



A Note on Reference to Kinds in Mandarin: the N-*lei*_{kind} Compound

XuPing Li
Zhejiang University

Abstract

This squib examines a special kind-referring expression in Mandarin Chinese, the N-*lei*_{kind} compound. We show that like Mandarin bare nouns, N-*lei*_{kind} compounds also denote kinds, but they can only be instantiated by sets of (sub) kind entities at type $\langle k, t \rangle$, and not sets of individuals at type $\langle e, t \rangle$. Specifically, those kind entities belong to basic-level categories in some folk taxonomy. We claim that N-*lei* is the nominalization counterpart of the classifier phrase *lei*-N, and it denotes superkinds, which are instantiated by sets of subkind entities. Accordingly, Mandarin bare nouns are comparable to bare plurals in English, whereas N-*lei* is comparable to definite singulars in English.

Keywords

kind terms, bare noun, kind classifier, N-*lei*

1. Introduction

As is well known, in English, there are two ways of making reference to kinds, namely, by means of bare plurals, such as *dodos* (1a), or definite singulars, such as *the dodo* in (1b). By contrast, indefinite singulars such as *a dodo* in (1c) don't denote kinds in any case.

- (1) a. *Dodos* are extinct.
 b. *The dodo* is extinct.
 c. **A dodo* is extinct.

Dayal (2004) makes a distinction between singular and plural kinds from a cross-linguistic perspective. She makes the generalization that in languages with determiners such as English, singular kinds typically occur with the definite determiner, but plural/mass kinds can be bare in some languages and definite in others, which are represented by Hindi/Russian and Romance languages, respectively.

Mandarin Chinese is an article-less and number-less language, so it is inertial to the distinction between singular and plural kinds. It is well-established in the literature (Krifka 1995, Chierchia 1998, Yang 2001, Li 2013, and some others) that Mandarin bare nouns denote kinds, as illustrated by (2). Yang (2001) and Li (2013) argues explicitly that Mandarin bare nouns are comparable to bare plurals but not to definite singulars in English in terms of their interpretations.

- (2) *jīng* kuai juezhong le. [bare noun]
 whale soon become:extinct PRF
 ‘Whales will soon become extinct.’

In addition, Mandarin has another frequently used kind expression, namely, *N-lei_{kind}*, in which bare nouns compound with the morpheme *-lei*, meaning ‘kind, type or species’.¹ Compare (3) with (2):

- (3) *jīng-lei* kuai juezhong le. [N-*lei_{kind}*]
 whale-kind soon become:extinct PRF
 ‘The kind whale will soon become extinct.’

1 The phenomenon of N-kind is not exclusively found in Mandarin, and it is also available in some Indo-European languages, such as German. This phenomenon in German is brought to my attention by Manfred Krifka (pers. comm. 2009). The data used below was further checked by my German colleague Franziska Kretzschmar (pers. comm. 2011). In German, the morpheme *art*, which means ‘kind’ can also form N-kind compound, such as *Wal-art* ‘the kind whale’ in (b).

(i) a. der Delphin ist ein Wal. b. der Delphin ist eine Wal-art.
 the dolphin is one whale the dolphin is one whale-kind

(a) and (b) have more or less the same interpretation. As informed by my German informant, example (b) entails that there is a hyponymy relation between dolphin and whale. In other words, (b) means that dolphin is a subkind of whale. It suggests that N-*art* compounds are also kind denoting. Most probably, N-*art* in German and N-*lei* in Mandarin instantiate the same phenomenon and they can be characterized by a unified semantics.

Juezhong ‘become extinct’ is a kind-level predicate and requires a kind-referring expression as its argument. Both the bare noun *jing* in (2) and the expression of *jing-lei* in (3) can saturate the argument position provided by the predicate, so they are expected to be kind referring. Essentially, in example (3), the compound *jing-lei* can be roughly translated into ‘the kind whale’, where the kind reference is overtly marked by the morpheme *lei*.

Both bare nouns and N-*lei* are kind terms in Mandarin, but how do these two kind expressions differ from each other? Is it possible that the distinction between bare noun and N-*lei* in Mandarin is comparable to that between bare plurals and definite singulars in English? To put it in an explicit way, if what Yang (2001) claims is correct, that is, Mandarin bare nouns are analogous to bare plurals in English, can N-*lei* be treated on a par with definite singular in a certain way?

In this squib, we make the following claims concerning the semantics of N-*lei*. First, given that N-*lei* can be used in kind generic sentences, we claim that N-*lei* is an authentic kind term. Second, like singular kinds in English, N-*lei* is interpreted with respect to a taxonomic domain. N-*lei* differs from bare nouns in that it can only be instantiated by sets of subkinds but not of individuals.

