Reference to subkinds and the role of classifiers*

Hiroki Nomoto
University of Minnesota
nomot002@umn.edu

2010 Annual Meeting of LSA, 7–10 January 2010 @ Baltimore

Claim: The primary role of classifiers is to impose a restriction on the possible ontological sort of entities ([object] or [kind]). Classifiers restrict the sort to [object]; without them, both [object] and [kind] are available. Classifiers do not exist to enable counting.

Evidence: In Malay, an optional classifier language, while 'Num N' is ambiguous between an object and a subkind reading, 'Num CL N' only receives an object reading.

Analysis: Individuals consist of two basic sorts, viz. [object] and [kind], and each has its own domain. NPs start their lives in the [kind] domain. The sort/type-shifter, Ins(tantiate), shifts the domain from [kind] to [object]. Overt classifiers only select [object] properties, signalling the application of Ins. Hence, 'Num CL N' is not ambiguous. When an overt classifier is absent, Ins may or may not apply, resulting in ambiguity between an object reading (interpreted in the [object] domain) and a subkind reading (interpreted in the [kind] domain).

Implication: The present study offers a natural account for reduplicated nouns in Malay and some other atypical plurals: they are formed by pluralization in the [kind] domain followed by Ins ('cross-domain plurals'), whereas English-type plurals are formed by pluralization in the [object] domain after Ins ('intra-domain plurals').

*Many thanks to Hooi Ling Soh, Brian Reese, Byeong-Uk Yi, Kartini Abd. Wahab, James Stevens and Eun-Ju Noh for discussions relating to the present study. I also thank the following people for sharing their knowledge about their native languages: Mohd Izzat Mohd Thiyahuddin, Muhammad Nizam Md Zin, Kartini Abd. Wahab (Malay) and Eun-Ju Noh (Korean). All errors are mine.

1 Introduction

Two common (mis-)beliefs about classifier languages

(1) a. MASSNESS OF NOUNS: Common nouns in classifier languages are mass(-like) and lack individuation.
(held by, e.g., Chierchia (1998b) and Borer (2005))
b. CLASSIFIERS FOR COUNTING: Classifiers exist for the purpose of counting, "to make nouns countable" (by individuating them).
(held by, e.g., Krifka (1995), Chierchia (1998b) and Wilhelm (2008))

- This set of beliefs dates back as early as Quine (1969:36) (Yi 2009).
- It was formed based upon observations of two types of languages: non-classifier languages (e.g. English) and obligatory classifier languages (e.g. Japanese)

(2) Non-classifier language: English
a. two ______ books
b. two *(glasses of) water

(3) Obligatory classifier language: Japanese
a. hon ni *(satu)
book two CL
'two books'
b. mizu ni *(hai)
water two CL.cup
'two glasses of water'

Influential claims made assuming (1) (cf. section 3.5)

(4) Krifka (1995)
In non-classifier languages, either numerals or nouns assume a built-in classifier.

(5) Chierchia (1998b): Nominal Mapping Parameter Hypothesis
Nouns in classifier languages denote kinds whereas nouns in non-classifier languages denote properties.

Are the two beliefs in (1) really correct?

- MASSNESS OF NOUNS: No.
Studies have shown that count/mass distinction exists in classifier languages (Kang 1994; Cheng and Sybesma 1999; Watanabe 2006).

- CLASSIFIERS FOR COUNTING: ?
  Use of classifiers outside the context of counting in some languages (e.g. Hmong, Vietnamese) is well-known. It suggests that classifiers can be used without numerals, but it does not suggest that numerals can be used independently of classifiers.

(6) Hmong
  a. ib tug lau qaib
     one CL rooster
     'a rooster'
  b. tus lau qaib
     CL rooster
     'the rooster'
  c. nws tus lau qaib
     3SG CL rooster
     'his/her rooster'

- This paper points out that numerals can appear without classifiers in some classifier languages, which I call 'optional classifier languages'.

2 Optional classifier languages and the role of classifiers

2.1 Optional classifier languages

- In 'optional classifier languages', numerals can modify nouns directly as well as with the intermediary of classifiers.
- The set of beliefs in (1) predicts that no such language exists because:
  - Existence of classifiers indicates that nouns *lack* individuation; whereas
  - Numeral modification of nouns without classifiers indicates that nouns *do not lack* individuation.
- In fact, optional classifier languages do exist, and there are a lot of them. According to Gil (2005):

classifier-languages	140	obligatory	78
		optional	**62**
non-classifier languages	260		

  e.g. Minangkabau, Hungarian, Chantyal, Hatam, Tongan, Haida, etc.

(7) Malay
  a. dua buku
     two book
     'two books'
  b. dua buah buku
     two CL book
     'two books'

- A pair like (7) shows that numerals can be used independently of classifiers.
- Thus, the CLASSIFIERS FOR COUNTING thesis in (1) does not hold.
- Classifiers exist not for the purpose of counting, but for some other function.

Q: Why do classifiers exist? What function do they play?

- With optional classifier languages, we do not have to compare two different languages to figure out the function of classifiers.
- We have a minimal pair like (7) in a single language. The pair differs only with respect to the presence or absence of the classifier. Hence, it should reveal the core function of the classifier.

2.2 The difference observed in minimal pairs

2.2.1 Object, kind and subkind readings

The following three readings of NPs must be distinguished:

Object reading: reference to particular specimens of a kind.

Kind reading: reference to a kind to which particular specimens belong.

Subkind reading[1]**:** reference to subclasses of a kind, i.e. kinds of a kind.

(8) Object reading (Krifka et al. 1995:5)
  a. *The lion/Lions* escaped yesterday from the Hellabrunn zoo.
  b. *A cat* was sitting on the mat when John arrived at home.

(9) Kind reading (Krifka et al. 1995:5)
  a. *The lion* is a predatory cat.
  b. *Lions* are predatory cats.

[1] Also known as the 'taxonomic reading'.

