

Bare nouns and number in Dëne Sų́liné

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Abstract This paper documents the number-related properties of Dëne Sų́liné (Athapaskan). Dëne Sų́liné has neither number inflection nor numeral classifiers. Nouns are bare, occur as such in argument positions, and combine directly with numerals. With these traits, Dëne Sų́liné represents a type of language that is little considered in formal typologies of number and countability. The paper critiques one influential proposal, that of Chierchia (in: Rothstein (ed.) *Events and grammar*, 1998a; *Natural Language Semantics* 6: 339–405, 1998b), and presents an alternative number typology, which introduces variation in the semantics of numerals. It will be shown that bare nouns in Dëne Sų́liné can be mass or count. Hence, the difference between count and mass cannot be expressed in terms of number, as in Chierchia. Instead, I express it in terms of atomicity. Mass nouns have nonatomic denotations, bare count nouns have atomic denotations that comprise singularities and pluralities. I also propose that numerals contain a function that accesses the singularities in a noun's denotation. Hence they are compatible with bare count nouns, but not with

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mass nouns. In classifier languages, numerals denote a cardinality only; singularity-accessing functions are expressed in separate elements: the classifiers. Thus, languages like Chinese require classifiers because the numerals are semantically deficient, and not, as is assumed by Chierchia and others, the bare nouns.

Keywords Number · Bare nouns · Count · Mass · Numerals · Classifiers · Athapaskan

1 Introduction

In this paper, I present the number-related properties of nouns in Dëne Sų́líné, and their relevance to formal theories of number and countability, specifically the proposal put forward in Chierchia (1998a, b). Dëne Sų́líné, formerly known as Chipewyan, is a Northern Athapaskan language spoken in Northern Canada in a large area to the east and south of Great Slave Lake. The data presented here are from the Cold Lake dialect of the language.

Dëne Sų́líné (henceforth: Dëne) is a bare noun language: nouns occur bare in argument positions, without any functional material such as articles or number inflection (see Sect. 3). This is reminiscent of languages like Mandarin, Cantonese, and Thai. However, in striking contrast to these languages, Dëne nouns are countable without the aid of a classifier. They combine directly with a numeral, as shown in (1). Such a structure would be ungrammatical in Mandarin or Thai; cf. (2).

(1)a. sų́lághe k'ásba
 five chicken
 'five chickens'

b. sų́lághe ǰ
 five dog
 'five dogs'

(2)a. sān *(zhī) xióng (Mandarin; Krifka 1995, 399)
 three CL bear
 'three bears'

b. rôm sǎam *(khan) (Thai; Hundius and Kölver 1983, 167)
 umbrella three CL:long, handled object
 'three umbrellas'

The Dëne pattern, i.e., the direct countability of bare nouns, has received little attention in the theoretical literature on number and countability. The highly

influential proposal of Chierchia (1998a, b) correlates count nouns with number inflection and predicts that bare nouns are mass, both within and across languages. Being mass, they are not countable directly, but require a classifier in the context of numerals. Chierchia's proposal is summarized in Sect. 2.

The Dëne facts, described in Sect. 3, do not follow from Chierchia's proposal. Based on Dëne, I shall argue that bare nouns can be count. Count and mass nouns are not distinguished by their number properties, but by the semantic property of atomicity (Sect. 4). Mass nouns have nonatomic denotations, as in traditional accounts (Link 1983, etc.). Nouns with atomic denotations are count, even if they are not specified for singular or plural, as in Dëne (Sect. 5). A surprising implication of my analysis is that numeral classifiers are required not when the nouns are mass, but when the numerals of a language are deficient. Thus, Mandarin and Thai differ from Dëne (and English) in the semantics of the numerals (Sect. 6).

While this paper deals primarily with Chierchia's proposal, it has wider, theory-independent implications. Chierchia's proposal reflects the widespread perception that number inflection and numeral classifiers are in complementary distribution, both across languages and within a single language (Sanchez 1973; Greenberg 1990[1972]; Krifka 1995; Doetjes 1997; Wiese 1997, 2000; Link 1998, Chap. 2; Cheng and Sybesma 1999; Borer 2005). This perception has led theories of nominal reference to assume that bare nouns are in some way not countable or 'individuated', and, because of this deficiency, require either number inflection or numeral classifiers to be counted (Greenberg 1990 [1972]; Hundius and Kölver 1983; Seiler 1986; Wiese 1997, 2000; Grinevald 2000; Krifka 2003; Borer 2005). However, the Dëne facts presented here show that number inflection and numeral classifiers are not in complementary distribution, and that, in principle, bare nouns are not deficient with respect to countability. I argue that bare nouns represent an independent third type of number/countability system, rather than a negligible exception of one of the other two types (Sect. 7).