The rest of the squib is organized as follows. Section 2 lays out the morphosyntactic properties of N-*lei*. In Section 3, we attempt to find out the interpretational difference between N-*lei* and bare noun in Mandarin by examining their behaviors in both episodic and generic sentences. In Section 4, we offer a compositional semantics for N-*lei*. The squib is wrapped up in section 5.

2. Morphosyntactic properties of N-*lei*

In this section, we attempt to define the morphosyntactic properties of N-*lei*. As will be shown below, N-*lei* is argued to be an N-N (or N-Cl) compounds. This kind of compounding is restricted to entities belonging to “basic-level categories” in some folk taxonomy.

To start off, we show that the morpheme *-lei* ‘kind’ itself can be used as a numeral classifier or as a nominal suffix as in N-*lei*. *Zhong* ‘species’ is a close equivalent to *lei*, but it can only be used as a classifier, not as a nominal suffix, which probably has something to do with the restriction of its lexical meaning. Consider the examples in (4):

- (4) a. *jìyú hé sānwényú shuǐyú liǎng lèi/zhōng yú.*
 carp and salmon belong:to two CL_{kind}/CL_{species} fish
 ‘Carps and salmons belong to two kinds of fish.’
 b. *jìyú hé sānwényú dōu shuǐyú yú-lèi/*yú-zhōng.*
 carp and salmon all belong:to fish:kind/fish-species
 ‘Carps and salmons both belong to the kind fish.’

In this research, we only discuss the use of *-lei* and leave aside the issue of *zhong*. Although the classifier use and the suffix use of *lei* might be correlated with each other, we focus on the use of *-lei* as a nominal suffix in *N-lei* for the time being. The correlation between *N-lei* and *lei-N* are discussed in Section 4.

First, the expression of *N-lei* is an N-N compound, in which the morpheme *-lei* is its head. *N-lei* is subject to the constraint of “Lexical Integrity Hypothesis” (Huang 1984). It does not allow any phrasal level syntactic operation. For example, *N-lei* does not allow NP ellipsis by deleting *-lei*, as shown in (5a). Besides, the noun in *N-lei* cannot be coordinated, that is, #[[N1-and-N2]-kind], as in (5b).

- (5) a. #wo liaojie yu-lei, bu liaojie niao-lei.
 I know fish-kind not know bird-kind
 Intended: ‘I know the kind fish but not the kind bird.’
 b. #wo liaojie [[niao he yu] lei].
 I know bird and fish kind
 Intended: ‘I know the kinds of bird and fish’

Second, *N-lei* compounding is only productive for a subset of the nominal lexicon. For example, it is possible to say *niao-lei* ‘the kind bird’ (6a) but not **maque-lei* ‘the kind sparrow’ (7a). More examples are contrasted between (6) and (7).

- (6) a. niao-lei b. yu-lei c. kunchong-lei d. gu-lei
 bird-kind fish-kind insect-kind grain-kind
 ‘the kind bird’ ‘the kind fish’ ‘the kind insect’ ‘the kind grain’
- (7) a. #maque-lei b. #liyu-lei c. #xuesheng-lei d. #dami-lei
 sparrow-kind carp-kind student-kind rice-kind

At first glance, the examples in (6) differ from those in (7) with respect to whether they belong to “basic-level categories” in the taxonomic hierarchy. Entities in basic-level categories have the following properties: they are expressed by short names, have greater frequency of use, and are learned first by children (Mervis and Rosch 1981: 93). It seems that those in (6) such as *bird*, *fish*, and *insect* belong to “basic-level categories”, while nouns such as *sparrow* and *carp* in (7) are on the nodes lower than that of *fish* in some relevant folk taxonomic networks. It is more difficult to come up with subkinds of *sparrows* or *carps* than that of *birds* and *fish*. This might account for why it is implausible for nouns that do not belong to basic-level categories to compound with *-lei*.

Our discussion of *N-lei* is based on “folk taxonomy” (Berlin 1992, Berlin et al 1973), which is a vernacular naming system, rather than the scientific classification in biology. *N-lei* doesn’t strictly correspond to any particular node in biological taxonomy, such as *gang* ‘class’, *mu* ‘order’, *ke* ‘family’, *shu* ‘genus’ and *zhong* ‘species’. For example, in scientific taxonomy, *whales* belong to the hierarchy of order and *mammals* belong to class, but in vernacular ways, it is possible to say both *jing-lei* ‘whale-kind’ and *buru-lei* ‘mammal-kind’. It is even possible to

construe them in a member–set relation in colloquial conversations, as expressed by *shuyu* ‘belong to’ in (8). In this case, both *jing-lei* and *buru-lei* belong to “basic-level categories” in our folk taxonomy.