(10) Subkind reading (Krifka et al. 1995:5)

a. The World Wildlife Organization decided to protect *a (certain) large cat*, namely the Siberian tiger.

b. *One metal*, namely copper, went strongly up on the market yesterday.

2.2.2 'Num N' vs. 'Num CL N'

- Unlike obligatory classifier languages, both 'Num N' and 'Num CL N' are grammatical.

(11) Di kedai ini kami menjual *tiga (buah) majalah*.
at store this we sell three CL magazine
'In this store, we have three magazines.'

- However, there is a difference in interpretation between sentences with and without a classifier.

  (a) 'Num N': ambiguous between an object and a subkind reading, with the former usually being far more salient than the latter due to pragmatic reasons (see Appendix A).

  (b) 'Num CL N': unambiguously object reading.

Object reading: 'three copies of magazines'

(12) Kami menjual {*tiga majalah*/ *tiga buah majalah*} dan semua
we sell three magazine three CL magazine and all
majalah itu majalah Mastika.
magazine that magazine Mastika
'We have three magazines and all of them are *Mastika*.'

Subkind reading: 'three kinds of magazines'

(13) Kami menjual {*tiga majalah*/ #*tiga buah majalah*}, iaitu
we sell three magazine three CL magazine namely
majalah Mastika, Majalah PC dan Nona.[2]
magazine Mastika magazine PC and Nona
'We have three (kinds of) magazines, namely *Mastika*, *Majalah PC* and *Nona*.'

[2] *Tiga buah majalah* is acceptable on an object reading, where we have a copy of each of three magazines: *Mastika* 1, *Majalah PC* 1, *Nona* 1.

- When a word meaning 'kind', 'type' and the like appears in the classifier position, a subkind reading, but not an object reading, is obtained.[3]

(14) Kami menjual *tiga jenis majalah*, iaitu majalah Mastika,
we sell three kind magazine namely magazine Mastika
Majalah PC dan Nona.
magazine PC and Nona
'We have three kinds of magazines, namely *Mastika*, *Majalah PC* and *Nona*.'

	object reading	subkind reading
'Num N'	√	√
'Num CL N'	√	*
'Num kind N'	*	√

Table 1: The difference between 'Num N' vs. 'Num CL N' (Malay).

Q: Is this contrast something peculiar to Malay (and other optional classifier languages)?

2.2.3 A similar contrast in obligatory classifier languages

Japanese

- Classifiers can be omitted in the 'N-case Num CL' pattern.[4]

- 'N-case Num' is ambiguous between an object and a subkind reading whereas 'N-case Num CL' only has an object reading.

(15) a. Uti-ni-wa haiburiddokaa-ga *yon* aru.
we-at-TOP hybrid.car-NOM four be
'We have four hybrid cars.'
(i) Object reading: Prius 2, Insight 2
(ii) Subkind reading: Prius 2, Insight 2, Sai 1, Lexus HS 1

b. Uti-ni-wa haiburiddokaa-ga *yon dai* aru.
we-at-TOP hybrid.car-NOM four CL be
'We have four hybrid cars.'
(i) Object reading: Prius 2, Insight 2

[3] I leave it open whether the words occurring in this position are syntactically classifiers (Cl) or nouns (N).

[4] See Watanabe (2006) for evidence that this sequence is a constituent.

(ii) *Subkind reading: Prius 2, Insight 2, Sai 1, Lexus HS 1

(16) Zetumetusi-souna tora-ga sukunakutomo *ni* (**hiki*) iru.[5]
extinct-likely tiger-NOM at.least two CL be
'There are at least two tigers that are likely to become extinct.'

Thai

- Classifiers cannot be omitted in the counting context.

(17) naŋsɯɯ sɔɔŋ *(lem)
book two CL
'two books'

- However, classifiers may be omitted in structures involving demonstratives.

(18) naŋsɯɯ (lem) nii
book CL this
'this books'

- According to Piriyawiboon (2009), the following contrast is observed:
  (a) 'N Dem': ambiguous between an object and a subkind reading. cf. 'Num N' in Malay
  (b) 'N CL Dem': unambiguously object reading. cf. 'Num CL N' in Malay

(19) a. rot nii
car this
(i) 'this particular car', (ii) 'this kind of car'
b. rot khan nii
car CL this
(i) 'this particular car', (ii) *'this kind of car'
(Piriyawiboon 2009)

- Malay, Japanese and English do not have the (b) pattern, but the (a) pattern shows the same interpretive possibilities as Thai.

(20) M: kereta ini [car this]
J: kono kuruma [this car]
E: this car
(i) 'this particular car', (ii) 'this kind of car'

[5] *Ni hiki* is acceptable if the sentence is intended to mean that there are at least two heads of tigers, all of which are of a kind that is likely to become extinct. This is an object reading.

- Thus, the contrast is not one restricted to the counting context, rather is a general one.

(21) Generalization: Cross-linguistically, the presence of a classifier in an NP only allows an object reading whilst its absence leads to ambiguity between an object and a subkind reading.

- The generalization in (21) holds true in all types of languages to the extent that the relevant expressions exist (Table 2).

	object reading	subkind reading
Expressions without classifiers		
(a) NUM N		
Malay (*tiga majalah*)	√	√
Japanese (**zassi san*)	—	—
English (*three magazines*)	√	√
(b) N DEM/DEM N		
Malay (*kereta ini*)	√	√
Japanese (*kono kuruma*)	√	√
English (*this car*)	√	√
Thai (*rot nii*)	√	√
Expressions with classifiers		
(a) NUM CL N		
Malay (*tiga buah majalah*)	√	*
Japanese (*zassi sansatu*)	√	*
English (unavailable)	—	—
(b) N CL DEM/DEM CL N		
Malay (**kereta buah ini*)	—	—
Japanese (**kono dai kuruma*)	—	—
English (unavailable)	—	—
Thai (*rot khan nii*)	√	*
cf. NUM KIND N		
Malay (*tiga jenis majalah*)	*	√
Japanese (*zassi san syurui*)	*	√
English (*three kinds of magazines*)	*	√

Table 2: The effect of classifiers cross-linguistically. '—' indicates that the relevant expression is unavailable or ungrammatical.