2 Bare nouns in Chierchia (1998a, b)

Here I briefly present Chierchia (1998a, b), an influential attempt to account for the crosslinguistic distribution of bare nouns in argument positions and their perceived mass characteristics. The account rests on two important innovations: (i) an atomic, plural semantics for mass nouns, and (ii) parametric variation in the semantic type of lexical nouns.

2.1 Atomic, plural mass nouns

As familiar from standard theories, the domain of count nouns is an atomic set partially ordered by the part-of relation and closed under sum formation, i.e., it

has the structure of a complete join atomic semilattice (e.g., Link 1983; Landman 1989; Gillon 1992). All members of this set have minimal parts, i.e., elements which have no parts besides themselves. Formally, following Landman (1989, 561), where \leq is the part-of relation:

- (3)a. *Atom*: a is an atom in A iff for every $b \in A$: if $b \leq a$ then $b = a$.
 b. *Atomic*: A is atomic iff for all $b \in A$: there is an $a \in At$ such that $a \leq b$,
 where At is the set of atoms in A .

The denotation of a singular noun corresponds to the set of atoms that satisfy the property expressed by the noun. The denotation of a plural noun is a set of sums (plural individuals) formed from the set of atoms denoted by the corresponding singular noun, but excluding the atoms. For example, in a world with three balls a , b , c , the extension of (singular) *ball* is $\{a, b, c\}$, and the extension of (plural) *balls* is $\{a \oplus b, a \oplus c, b \oplus c, a \oplus b \oplus c\}$, where \oplus is the sum operation.

For mass nouns, standard theories assume a parallel *nonatomic* domain, i.e., a complete join semilattice for which (3b) does not hold (cf. Link 1983; Landman 1989). The fact that mass extensions are nonatomic expresses the intuition that the meaning of words like *water* and *ice* does not specify minimal parts (cf. Bunt 1985, 44–47). But, focusing instead on mass nouns like *change* (of money) and *furniture*, which do appear to have clear minimal parts, Chierchia argues that no special nonatomic domain is needed for mass nouns:

There are some objects that clearly qualify as elements of the extension of *furniture* and as minimal ones at that. For example a clear instance of *table* also counts as a clearly atomic or minimal element of the extension of *furniture*, since a leg of that table or one of its drawers does not qualify as *furniture*. This illustrates how *furniture* is no less “atomic” (i.e., made up of discrete sets of singularities) than *piece of furniture* or, indeed, *table*. (Chierchia 1998a, 68)

For Chierchia, the difference between count and mass nouns lies not in atomicity, but in their number properties. Count nouns are inherently singular, i.e., their lexical meaning profiles “the minimal representatives of a kind or substance” (Chierchia 1998a, 54). Mass nouns, while atomic, do not single out the atoms. Their lexical meaning comprises all of the instances of a kind or substance. Formally, the extension of a mass noun is a set of singularities (atoms) plus the pluralities formed from them. For example, in a world with three pieces of furniture a , b , c , the extension of *furniture* is $\{a, b, c, a \oplus b, a \oplus c, b \oplus c, a \oplus b \oplus c\}$, where $a, b, c \in At$. In other words, the extension of a mass noun is a complete join atomic (sub-)semilattice; in the terms of Link (1983), $N_{\text{mass}} = *N$.

Chierchia calls this type of denotation “inherently plural”, presumably because pluralities are included. This term is somewhat misleading, however, since singularities are also included. I shall call such denotations (and the corresponding nouns) *number-neutral*, which expresses more accurately that

“the difference between plural and singular is quite literally neutralized” (Chierchia 1998a, 69).

Chierchia’s view of the count/mass distinction is summarized, and compared to the traditional view, in Table 1.

Table 1 Views of the count/mass distinction

Traditional		Chierchia	
Criterion: atomicity		Criterion: number	
Atomic and nonatomic domains		Atomic domain only	
COUNT N	MASS N	COUNT N	MASS N
Atomic denot.	Nonatomic denot.	sg (or pl) denot.	Number-neutral denot.

2.2 Predictions and typology

The typical properties of mass nouns are derived from their inherent plurality or rather, number-neutrality, in the sense just discussed. First, Chierchia predicts that mass nouns cannot be pluralized because they are already plural. Specifically, the definition of the plural operation yields the empty set for mass nouns (see Sect. 4 for details). Second, mass nouns are not countable: “Numerals will not be able to combine directly with a noun: a classifier will be necessary to individuate an appropriate counting level” (Chierchia 1998b, 353f).