- (8) *jing-lei* *shuyu* *buru-lei*.
 whale-kind belong:to mammal-kind
 ‘The kind whale belongs to the kind mammals.’

Third, N-*lei* tends to be used to refer to entities in biology but not in other domains. It is impossible for -*lei* to make compounds with nouns such as *canju* ‘tableware’, *qiche* ‘automobile’, or *wenju* ‘stationary’, as shown by the ungrammaticality of examples in (9).² In other words, it is not appropriate to use N-*lei* to represent artifacts as true kinds, although they may belong to basic-level categories. This probably has to do with the lexical meaning of *lei*, often translated as ‘kind’, which is usually a biological concept.

- (9) a. **canju-lei* b. **qiche-lei* c. **wenju-lei*
 tableware-kind vehicle-kind stationary-kind

Based on the examples from (6) to (9), we suggest that N-*lei* compounds usually represent “natural kinds” that belong to “basic-level categories” in folk biology.

3. Two types of kind terms: bare nouns and N-*lei*

Krifka (1995) and Chierchia (1998) independently argue that Mandarin bare nouns denote kinds as default. We argue that N-*lei* is a true kind term and its kind reference is marked explicitly by -*lei*. This section attempts to find out the semantic difference between these two kind expressions by examining the possible semantic contexts where they are allowed. We will examine the behaviors of bare nouns and N-*lei* in episodic and generic sentences respectively.

2 The ungrammatical examples of N-*lei* in (9) can be used in [[N-*lei*] N] as a modifier without causing any problem. However, [[N-*lei*] N] in the following examples are not interpreted with a kind reading.

- (i) a. [[*Huasheng-lei*] *zhipin*] *zuihao bu yao chi*.
 peanut-kind products better not want eat
 ‘It is better not to eat peanut products and the like.’
 b. [*qiche-lei*] *xiaohaoping zai zhongguo jiating hen puban*.
 car-kind consumables very China family very common
 ‘Consumables like automobiles are very common in Chinese families.’

In the phrase of [[N-*lei*]-N] in (i), the modifier [N-*lei*] is interpreted as a collection of entities that are of similar attributes in the relevant contexts and they do not necessarily constitute a kind. As Quine (1969) puts, “objects that enter into a natural relation do not form a natural kind. Not all sets are natural kinds” (cf. Stanford encyclopedia of philosophy: natural kinds). For example, *huasheng-lei zhipin* ‘peanut-kind product’ in (a) simply means products made of peanuts and the like and *huasheng-lei* is interpreted as *the peanut and the like*. The associated members of peanuts may differ in different contexts. Example (a) can be used by doctor to advice a patient not to eat food rich in oil. In this context, *huasheng-lei zhipin* may include products made of peanuts, walnuts, sunflower seeds, and so on. Thus, *lei* in [[N-*lei*] N] doesn’t mean ‘kind’ or ‘species’ and [[N-*lei*] N] are not kind terms. They should be distinguished from N-*lei* compounds.

3.1 Bare nouns and N-*lei* in episodic sentences

Both bare nouns and N-*lei* can be used in kind generics, whose predicates are realized by *juezhong* ‘become extinct’ or *jinhua* ‘evolve’ as in (10). However, bare nouns differ from N-*lei* in episodic sentences. As shown in (11), bare nouns can be used in episodic sentences, but N-*lei* cannot.

- (10) a. niao / niao-lei kuai juezhong le.
bird / bird-kind soon become:extinct PRF
‘Birds/ The kind bird will soon become extinct.’
b. niao/niao-lei shi you konglong/konglong-lei jinhua er lai de.
bird/bird-kind be from dinosaur/ dinosaur-kind evolve thus come PRT
‘Birds were/The kind bird was evolved from dinosaurs/the kind dinosaur.’
- (11) a. ta zuotian chi le yu/*yu-lei.
he yesterday eat PFV fish/fish-kind
‘He ate fish yesterday.’
b. ting zai shu-shang de niao/*niaolei feizou le.
stay at tree-on Mod bird/bird-kind fly:away PRF
‘The birds staying in the trees flew away.’

The contrast between (10) and (11) suggests that both bare nouns and N-*lei* can be kind-denoting, but bare nouns can have sets of individuals to instantiate the relevant kind, and N-*lei* cannot. In other words, Chierchia’s (1998:364) DKP (“Direct Kind Predication”) is not active for N-*lei*, because N-*lei* cannot be type-shifted to its corresponding property, namely, a set of individuals instantiating the relevant kind.