- Sentences to test the generalization in (21) need to be constructed carefully because there are extralinguistic factors that strongly favor one reading over the other (see Appendix A for particular factors).

3 Analysis

3.1 Background

3.1.1 Ontology of the domain of individuals

- Individuals consist of two basic sorts: [object] individuals (type e^o) and [kind] individuals (type e^k) (Carlson 1977).
- The domain of [object] individuals has the structure of a (complete) atomic join-semilattice (Link 1983; Landman 1989a) (Fig. 1).
  Notation: Lowercase letters for [object] individuals.

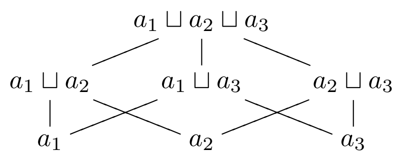


Figure 1: Domain of [object] individuals.

- There is a distinct domain for [kind] individuals.[6]
- The structure of the domain of [kind] individuals parallels that of [object] individuals, i.e. a (complete) atomic join-semilattice (Fig. 2).
  Notation: Uppercase letters for [kind] individuals. A' is a subkind of the kind A.

3.1.2 Kinds

- A kind is the totality of its instances (Chierchia 1998b).
- There are two ways to get a kind corresponding to the two domains of individuals.

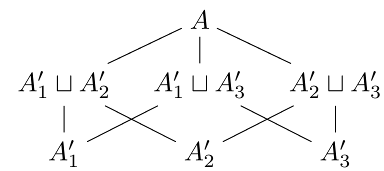


Figure 2: Domain of [kind] individuals. $A'_1 \sqcup A'_2 \sqcup A'_3 = A$ (cf. fn. 7).

  – In the [object] domain: the sum of all instances, viz. $a_1 \sqcup a_2 \sqcup a_3$ in Fig. 1.
    This is a [kind] "emulation."
  – In the [kind] domain: the sum of all subkinds, viz. $A'_1 \sqcup A'_2 \sqcup A'_3 = A$[7] in Fig. 2.
    This is a genuine [kind] element.

- Prediction: The same kind can be expressed in two different forms whose properties are not exactly identical.
- A candidate: singular vs. plural kinds[8]
  – Singular kinds (e.g. *the tiger*): kinds in the [kind] domain
  – Plural kinds (e.g. *tigers*): kinds in the [object] domain
- This makes sense because
  1. In the [kind] domain, there is a [kind] atom whereas in the [object] domain, a kind is the maximal plurality of its instances.[9]
  2. Singular definite kinds in English must be 'well-established' whereas no such restriction exists for bare plural kinds (attributed to Barbara Partee by Carlson 1977). This is expected because the kind in the [kind] domain is the true kind.

[6]Dayal (2004) assumes this too if my understanding is correct (see also Krifka 2003). She refers to the [kind] domain as 'the taxonomic domain'. I prefer the former name because the latter may misguide one to think that the [kind] domain is structured in accordance with a taxonomy hierarchy, which is not the case. As Dayal notes, not all subkinds and their sums have a corresponding node in a taxonomy hierarchy. In other words, elements in the [kind] domain are not necessarily natural kinds. For example, the sum of tigers and whales, which are two subkinds of mammals, do not form a natural kind, hence no corresponding node in the taxonomy hierarchy.

[7]More accurately, $\uparrow(A'_1 \sqcup A'_2 \sqcup A'_3) = A$, i.e. a kind is a group (in the sense of Link (1984); Landman (1989a,b)) formed by the sum of all its subkinds. Chierchia (1998b:379–383) also treats singular kinds as a group, but only for mass nouns; the singular kind of a count noun such as *the tiger* is derived by massifying it first.

[8]See Dayal (2004) for the role of determiners in singular kinds in languages with determiners.

[9]This claim has been also made by Dayal (2004). My system and hers differ with respect to which type of kinds is basic. Dayal (2004) treats plural kinds as the default and singular kinds result from "a shift to the taxonomic domain as a repair option" (435). By contrast, in my system, it is singular kinds that are basic and plural kinds are derived by sort/type-shifting to the [object] domain. My system predicts that when a language has only one type of kinds, it is the singular kind. This is indeed the case in Malay, in which plurals (see section 4 below) do not function as kind terms.

- Type-shifting operations make it possible to go back and forth between kinds (type e) and properties (type $\langle e, t\rangle$) (Chierchia 1998b): Fig. 3.[10]

(22) a. For any kind k, $^{\cup}k = \lambda w \lambda y[y \leq k_w]$[11]
b. $^{\cap}P = \lambda w[\iota x P_w(x)]$

(Chierchia to appear:(33))

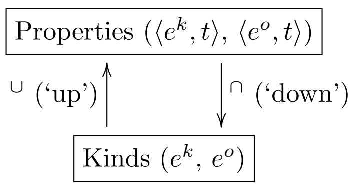


Figure 3: Type-shifting between kinds and properties. Note that type-shifting is orthogonal to sort-shifting discussed below. Type-shifting occurs between two entities of the same sort.

3.1.3 Connecting the two domains

- The realization relation R (Carlson 1977) holds between the [kind] and [object] domains.
  $R(a, A)$ iff the object a belongs to the kind A.
  e.g. $R(\text{Zana}, \text{TIGER})$ (cf. Zana is a tiger in Zoo Negara, Malaysia.)

- NPs by default denote [kind] individuals (type e^k).

- NPs can denote [object] individuals/properties through application of a sort/type-shifting operation that turns [kind] into [object].

(23) Ins(tantiate) := $\lambda x^k \lambda s \lambda y^o [R_s(y, x)]$
Ins maps a [kind] individual to a property of the corresponding [object] individuals, which realize the kind in world/situation s.[12]

- Ins applies freely.

[10] In this paper, I will ignore intensionality for simplicity and say, e.g., that kinds are of type e rather than type $\langle s, e\rangle$.

[11] $\leq$ is a 'part of' relation.

