kinds can be thought of as proper names. I suggested that both nominals and classificatory adjectives

assert that the kind they refer to bears a certain name. This is evident from the compatibility with the *so-called* construction. Thus, a noun phrase like *giant anteater* can be analyzed as asserting belonging to the kind that is a subkind of ANTEATER and called *giant*. The theory also encompasses taxonomic readings of noun phrases in sentences like *An anteater is extinct*, as well as the total reading of singular noun phrases with *the* like *The anteater inhabits South America*.

The work only caputers a small part of the data related to kind reference. It does not concern *ad-hoc* kinds, which are described and analyzed by Mendia (2019). It also does not explore such kind reference–related phenomena as bare nouns or the *kind-of* construction. A broader theory of kind reference would require a much longer form factor.

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