Chierchia’s proposal also makes typological predictions, based on a semantic parameter which introduces variation in the lexical meaning of nouns (and their phrasal projection NP): Lexical nouns can be of type $\langle e, t \rangle$ or e . Only nouns of the argumental type e can occur bare in argument positions. Type e nouns are kind terms (or proper names, which I ignore). If shifted to a predicative meaning ($\langle e, t \rangle$), these nouns will denote the set of all instances of the kind, singular and plural ones. The predicative denotation of such nouns thus is an (atomic) set closed under sum formation, or *N. But this is Chierchia’s definition of mass nouns, as we saw in Sect. 2.1. Thus, bare noun arguments will be mass both across and within languages.

Lexical nouns of the predicative type $\langle e, t \rangle$ can be count or mass: it is a lexical matter whether they are inherently singular or inherently plural/number-neutral (cf. Chierchia 1998b, 355 on French).

The parameter predicts the types of languages shown in Table 2 (Chierchia 1998a, 90–95; 1998b, 353–362). We see that number/plural inflection is the manifestation of being count.

Let me sum up. Chierchia manages to predict seemingly unrelated clusters of nominal properties from two basic assumptions, a semantic parameter for nouns, and an atomic, number-based semantics for mass nouns. The latter

Table 2 Typology according to Chierchia

	[+arg, -pred]	[-arg, +pred]	[+arg, +pred]
<i>Mapping</i>	N/NP => <i>e</i>	N/NP => $\langle e, t \rangle$	N/NP => <i>e</i> or $\langle e, t \rangle$
<i>Properties</i>	a. The extension of all nouns is mass b. No plural marking c. Numeral classifiers obligatory for counting d. Generalized bare arguments ⁱ	a. Count/mass distinction b. Count nouns: plural marking c. Mass nouns: classifiers or measure constr's d. No bare arguments ⁱⁱ	a. Count/mass distinction: type <i>e</i> Ns: mass, type $\langle e, t \rangle$ Ns: count b. Count nouns: plural marking c. Mass nouns: classifiers or measure constr's d. Only mass nouns (type <i>e</i>) can be bare arguments ⁱⁱⁱ
<i>Examples</i>	Mandarin, Thai	French, Italian	English, German

ⁱ In Chierchia 1998a, it is also predicted that this type of language will lack a definite or indefinite article

ⁱⁱ To be precise, a determiner will be needed to derive an argumental type. The determiner can be \emptyset , as proposed for Italian. A [-arg, +pred] language without articles will allow covert shifts and hence bare arguments. Slavic languages may be examples of this subtype

ⁱⁱⁱ Bare plurals are fine in argument positions as well, because plural count nouns, while starting out as predicates, can be shifted to a kind denotation. The shift to kind is not defined for singular count nouns. It can also not happen in a language like French, where *e* is not a lexical option. Cf. Chierchia (1998b:350, 357) for details

hinges on the view that count and mass nouns differ not in atomicity, but in number properties: count nouns are inherently singular, mass nouns are inherently number-neutral.

My critique of Chierchia is based on the fact that Dëne does not correspond to any of the language types shown in Table 2, but represents an unpredicted mix, as we shall see in the next section.

3 Dëne nouns do not fit the typology

Dëne has generalized bare arguments and no plural marking, which would indicate that all nouns are mapped to type *e* and hence mass. But Dëne also lacks numeral classifiers, which is incompatible with a mapping to type *e*.

Generalized bare arguments. As mentioned in the introduction, Dëne is a bare noun language: nouns are not associated with any functional material except for possessive affixes. In the absence of articles, number inflection, case, etc., nouns occur bare in argument positions. They are translated as definite or indefinite,

depending on the context. This corresponds to property (d) of [+arg, -pred] languages.¹

- (4)a. k'ásba nághílnígh
 chicken perf-1sgS-buy O
 'I bought a chicken.'
- b. horelyú ts'én dejúli nádé
 all towards mosquito impf-pl stay/live
 'There are mosquitoes everywhere.'²
- c. yeh hoghí'á
 house ar-perf-sg round O
 'There used to be a house there.'
- d. dzé hélnágh
 gum perf-swallow
 'He swallowed the gum.' (i.e., chewing gum)
- e. h dëneyuaze the?át
 dog boy-dim perf-bite/chew O
 'The dog bit the little boy.'
- f. sas jíe ghheldel
 bear berries perf-consume pl O
 'The bear ate all the berries.'