As will be shown below, the difference between bare noun and N-*lei* is more evident in generic sentences. We will examine their differences at predicative and argumental positions respectively.

3.2 Bare noun and N-*lei* as generic predicate

The first difference is concerned with what entity the property expressed by bare noun and N-*lei* can be predicated.

On predicative uses, Mandarin bare nouns can be read indefinite, and they can be instantiated by sets of individuals (see Krifka 1995, Yang 2001). As reported in Li (2013), Mandarin bare nouns can also be instantiated by sets of subkind entities. As shown in (12), bare nouns such as *jing* ‘whale’ can be predicated of both individuals such as *Moby Dick* and kind entities such as *dolphins*.

- (12) a. Moby Dick shi jing.
Moby Dick be whale
‘Moby Dick is a whale.’
b. Haitun shi jing.
dolphin be whale
‘Dolphins are whales.’

In contrast, N-*lei* such as *jing-lei* ‘the kind whale’ can only be predicated of kind entities such as *dolphin*, but not individual such as *Moby Dick*, as illustrated in (13). Importantly, it is more appropriate to express this sort of predication by the verb *shuyu* ‘belong to’ than the copula *shi* ‘be’. Compare (13) with (14).

- (13) a. ?Moby Dick shuyu jing-lei.
 Moby Dick belong:to whale-kind
 ‘?Moby Dick belong to the kind whale.’
 b. Haitun shuyu jing-lei.
 dolphin belong:to whale-kind
 ‘Dolphins belong to the kind whale.’
- (14) a. #Moby Dick shi jing-lei.
 Moby Dick be whale-kind
 ‘Moby Dick is a whale.’
 b. ?Haitun shi jing-lei.
 dolphin be whale-kind
 ‘?Dolphins are the kind whale.’

Moby Dick is not felicitous with these two predicates in general, but the one in (13a) is better than the one in (14a). The former is, at least, marginally accepted. It does not mean that *Moby Dick* is a subtype of the kind whale. This sentence becomes acceptable only when we take *Moby Dick* to be a particular representative of the kind whale. Such reading is made possible by the use of verb *shuyu* ‘belong to’. Both sentences with *haitun* mean that dolphins are a subkind of the kind whale, but (13a) sounds more natural than (14b).

The second difference between Mandarin bare nouns and N-*lei* at predicative positions has to do with classifiers. It appears that kind classifiers such as *zhong* ‘kind’ can modify both bare nouns and N-*lei*, as in (15a), but individual classifiers, such as *tiao*, can only modify bare nouns, as in (15b).

- (15) a. ni zhidao shijie shang you [duoshao zhong yu/yu-lei] ?
 you know world on only how many CL_{kind} fish/fish-kind
 ‘Do you know how many kinds of fish there are in the world?’
 b. wo chi le [san tiao yu/*yu-lei].
 I eat PFV three CL_{tail} fish/fish-kind
 ‘I ate three tails of fish.’

Individual classifiers require access to individuals in the denotation of noun. The impossibility of the modification of individual classifier of N-*lei* in (15b) suggests that N-*lei* has individuals in its denotation but not as basic atoms.

A third difference that distinguishes N-*lei* from bare nouns is that N-*lei* can only be modified by individual-level (or classifying) adjectives but not by stage-level adjectives, while bare nouns have no such restriction. Compare (16) with (17).

- | | |
|--|---|
| (16) a. redai yu-lei
tropical fish-kind | b. gongjixing yulei
aggressive fish-kind |
| c. *ji'e-de yulei
hungry-Mod fish-kind | d. *shengqi-de yulei
angry-Mod fish |
| (17) a. redai yu
tropical fish | b. gongjixing yu
aggressive fish |
| c. ji'e-de yu
hungry-Mod fish | d. shengqi-de yu
angry-Mod fish |

[Modifier-[N-lei]] in (16) can only refer to different types of fish, including *tropical fish* and *aggressive fish*, where the modifier expresses classifying properties that help to establish subkinds. These properties can also be predicated of bare nouns, as shown by (17a-b). By contrast, properties expressing transitory properties such as *being hungry* or *angry* can only be predicated of bare nouns but not of N-*lei*, as shown by (c-d) in (17) and (18).

These tests suggest that even in generic sentences, N-*lei* differs from bare nouns in their instantiations of the relevant kinds. Specifically, Mandarin bare nouns can be instantiated by both sets of individuals and sets of subkind entities, but N-*lei* at predicative positions can only be represented by sets of subkind entities but not sets of individuals.

3.3 Bare nouns and N-*lei* as argument in generics

We now turn to the interpretational differences between bare nouns and N-*lei* at argumental positions in generics. We look into their behaviors in the contexts of characterizing predicates and quantificational properties (cf. Zamparelli 2001, Krifka et al. 1995).