[12] This formulation of Ins is essentially the same as Dölling's (1995) INST. It shifts not only the sort but also the type. An alternative formulation which is (closer to) a pure sort-shifter would be: $\lambda x^k \lambda s[\iota y^o R_s(y, x)]$.

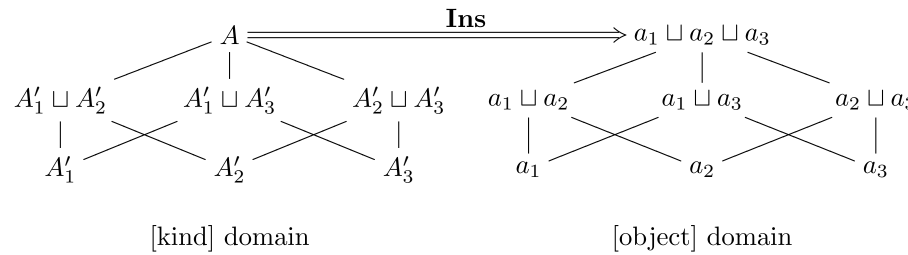
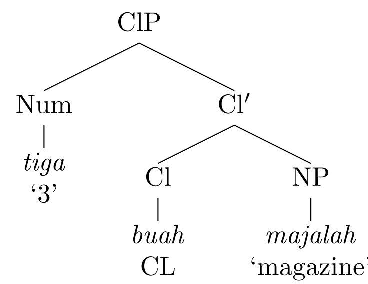


Figure 4: Sort-shifting by Ins. In this figure, Ins shifts a kind represented in the [kind] domain to the very same kind represented in the [object] domain.

3.2 Syntax

(24)



- This structure is due to Watanabe (2006).[13]

- I assume a null classifier [$_{\text{Cl}}$ Ø] where an overt classifier is absent.

3.3 Semantics

3.3.1 Classifiers

(21) Generalization: Cross-linguistically, the presence of a classifier in an NP only allows an object reading whilst its absence leads to ambiguity between an object and a subkind reading.

- (21) can be rendered as: the presence of an overt classifier in an NP entails that Ins has applied whilst its absence does not.

[13] I renamed Watanabe's '#P' as 'ClP' because classifiers are the main concern of this paper. I consider pluralization by means of reduplication (see section 4) to be a lexical process. This explains the fact that classifiers can co-occur with reduplicated nouns in Malay (Humnick et al. 2009) and Indonesian (Chung 2000; Dalrymple and Mofu 2009).

(25) Claim:

a. Overt classifiers select only [object] properties, but not [kind] properties. Thus, they force application of Ins.

b. The null classifier imposes no selectional restriction; it is compatible with both [object] and [kind] properties.

- As a consequence, we get three types of form-meaning associations:

Num/Dem Ø N	+ Ins	→ object reading (interpreted in the [object] domain)
Num/Dem Ø N	+ no Ins	→ subkind reading (interpreted in the [kind] domain)
Num/Dem CL N	+ Ins	→ object reading (interpreted in the [object] domain)
Num/Dem CL N	+ no Ins	→ *

- Classifiers are not the operation Ins itself. Rather, they provide directions on how to access atoms (= a_1, a_2 and a_3 in Fig. 1/4), i.e. additional specifications for R within Ins. They are thus modifiers (type $\langle\langle e,t\rangle,\langle e,t\rangle\rangle$).

(26) $[\![\text{CL}]\!] = \lambda P^o \lambda x^o[\forall y \in \text{AT}(x) : \text{CL}(y) \wedge P(x)]$, where

a. AT(tomicity) is a function that returns the smallest elements of its argument:

(i) If P is of type $\langle e,t\rangle$, $\text{AT}(P) = \{x \in P : \forall y \in P[y \leq x \rightarrow x = y]\}$

(ii) If x is of type e, $\text{AT}(x) = \text{AT}(\lambda y[y \leq x])$

(Chierchia to appear:(29b))

b. CL denotes properties that all nouns for which the relevant classifier is used have in common, e.g. animacy, shape, etc.

Classifiers *ensure* that the extension of the property denoted by a noun is comprised of [object] individuals (and their sums) that have properties characteristic of the relevant classifiers.[14,15]

- The null classifier has no obvious semantic effect by itself.

- Unlike overt classifiers, there is no specification of the sort. It can be either [object] or [kind] depending on the sort of the argument.
Notation: No superscript when the sort is not specified.

(27) $[\![\text{Ø}]\!] = \lambda P \lambda x.P(x)$

3.3.2 Numerals

- Numerals are cardinality predicates of property extensions, i.e. modifiers of type $\langle\langle e,t\rangle,\langle e,t\rangle\rangle$ (Ionin and Matushansky 2006; Chierchia to appear).

- There is no specification of the sort. It can be either [object] or [kind] depending on the sort of the argument.

(28) $[\![\text{n}]\!] = \lambda P \lambda x[\mu_{\text{AT},P}(x) = n]$,
where $\mu_{\text{AT},P}(x)$ is the number of P-atoms that are part of x.
A numeral takes a property and returns a property whose extension contains n atomic individuals of which the original property holds.[16]

3.4 Examples

I assume that bare nouns in general denote [kind] individuals.