Characterizing sentences refer to sentences expressing “generalizations about sets of entities or situations” (Krifka et al 1995). They usually express a regularity of a nonaccidental property. Mandarin bare nouns and N-*lei* show an interesting contrast in these two contexts, as in (18) and (19).

- (18) a. gou/# gou-lei wang-wang jiao.
dog/ dog-kind woof-woof bark
'Dogs/ # The kind dog bark(s).'
- b. gou/# gou-lei you si tiao tui.
dog/ dog-kind have four Cl leg
'Dogs have / The kind dog has four legs.'
- (19) gou /gou-lei xianghu zajiao.
dog/ dog-kind mutually interbreed
'Dogs/ Dog kinds interbreed with each other.'

It is preferable for predicates such as *wang-wang jiao* 'bark' (18a) or *you si tiao tui* 'have four legs' (18b) to take bare nouns as subject and not N-*lei*. They express properties that are only true of individual dogs. On the contrary, the property of

zajiao ‘interbreed’ in (19) can naturally apply to both N-*lei* and bare nouns. It expresses properties that are true of subkind entities, for example, the breeding of different (sub)species.

Nevertheless, some native speakers judge the examples in (18) to be legitimate. For them, N-*lei* is compatible with these object-level predicates. On this interpretation, in (18b), the property of *having four legs* is ascribed to entities in the denotation of N-*lei*. Indeed, it appears that it is much easier for some object-level predicates than others to take N-*lei* as subject. For example, the acceptability of sentences in scores higher than those in (18). The difference between (18) and (20) is expected, because “having feather” or “using gills to breath” are signature properties for birds and fish respectively, whereas “having four legs” is not a typical, defining feature for dogs, because many animals apart from dogs have four legs.

- (20) a. *yu-lei yong sai huxi.*
 fish-kind use gill breath
 ‘The kind fish uses gills to breath.’
 b. *niao-lei you yumao.*
 bird kind have feather
 ‘The kind bird has feathers.’

This kind of sentence is particularly interesting, because it combines “kind referring NP” genericity with “characterizing” genericity. English have examples of the similar kind, such as “The potato contains vitamin C.” It indicates that “the property expressed by the verbal predicate must be characterizing for the objects of the kind” (Krifka et al 1995:81). We wonder whether the object-level property characterizes the individual instantiations or subkinds in the denotation of N-*lei* in Mandarin.

The particle *dou* is a distributive operator (Lin 1998), which indicates distribution of a predicate over a plural noun phrase preceding it. As shown in (21), *dou* can either quantify bare nouns or N-*lei*. The default reading of (21a) is that all fish individuals use gills to breathe. By contrast, there is no DKP at play for N-*lei*. Example (21b) only means that all subkinds of fish breathe with gills.

- (21) a. *Yu dou yong shai huxi.*
 fish all use gills breathe
 ‘Fish all uses gills to breathe.’
 b. *Yu-lei dou yong shai huxi.*
 fish-kind all use gills breathe
 ‘The kind fish all uses gills to breathe.’

This suggests that the characterizing properties characterize objects in the denotation of bare noun, whereas it characterizes subkind entities of the relevant kind denoted by N-*lei*.

Quantificational properties express properties that refer to spatial/temporal frequency (i.e., ratio between number of individuals and space/time units) of

some class (cf. Zamparelli 2001:4). In English, such properties can be expressed by *common* / *rare* / *abundant* / *widespread* / *scarce*. We choose the Mandarin equivalents, *changjian* ‘common’ and *hanjian* ‘rare’ to examine their compatibility with bare nouns and N-*lei*.

As shown in (22), only bare nouns can be predicated of the quantificational property expressed by *changjian* / *hanjian* ‘common/rare’, but N-*lei* cannot. However, when N-*lei* is modified by some classifying adjective, it becomes compatible with the quantificational property expressed by *hanjian* ‘be rare’, as shown in (22c).

- (22) a. *zai neilu, niao hen changjian, yu hen hanjian.*
 at inland bird very common fish very rare
 ‘In inland China, birds are common, and fish is rare.’
 b. *#zai neillu, niao-lei hen changjian, yu-lei hen hanjian.*
 at inland bird-kind very common fish-kind very rare
 ‘In inland China, the kind bird is very common, the kind fish is very rare.’
 c. *zai neillu, haiyang yu-lei hen hanjian.*
 at inland sea fish-kind very rare
 ‘In inland China, the sea fish is very rare.’

Given that predicates such as *changjian* ‘be common’ and *hanjian* ‘be rare’ express properties about the spatial/temporal distribution of individuals only, it is expected that N-*lei* in (22b), whose denotation is a set of subkinds, can only be are not compatible with such predicates. In the example of (22c), the modified form of N-*lei* in (23c) refers to a particular type of fish, whose instantiations can be sets of fish individuals, so it can go with such quantificational properties. This gives us some hint that the modified form of N-*lei* might be semantically equivalent to a kind of N-*lei*.

To sum up, with a careful comparison between bare noun and N-*lei* in episodic and generic sentences (including both argument and predicate uses), we draw the conclusion that both bare nouns and N-*lei* are kind terms but they differ from each other in the possibility of having different kinds of instantiations. Regardless in predicative or argumental positions, the kind denotation of bare nouns can be instantiated by sets of individuals or sets of subkinds, while DKP does not work automatically for N-*lei*, and the property counterpart of N-*lei* is usually represented by sets of subkind entities only.

4. Semantics of N-*lei*

This section formalizes our above intuitions about the interpretation of N-*lei*. We argue that N-*lei* is similar to definite singulars in English, both of which are interpreted with respect to the domain of subkinds in the sense of Dayal (2004). We also suggest that N-*lei* is the nominalization counterpart of the classifier phrase of *lei*-N and discuss the difference of *lei* in these two cases.

4.1 Two domains of quantification (Dayal 2004)

It's shown in the introductory section that English has two distinct kind expressions, namely, bare plurals and definite singulars, as exemplified by (23). One of the differences between them is that definite singulars are restricted to well-established kinds, as shown by the contrast between *Green bottles have long necks* and *#The green bottle has a long neck* (Carlson 1977).

- (23) a. Dinosaurs are extinct.
b. The dinosaur is extinct.

According to Dayal (2004), one of the characterizing differences between them is that plural kinds, such as *dinosaurs* in (23a), are transparent with respect to the objects in their extension and singular kinds, such as *the dinosaur* in (23b), are atomic entities that do not allow semantic operations from kinds to objects.

It is easily verified that plural definites lead themselves to taxonomic readings. According to Wilkinson (1991), (24a) would become unacceptable if the definite determiner is omitted. We refer readers to Dayal's (2004:425) for her response to Wilkinson's comment.

- (24) a. The crustaceans evolved simultaneously.
b. The dinosaurs became extinct at various points in time.

Dayal (2004:427) states explicitly that definite generics can be identified as involving taxonomic reading by inserting an optional *kind*, as in (25):

- (25) The (kind) lion comes in several varieties, the African lion, the Asian lion...

In order to capture this difference, Dayal (2004) proposes that the denotation of common nouns is ambiguous between the domain of individuals and the domain of subkinds, that is, D_c versus D_k , and that the singular definite generic NPs always quantifies over the domain of subkinds. The semantics of the definite singular kind terms, that is, the dinosaur in (23b), can be roughly represented as in (26):

- (26) $|| \text{the dinosaur} || = (\iota X [DINOSAUR(X)])$, where X is a variable for subkind terms (entities in taxonomic domain).

The definite generic is derived compositionally from the meaning of the definite determiner combining with a common noun denoting a set of taxonomic entities. According to the semantics in (26), the definite article *the* retains its regular function as an iota operator and the generic denotations comes from the common noun, whose domain of quantification must include subkinds of the relevant kind.

Example (27) illustrates the case of a more standard taxonomic statement, where the quantificational domain includes subkinds of lions. Here, the singular predicative term *lion* includes one or more individuals, such as the African lion, the Asian lion, and the Berber lion, as shown in (27c).

- (27) a. The African lion is a lion.
 b. lion (iX [AFL (X)])
 c. LION'={AFL, ASL, BL}

4.2 N-*lei* as a superkind term

We suggest that the distinction between bare noun and N-*lei* in Mandarin is comparable to that between bare plurals and definite singulars in English. Yang (2001) claims that Mandarin bare nouns are on a par with English bare plurals. We further argue that N-*lei* is comparable to definite singulars in English, both of which are required to be interpreted at a taxonomic level. The semantic difference between bare nouns and N-*lei* is worked out in what follows.

For the sake of completeness, we make a brief excursion to the semantics of bare nouns in Mandarin before tackling the semantics of N-*lei*.

We, following Chierchia (1998), assume that all nominals are interpreted in a complete atomic Boolean domain D , generated by a partially vague set of atoms. We assume a “part-of” relation \sqsubseteq_D and a sum operation \sqcup_D such that for every $x \subseteq D$: $\sqcup_D x \in D$. \sqcup_D is the operation of complete join with respect to \sqsubseteq_D , which means that for every $x \subseteq D$: $\sqcup_D x$ is the smallest element of D such that for all $d \in x$: $d \sqsubseteq_D \sqcup_D x$.