The general patterns

(29) Num Ø NP

a. With Ins: object reading

$[\![\text{Num Ø NP}]\!] = [\![\text{Num}]\!]([\![\text{Ø}]\!]([\![\text{NP}]\!]))$
$= [\![\text{Num}]\!]([\![\text{Ø}]\!](a^k))$
$= [\![\text{Num}]\!]([\![\text{Ø}]\!](\lambda x^o.P(x)))$ by Ins
$= [\![\text{Num}]\!](\lambda Q \lambda y[Q(y)](\lambda x^{\mathbf{o}}.P(x)))$
$= [\![\text{Num}]\!](\lambda y^{\mathbf{o}}.P(y))$
$= \lambda R \lambda z[\mu_{\text{AT},R}(z) = n](\lambda y^o.P(y))$
$= \lambda z^o[\mu_{\text{AT},P}(z) = n]$

b. Without Ins: subkind reading

$[\![\text{Num Ø NP}]\!] = [\![\text{Num}]\!]([\![\text{Ø}]\!]([\![\text{NP}]\!]))$
$= [\![\text{Num}]\!]([\![\text{Ø}]\!](a^k))$
$= [\![\text{Num}]\!]([\![\text{Ø}]\!](\lambda x^k.P(x)))$ by $^\cup$
$= [\![\text{Num}]\!](\lambda Q \lambda y[Q(y)](\lambda x^{\mathbf{k}}.P(x)))$

[14] A similar function should be, in principle, possible for the [kind] domain: $[\![\text{CL}']\!] = \lambda P^k \lambda x^k[\forall y \in \text{AT}(x) : \text{CL}(y) \wedge P(x)]$. This could be the denotation for words meaning 'kind', 'subtype', 'species' and so on. These words are then considered to be classifiers semantically (cf. fn. 3).

[15] Note that (26) does not say that classifiers individuate objects. It says that classifiers are only compatible with already individuated (= count) objects (cf. Cheng and Sybesma's (1999) 'count-classifiers').

[16] This is a slightly simplified version of the semantics of numerals given by Chierchia (to appear:(47)). Specifically, I do not take into account the distinction between stable and unstable atoms, which is central to Chierchia's theory of mass terms.

$= [\![\text{Num}]\!](\lambda y^{\mathbf{k}}.P(y))$
$= \lambda R \lambda z[\mu_{\text{AT},R}(z) = n](\lambda y^{k}.P(y))$
$= \lambda z^{k}[\mu_{\text{AT},P}(z) = n]$

(30) Num CL NP

a. With Ins: object reading
$= [\![\text{Num}]\!]([\![\text{CL}]\!](a^{k}))$
$= [\![\text{Num}]\!]([\![\text{CL}]\!](\lambda x^{o}.P(x)))$ by Ins
$= [\![\text{Num}]\!](\lambda Q^{\mathbf{o}} \lambda y^{\mathbf{o}}[\forall z \in \text{AT}(y) : \text{CL}(z) \wedge Q(y)](\lambda x^{\mathbf{o}}.P(x)))$
$= [\![\text{Num}]\!](\lambda y^{\mathbf{o}}[\forall z \in \text{AT}(y) : \text{CL}(z) \wedge P(y)])$
$= \lambda R \lambda v[\mu_{\text{AT},R}(v) = n](\lambda y^{o}[\forall z \in \text{AT}(y) : \text{CL}(z) \wedge P(y)])$
$= \lambda v^{o}[\mu_{\text{AT},\forall z \in \text{AT}(v):\text{CL}(z) \wedge Q}(v) = n]$

b. Without Ins: subkind reading
$= [\![\text{Num}]\!]([\![\text{CL}]\!](a^{k}))$
$= [\![\text{Num}]\!]([\![\text{CL}]\!](\lambda x^{k}.P(x)))$ by $^{\cup}$
$= [\![\text{Num}]\!](\lambda Q^{\mathbf{o}} \lambda y^{\mathbf{o}}[\forall z \in \text{AT}(y) : \text{CL}(z) \wedge Q(y)](\lambda x^{\mathbf{k}}.P(x)))$
$= ??$ composition fails due to sortal mismatch

See Appendix B for an illustration using concrete examples (*tiga majalah* 'three magazines' vs. *tiga buah majalah* 'three CL magazines').

3.5 Comparison with previous studies

3.5.1 Krifka (1995) and his successors

Wilhelm (2008)

- The denotation of numerals is different between classifier and non-classifier languages.
  - Non-classifier languages: contains an atom-accessing function.
  - Classifier languages: lacks an atom-accessing function.

(31) Numerals of non-classifier languages (e.g. English *three*)
$[\![\text{three}]\!] = \lambda P \lambda x[P(x) \& \text{OU}(x) = 3]$
'a function from a set P (of atoms and sums) onto that subset of P containing the sums of three object units/atoms'
OU is a function which gives the number of 'object units' (i.e. atoms) in a plurality. (Wilhelm 2008:55)

(32) Numerals of classifier languages (e.g. Mandarin *san* 'three')
$[\![\text{san}]\!] = 3$ (Wilhelm 2008:56)

- In classifier languages, the atom-accessing function *OU* is expressed by classifiers.

(33) Mandarin general classifier *ge* 'unit'
$[\![\text{ge}]\!] = \lambda n \lambda P \lambda x[P(x) \& \text{OU}(x) = n]$,
where n is a natural number (Wilhelm 2008:55)

Problems of Wilehelm's analysis and solutions for them

1. The cross-linguistic generalization in (21) is not explained.
   Suppose *OU* restricts the domain of quantification to [object] individuals. Then, the fact that 'Num/Dem CL N' in classifier languages has an object reading is explained. But it is unclear why 'Num/Dem N' in non-classifier languages (and some classifier languages) has both object and subkind readings.
   → I have developed a system that accounts for (21).

2. Some classifier languages use classifiers in non-counting contexts too (cf. Hmong examples in (6)). Classifiers will have two denotations in these languages: one with a number variable n (for use in counting contexts) and another without it (for use in non-counting contexts).
   → This problem does not arise in the present study because it denies the CLASSIFIERS FOR COUNTING thesis. The denotation of classifiers is given in a manner that does not make reference to number.

3. Numerals in optional classifier languages have two denotations: the non-classifier language type (for 'Num N') as well as the obligatory classifier language type (for 'Num CL N').[17]
   → In the present analysis, the denotation of numerals does not vary across languages.

4. In fact, the third problem also arises in well-known obligatory classifier languages because classifiers become optional in some contexts.
   (a) Japanese: CL in 'N-case Num CL' is optional (see (15)).
   (b) Korean: Classifiers are optional for an extremely limited number of (animate) nouns including *salam* 'person', *haksayng* 'student', *kay* 'dog' (Kang 1994; Lee and Ramsey 2000).
   (c) Many languages: Classifiers tend to be optional/unacceptable for large numbers (Aikhenvald 2000:100 and references cited therein).

   → In the present analysis, classifiers play the role of disambiguating an object reading from a subkind reading. Classifiers become unnecessary when there are other means of disambiguation.

[17] Dalrymple and Mofu (2009) reach a similar conclusion for Indonesian, but they claim that it is not problematic, given a "glue" semantic approach.

(a): The 'N-case Num CL' pattern is different from the other patterns in that it forces a non-specific interpretation (Kamio 1977). I suppose that information structure is the relevant factor facilitating disambiguation (cf. Krifka 2003).

(b), (c): Animate nouns are large numbers are two pragmatic factors that bias towards an object reading (see Appendix A).

3.5.2 Chierchia (1998a,b, to appear)

- The present analysis is compatible with the Nominal Mapping Parameter Hypothesis (Chierchia 1998b).
  - The present analysis agrees with Chierchia (1998b, to appear) that common nouns in classifier languages denote kinds.
  - However, it is open whether common nouns in non-classifier languages denote kinds or properties as long as they denote in the [kind] domain. (I assume the former following, e.g., Krifka (1995); Dölling (1995); Baker (2003).)
- The present analysis does not adopt the analysis of mass terms proposed in Chierchia (1998a,b) (instead, his analysis in Chierchia (to appear) is adopted). That is to say, it does not identify the denotation of mass nouns with that of plurals.
- Thus, application of Ins as defined in (23) will not result in a mass denotation. The result is a number-neutral property. So, the claim that all common nouns in classifier languages are mass-like (MASSNESS OF NOUNS) has no motivation theory-internally as well as empirically.
- The present study denies the CLASSIFIERS FOR COUNTING thesis, which is assumed by Chierchia (1998a, to appear). Classifiers do not exist to make it possible to combine numerals with nouns.
- Chierchia's analyses of classifiers hinge on the two misbeliefs in (1):
  - Chierchia (1998b): "Classifier phrases map mass noun denotations into sets of atoms" (347); "a classifier will be necessary to individuate an appropriate counting level" (354)
    —based on MASSNESS OF NOUNS and CLASSIFIERS FOR COUNTING.
  - Chierchia (to appear): "if in a language all nouns are kind denoting, by the time they combine with a number something must intervene to turn a kind into the corresponding property. That seems to constitute a natural slot for classifiers."
    —based on CLASSIFIERS FOR COUNTING.[18]
- Neither explains the facts discussed in this paper.

4 Implication: 'cross-domain plurals'

- The present analysis predicts the existence of three types of plurals:

plurals:
- 1. intra-domain plurals
  - 1a. [object] intra-domain plurals
  - 1b. [kind] intra-domain plurals
- 2. cross-domain plurals

1a. [object] intra-domain plurals

- Plurals in the [object] domain (= the familiar type of plurals).
- Denote pluralities of [object] individuals, i.e. pluralities of instances of a kind.
- Do not entail anything about the subkinds to which the atomic individuals belong.
- e.g. *(three) tigers* (English)—it does not matter whether the tigers in question are of the same kind or not.

1b. [kind] intra-domain plurals

- Plurals in the [kind] domain.
- Denote pluralities of [kind] individuals, i.e. pluralities of subkinds of a kind.
- e.g. *(three) tigers* (English)—(three) subspecies of the tiger-kind.

2. Cross-domain plurals

- Denote pluralities of [object] individuals like intra-domain [object] plurals.
- Entail that the atomic individuals belong to more than one subkind. Thus, distinctness and/or diversity of objects is implied.

[18] Also crucial to this reasoning is his assumption that "no automatic type adjustments are possible to turn kinds into properties in number-noun constituents" (79c), with the type of numerals being $\langle\langle e,t\rangle,\langle e,t\rangle\rangle$ (cf. section 3.3.2). In my analysis, the freely available operation of Ins makes the necessary type adjustment.

– e.g. reduplicated nouns in Malay/Indonesian: *buku-buku* 'books', *gunung-ganang* 'mountain range (cf. *gunung* 'mountain')'[19]

– Some other atypical plurals reported in the literature may also fall into this category.
e.g. distributives in North American languages (Ojeda 1998; Corbett 2000) and mass plurals in Greek (Tsoulas 2006) (given a liberal conception of the kind-subkind relation).

- The three categories of plurals differ with respect to (i) whether Ins applies and (ii) the timing of pluralization (PL): Fig. 5.

1a. [OBJECT] INTRA-DOMAIN PLURALS	1b. [KIND] INTRA-DOMAIN PLURALS	2. CROSS-DOMAIN PLURALS	DOMAIN
	PL	**PL**	
	↓	↓	
	pluralities of subkinds	pluralities of subkinds	[kind]
		↓	
Ins		**Ins**	———
↓		↓	
instances of a kind		instances of pluralities of subkinds	[object]
↓			
PL			
↓			
pluralities of instances of a kind			

Figure 5: Three paths to plurals. Note that $2 \subseteq 1a$.

[19]Dalrymple and Mofu (2009) correctly point out that reduplication in Indonesian does not have exactly the same semantics as plural formation in English. They claim that "reduplicated forms indicates that a relatively large number of individuals is involved." However, examples like (i) show that the number need not be large because the reduplicated form *buku-buku* (as well as the non-reduplicated form *buku*) denotes just two books.

(i) Terdapat **dua buku** tidak dapat disiapkan oleh Al-Farabi di zamannya. **Buku-buku** itu ialah "Kunci Ilmu"... dan "Fihrist Al-Ulum"....'
'There are **two books** that Al-Farabi could not complete in his time. Those **books** are "The Key of Sciences,"... and "Fihrist Al-Ulum,"....' (Mardzelah binti Makhsin, *Sains Pemikiran & Etika*, p. 104)

5 Conclusion

5.1 Summary

- Both MASSNESS OF NOUNS and CLASSIFIERS FOR COUNTING theses are wrong assumptions. Classifiers do not individuate mass entities to make them countable. There is no difference with regard to individuation between classifier and non-classifier languages.