Chierchia (1998:349) assumes that kinds can be modeled as individual concepts of a certain sort: functions from worlds (or situations) into pluralities, the sum of all instances of the kind. Kind terms are thus expressions denoting entities of type k , and they are defined as the maximal entity in the denotation. Adopting the neo-Carlsonian approach, we assume that Mandarin bare nouns have the kind reading by default (Chierchia 1998, Yang 2001, Li 2013) and count nouns in English are predicates, which are turned into kinds by the DOWN operator \cap (Chierchia 1998). The semantics for kind terms proposed in (28a) is applicable to both Mandarin bare nouns and English bare plurals, as given in (28b).

- (28) a. For any property P associated with the kind and the world of evaluation w
 $\cap P = \lambda w. \sqcup_D (P_w)$
 b. $[[\text{gou}_k]] = [[\text{dogs}_k]] = \cap \text{DOG} = \lambda w. \sqcup_D (\text{DOG}_w)$

We now move onto the discussion on the semantics of N-*lei* in Mandarin.

It is briefly mentioned in Section 2 that the morpheme *-lei* can be used either as a kind classifier or as a noun suffix. The examples are reproduced in (29). In addition to *lei* ‘kind’, some individual classifiers, such as *zhang* ‘piece’ and *di* ‘drop’ can also compound with bare nouns, as shown in (30) (see Zhang 2013 for the discussion on the syntactic derivation of such expressions).

- (29) a. [yi [lei [niao]]] a'. [[niao]lei]
 one CL_{kind} bird bird-kind
 b. [yi [lei [yu]]] b'. [[yu]lei]
 one CL_{kind} fish fish-kind

- (30) a. [yi [li [mi]]] a'. [[mi] li]
 one CL_{grain} rice rice-grain
 b. [yi [di [shui]]] b'. [[shui]di]
 one CL_{drop} water water-drop

Classifier-Noun is predicative and Noun-Classifier is argumental, that is, being kind terms. Their interpretational difference is straightforwardly represented as follows.

On the one hand, kind classifier phrases in (29a–b) denote sets of subkind entities, and individual classifier phrases in (30a–b) denote sets of atomic individuals (see Li 2013). Given that Mandarin bare nouns are kinds, we suggest that an individual classifier triggers some type-shifting operation $\langle k, \langle e, t \rangle \rangle$, which turns bare nouns from its kind denotation to the corresponding properties, that is, sets of atomic entities. This type-shifter can be seen as the operator \cup defined in Chierchia (1998). The semantics of individual classifier phrases is provided in (31), where the individual classifier has an atomization/individuation function, as notated ATOM.

- (31) $[[li\ mi]] = [[li]] ([[mi]]) = \lambda x. x \in \cup RICE(x) \ \& \ ATOM_{grain}(x)$

To represent the semantics of kind classifier, we define \cup as a variant of the UP operator \cup , which applies to a kind term and returns a set of subkinds. Let $\pi(P_w)$ be a partition of the set of individuals in P_w into some subkind entities (similar to Carlson's (1980) "disjoint condition" for kind). Its semantics is offered in (32). Following Dayal (2004), we use the variable X to range over taxonomic entities, which are ontologically different from individuals. It stipulates that individuals are not accessible in the set of X -atoms.

- (32) $[[lei\ yu]] = [[lei]] ([[yu]]) = \lambda X. X \in \cup FISH(X) = \lambda X. X \in \pi(FISH)$, where π is a partition operator that derives subkinds from the extension of bare nouns according to some defining properties, such as the taxonomical hierarchy in some folk biology.

On the other hand, Noun-Classifier is argumental, that is, kind denoting, but N-*lei* and N-Individual classifier are instantiated by different types of entities. *Niao-lei* (29a') and *yu-lei* (29b') refer to 'the kind bird' and 'the kind fish' respectively, and on their predicative uses, they can only be realized by sets of subkind entities. By contrast, Noun-Individual Classifier can be seen as a modified form of common noun. *Mili* in (30a') means 'rice grains' and *shuidi* (30b') means 'water drops', referring to 'water that comes in the form of drops', which is distinguished from other forms of water, such as *puddle*.

Syntactically, the expression of Classifier-Noun is a modified noun, where the classifier is an adnominal modifier (CN/CN), whereas the modification relation is reversed in Noun-Classifier, where the noun acts as a modifier to the classifier. With respect to their semantic difference, we suggest Noun-Classifier to be a nominalized form of Classifier-Noun.