- The primary role of classifiers is to impose a restriction on the ontological sort. Any theory of classifiers must include a way to capture this fact.

- NPs start their lives in the [kind] domain. The freely available sort/type-shifter Ins shifts the domain to the [object] domain.

- The proposed semantics of (overt) classifiers ensures the application of Ins by selecting properties of the [object] sort.

- Individual classifiers provide additional directions on how a kind is instantiated. In other words, classifiers *help* Ins, whose definition includes the realization relation R. Classifiers are not Ins or R itself.

5.2 Remaining issues for future study

- Why are classifiers (almost always) required in obligatory classifier languages? Is it simply because of the different degrees to which a language wants the "help" in the form of overt linguistic expressions—obligatory classifier languages > optional classifier languages > non-classifier languages? Or are there any deep reasons, e.g., the role that classifiers play in syntax?

- How are the uses of classifiers in non-counting contexts explained? Is the explanation solely syntactic? Does the analysis proposed in this paper have anything to say about them?

Appendices

A Pragmatic factors affecting the ease of object/subkind readings

In general, a subkind reading is difficult to obtain. This is because (i) we talk more about objects than about (sub)kinds and (ii) a stronger alternative expression is available for a subkind reading, viz. one containing a word meaning 'kind'. In addition, the following factors favor one reading over the other.

Largeness of the numeral Large numbers bias towards the object reading.

(34) Perpustakaan kita mempunyai 5/143 jurnal linguistik.
library our have 5/143 journal linguistics
'Our library has 5/143 linguistics journals.'
—A subkind reading is difficult to obtain for *143*.

Animacy of the noun Nouns of high animacy bias towards the object reading.

(35) Saya jarang nampak *orang/kucing/kereta/bunga* ini di kawasan saya.
I rarely see person/cat/car/flower this at area my
'I rarely see this person/cat/car/flower in my area.'
—Ease of object reading: *orang* 'person' > *kucing* 'cat' > *kereta* 'car' > *bunga* 'flower'

Generality of the noun The more specific the noun, the more difficult the subkind reading becomes.

(36) *Haiwan/mamalia/harimau* ini sangat bahaya.
animal/mammal/tiger this very dangerous
'This animal/mammal/tiger is very dangerous.'
—The subkind reading is less readily available for *harimau* 'tiger' than *haiwan* 'animal' and *mamalia* 'mammal'.

World knowledge

(37) Dalam *bakul/kebun* ini ada dua epal.
in basket/orchard this be two apple
'There are two apples in this basket/orchard.'

a. *bakul* 'basket': the object reading is more salient than the subkind reading.
b. *kebun* 'orchard': only the subkind reading is reasonable, given our knowledge about what average orchards and apple trees are.

B Derivations of *tiga majalah* 'three magazines' and *tiga buah majalah* 'three CL magazine'

(38) tiga majalah 'three magazines'

a. With Ins: object reading 'three copies of magazines'
$[\![\text{tiga } \emptyset \text{ majalah }]\!] = [\![\text{tiga}]\!]([\![\emptyset]\!]([\![\text{majalah}]\!]))$
$= [\![\text{tiga}]\!]([\![\emptyset]\!](\text{magazine}^k))$
$= [\![\text{tiga}]\!]([\![\emptyset]\!](\lambda x^o.\text{magazines}(x)))$ by Ins
$= [\![\text{tiga}]\!](\lambda P \lambda y[P(y)](\lambda x^o.\text{magazines}(x)))$
$= [\![\text{tiga}]\!](\lambda y^o.\text{magazines}(y))$
$= \lambda Q \lambda z[\mu_{\text{AT},Q}(z) = 3](\lambda y^o.\text{magazines}(y))$
$= \lambda z^o[\mu_{\text{AT,magazines}}(z) = 3]$

b. Without Ins: subkind reading 'three titles of magazines'
$[\![\text{tiga } \emptyset \text{ majalah }]\!] = [\![\text{tiga}]\!]([\![\emptyset]\!]([\![\text{majalah}]\!]))$
$= [\![\text{tiga}]\!]([\![\emptyset]\!](\text{magazine}^k))$
$= [\![\text{tiga}]\!]([\![\emptyset]\!](\lambda x^k.\text{magazines}(x)))$ by $^\cup$
$= [\![\text{tiga}]\!](\lambda P \lambda y[P(y)](\lambda x^k.\text{magazines}(x)))$
$= [\![\text{tiga}]\!](\lambda y^k.\text{magazines}(y))$
$= \lambda Q \lambda z[\mu_{\text{AT},Q}(z) = 3](\lambda y^o.\text{magazines}(y))$
$= \lambda z^k[\mu_{\text{AT,magazines}}(z) = 3]$

(39) tiga buah majalah 'three CL magazine'

a. With Ins: object reading 'three copies of magazines'
$[\![\text{tiga buah majalah}]\!] = [\![\text{tiga}]\!]([\![\text{buah}]\!]([\![\text{majalah}]\!]))$
$= [\![\text{tiga}]\!]([\![\text{buah}]\!](\text{magazine}^k))$
$= [\![\text{tiga}]\!]([\![\text{buah}]\!](\lambda x^o.\text{magazines}(x)))$ by Ins
$= [\![\text{tiga}]\!](\lambda P^o \lambda y^o[\forall z \in \text{AT}(y) : \text{buah}(z) \wedge P(y)](\lambda x^o.\text{magazines}(x)))$
$= [\![\text{tiga}]\!](\lambda y^o[\forall z \in \text{AT}(y) : \text{buah}(z) \wedge \text{magazines}(y)])$
$= \lambda R \lambda v[\mu_{\text{AT},R}(v) = 3](\lambda y^o[\forall z \in \text{AT}(y) : \text{buah}(z) \wedge \text{magazines}(y)])$
$= \lambda v^o[\mu_{\text{AT},\forall z \in \text{AT}(v):\text{buah}(z) \wedge \text{magazines}}(v) = 3]$

b. Without Ins: subkind reading 'three titles of magazines'
$[\![\text{tiga buah majalah}]\!] = [\![\text{tiga}]\!]([\![\text{buah}]\!]([\![\text{majalah}]\!]))$
$= [\![\text{tiga}]\!]([\![\text{buah}]\!](\text{magazine}^k))$
$= [\![\text{tiga}]\!]([\![\text{buah}]\!](\lambda x^k.\text{magazines}(x)))$ by $^\cup$
$= [\![\text{tiga}]\!](\lambda P^o \lambda y^o[\forall z \in \text{AT}(y) : \text{buah}(z) \wedge P(y)](\lambda x^k.\text{magazines}(x)))$
$= ??$ composition fails due to sortal mismatch

References

Aikhenvald, Alexandra Y. 2000. *Classifiers: A Typology of Noun Categorization Devices*. Oxford: Oxford University Press.

Baker, Mark C. 2003. *Lexical Categories*. Cambridge: Cambridge University Press.

Borer, Hagit. 2005. *Structuring Sense*. Oxford: Oxford University Press.

Carlson, Gregory N. 1977. Reference to Kinds in English. Doctoral Dissertation, University of Massachusetts, Amherst.

Cheng, Lisa Lai-Shen, and Rint Sybesma. 1999. Bare and not-so-bare nouns and the structure of NP. *Linguistic Inquiry* 30:509–542.

Chierchia, Gennaro. 1998a. Plurality of mass nouns and the notion of "semantic parameter". In *Events and Grammar*, ed. Susan Rothstein, 53–104. Kluwer Academic Publishers.

Chierchia, Gennaro. 1998b. Reference to kinds across languages. *Natural Language Semantics* 6:339–405.

Chierchia, Gennaro. to appear. Mass nouns, vagueness and semantic variation. *Synthese*.

Chung, Sandra. 2000. On reference to kinds in Indonesian. *Natural Language Semantics* 8:157–171.

Corbett, Greville G. 2000. *Number*. Cambridge: Cambridge University Press.

Dalrymple, Mary, and Suriel Mofu. 2009. Plural semantics, reduplication, and numberal modification in Indonesian. Ms. University of Oxford.

Dayal, Veneeta. 2004. Number marking and (in)definiteness in kind terms. *Linguistics and Philosophy* 27:393–450.

Dölling, Johannes. 1995. Ontological domains, semantic sorts and systematic ambiguity. *International Journal of Human-Computer Studies* 43:785–807.

Gil, David. 2005. Numeral classifiers. In *The World Atlas of Language Structures*, ed. Martin Haspelmath, Matthew Dryer, David Gil, and Bernard Comrie, 226–229. Oxford: Oxford University Press.

Humnick, Linda, Elissa Gutterman, Erin Baker, Hiroki Nomoto, and Adam Major. 2009. Bahasa Melayu. Paper presented at the 2nd meeting of Minnesota Student Workshop on Linguistics (MNSWOL).

Ionin, Tania, and Ora Matushansky. 2006. The composition of complex cardinals. *Journal of Semantics* 23:315–360.

Kamio, Akira. 1977. Suuryoushi no shintakkusu. *Gengo* 6:83–91.

Kang, Beom-Mo. 1994. Plurality and other semantic aspects of common nouns in Korean. *Journal of East Asian Linguistics* 3:1–24.

Krifka, Manfred. 1995. Common nouns: A contrastive analysis of Chinese and English. In *The Generic Book*, ed. Gregory N. Carlson and Francis Jeffrey Pelletier, 398–411. Chicago: Chicago University Press.

Krifka, Manfred. 2003. Bare NPs: Kind-referring, indefinites, both, or neither? In *Proceedings of SALT XIII*, ed. Rob Young and Yuping Zhou. Ithaca, NY: CLC Publications.

Krifka, Manfred, Francis Jeffrey Pelletier, Gregory N. Carlson, Alice ter Meulen, Godehard Link, and Gennaro Chierchia. 1995. Genericity: An introduction. In *The Generic Book*, ed. Gregory N. Carlson and Francis Jeffrey Pelletier, 1–124. Chicago: University of Chicago Press.

Landman, Fred. 1989a. Groups I. *Linguisitcs and Philosophy* 12:559–605.

Landman, Fred. 1989b. Groups II. *Linguistics and Philosophy* 12:723–744.

Lee, Iksop, and S. Robert Ramsey. 2000. *The Korean Language*. Albany, NY: State University of New York Press.

Link, Godehard. 1983. The logical analysis of plurals and mass terms: A lattice-theoretical approach. In *Meaning, Use and Interpretation of Language*, ed. R. Baeuerle, C. Schwarze, and Arnim von Stechow, 302–323. Berlin: de Gruyter.

Link, Godehard. 1984. Hydras. on the logic of relative clause constructions with multiple heads. In *Varieties of Formal Semantics: Proceedings of the Fourth Amsterdam Colloquium, September 1982*, ed. Fred Landman and Frank Veltman, 245–258. Dordrecht: Foris.

Ojeda, Almerindo E. 1998. The semantics of collectives and distributives in Papago. *Natural Language Semantics* 6:245–270.

Piriyawiboon, Nattaya. 2009. The role of classifiers in N + Dem in Thai. Paper presented the 19th annual meeting of the Southeast Asian Linguistics Society (SEALS).

Quine, Willard Van Orman. 1969. *Ontological Relativity and Other Essays*. New York: Columbia University Press.

Tsoulas, George. 2006. Plurality of mass nouns and the grammar of number. Paper presented at the 29th GLOW Colloquium.

Watanabe, Akira. 2006. Functional projections of nominals in Japanese: Syntax of classifiers. *Natural Language and Linguistic Theory* 24:241–306.

Wilhelm, Andrea. 2008. Bare nouns and number in Dëne Sų̈łiné. *Natual Language Semantics* 16:39–68.

Yi, Byeong-Uk. 2009. Class and count nouns in Korean. Paper presented at the Workshop on Plurality in Classifier Languages.