We adopt Huang's (2006) compositional semantics for noun compounds. Following Heim and Kratzer (1998), Huang proposes that modification is a case of conjunction/intersection, which requires sameness of types. She also suggests that when a noun is modified by a "Simple Adjective" in Mandarin, both the noun and the adjective should be of the same type e . Given two properties x and y , $x \wedge y$ is a new property defined in (33):

(33) Definition of Nominal Modification (Huang 2006: 358)

- a. $x \wedge y = \text{nom}(\lambda z[\text{pred}(x_{si})(z) \wedge \text{pred}(y_{si})(z)])$, where the subscript s stands for any sort of type e and the indexical i marks identical sorts.
- b. $\text{xin shu} \rightarrow \text{xin} \wedge \text{shu}$ 'new book'

Owing to the nominal source of classifiers, the expression of *mi-li* 'rice-grain' can be regarded as an N-N compound. It refers to a particular type of grain, namely, grains that have the property of being rice. According to the semantic template in (32), both the modifier *mi* 'rice' and the head *li* 'grain' are supposed to have the same semantic type e (the type k in our term). Accordingly, the semantics for *mi-li* is provided in (34).

(34) $[[\text{mi-li}]] = [[\text{mi}]] \wedge [[\text{li}]]$
 $= {}^\cap (\lambda x. (\text{INST}(x, {}^\cap \text{RICE}) \wedge \text{grain}(x)))$
 $= {}^\cap \lambda x. (\text{rice}(x) \& \text{grain}(x))$

In the same vein, *yu-lei* 'fish-kind' is also argued to be a sort of compound and it refers to a particular type of kind entity, that is, kind entities that have the property of being fish. We suggest that the head *lei* introduces the nominalization operator ${}^\cap$, a variant of Chierchia's ${}^\cap$, which sum all the relevant subkind entities into the largest plurality. We define the kind denoted by *N-lei* to be ${}^\cap P_w$, which is represented as in (35):

- (35) a. ${}^\cap P_w = (\sqcup_D(X): X \in \pi({}^\cap PP_w))$, the kind that corresponds to the sum of the relevant subkinds of the kind denoted by N according to partition π .
- b. $[[\text{yu-lei}]] = {}^\cap \text{FISH}_w = (\sqcup_D(X): X \in \pi({}^\cap \text{FISH}_w))$

We argue that *N-lei* compounds denote kinds intrinsically, which can be modeled as a sum of the subkind entities at the relevant taxonomic level (e.g., at the basic-level categories in folk taxonomy), and such subkind entities are derived from sum of the individuals instantiating the kind.

The semantics in (34) and (35) guarantee that Noun-Individual Classifier is a kind term that is instantiated by a set of individuals and *N-lei* is instantiated by a set of subkinds. To conclude, we claim that in those Noun-Classifier compounds, including *N-lei* and N-Individual classifier, the classifiers can be seen as domain indicators that restrict the denotation of the bare noun to be interpreted in different domains of interpretation, such as Dayal's (2004) D_e (the domain of individuals) or D_k (domain of subkinds).

5. Concluding remarks

This squib presents a case study of a special kind-referring expression in Mandarin, the N-*lei* compound. We showed that the N-*lei* compounds in Mandarin Chinese are kind terms, but they only allow subkind entities to instantiate the relevant kind term. The significance of this study lies in these two aspects: (i) in number-less and article-less languages such as Mandarin, there are, sometimes, lexical devices available to form some special kind expressions; and (ii) it provides evidence showing that the Dayal's (2004) proposal is plausible that there are two types of domains in the denotation of nouns, that is, D_e and D_k , and one of the two domains can be explicitly expressed by *-lei*.

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- Mailing Address: Mailbox 111, Department of Chinese, Zhejiang University,
148# Tianmushan Road, Hangzhou, 310028, Zhejiang province, China
- Email: xupingli@zju.edu.cn
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從“鳥類快絕種了”談漢語名詞的類指

李旭平

浙江大學

提要

本文旨在探討漢語中“名類”複合詞的語義特點。我們認為“名類”和普通光杆名詞都屬於類指表達，但是“名類”所表示的類指物體只能謂詞化為由“表類個體”構成的集合，其相應的語義類型為 $\langle k, t \rangle$ ，而不能是類型為 $\langle e, t \rangle$ 的個體集合。複合詞“名類”是量詞短語“類+名”相對的名詞化形式，但它所表示的類指個體必須屬於大眾分類學中的“基本範疇”。我們認為，漢語的光杆名詞表示類指時，它的語義內涵類似於英語的光杆複數形式，而複合詞“名類”語義更加接近英語“the+N”這一類指短語。

關鍵詞

類指，量詞，光杆名詞，名類