No plural inflection. A further [+arg, -pred] characteristic is that Dëne nouns have no plural marking. The language has no nominal number inflection; nouns have the same form in singular and plural contexts. This is illustrated in (5)–(7), where the (a) sentences represent singular and the (b) sentences plural contexts.

- (5)a. Larry ?lághe ?ejëre nághélnígh.
 Larry one bovine perf-buy O
 'Larry bought one cow.'
- b. Larry ?ejëre nádághélnígh.
 Larry bovine distr-perf-buy O
 'Larry bought several cows/cattle.'

¹ Dëne is polysynthetic. The verbs are complex structures, with the last syllable corresponding to the stem. I follow the consensus that in Northern Athapaskan languages, the nouns/NPs rather than the pronominal affixes are the syntactic arguments (Rice and Saxon 2005; Cook 2004; Saxon 1989). Word order is SOV.

Data are presented in the practical orthography, with the following conventions: dh = [ð], th = [θ], gh = [ɣ], ł = [ʃ], zh = [ʒ], sh = [ʃ], j = [tʃ], ch = [tʃʰ]; voiced obstruent symbols represent plain voiceless obstruents, voiceless obstruent symbols represent aspirated obstruents; C' = glottalized consonant; y = [j], ɪ = [i], ʌ, ɛ, ɪ etc. = nasal vowels, á, é etc. = high-tone vowels, ẽ = schwa. Some abbreviations: 1, 2, 3 = first, second, third person, 4 = fourth ("the other third") person, ar = areal (an argument that is a location or situation), assert = assertive, dim = diminutive, distr = distributive/plural, impf = imperfective, mom = momentaneous, opt = optative mood, perf = perfective, poss = possessed noun suffix, S = subject. Third person subject marking is zero, i.e., it is indicated by the absence of first or second person subject marking.

² The sentence has the same meaning if *dejúli* precedes the PP.

- (6) a. tth'áy thĩtsı́ sı́
dish perf-1sgS-make sg O perf assert
'I made a (one) dish.'
- b. tth'áy ghı́gha sı́
dish perf-1sgS-make pl O perf assert
'I made several dishes.'
- (7) a. yuwé hı́ nádhër
over there dog impf-sg/dl stay/live
'There's a dog that lives over there.'³
- b. yuwé hı́ nádé
over there dog impf-pl stay/live
'There's dogs that live over there.'

The singular or plural interpretation is provided either by a numeral, as in (5a), or by verbal elements, such as the distributive prefix *dá-* in (5b) and the verb stems with inherent number in (6)–(7): *-tsı́* 'make sg O perf' vs. *-gha* 'make pl O perf', *-dhër* 'sg/dl stay/live' vs. *-dé* 'pl stay/live'. More on the stems in Sect. 6.2.

The overwhelming majority of nouns follows this numberless pattern. The only nouns which show some sort of plural marking are a handful of kinship terms that can be suffixed with *-kui* when denoting a group of kin. Since *-kui* is limited to a small set of nouns and shows idiosyncracies even within that set, I do not take it as an instance of plural marking in the sense of Chierchia's typology. See the Appendix for examples and discussion of *-kui*.

No numeral classifiers. So far, Dëne appears to be a [+arg, –pred] language. The traits just discussed are incompatible with language types [–arg, +pred] and [+arg, +pred]. However, Dëne also has a trait that indicates the opposite classification. Dëne does not have numeral classifiers. As mentioned in the introduction, numerals combine directly with nouns:

- (8) a. sɔ́lághe k'ásba
five chicken
'five chickens'
- b. sɔ́lághe bek'eshích'elyı́
five table
'five tables'
- c. sɔ́lághe dzół
five ball
'five balls'

To make matters worse, Dëne is not the only language with such traits. Bare, numberless nouns are also (optionally) countable directly, for example in

³ The subject of *-dhër* may also be dual, but in isolated sentences, the verb form for a dual subject would be *náhedhër*, with the third person dual prefix *he-* (see also footnote 14 on *he-*). The noun, *hı́*, would remain unchanged.

Korean (Kang 1994), Hungarian (Ortmann 2000), Turkish (Bliss 2003), and Armenian (Borer 2005).

In sum, Dëne looks like a bare noun language, but it lacks obligatory numeral classifiers. I submit that this combination of traits, which is so surprising on Chierchia's account, falls out naturally if we allow the possibility that bare nouns are count. Bare count nouns are possible if we abandon the atomic, number-based definition of mass nouns, and embrace the traditional view that only count noun denotations are atomic, while mass denotations are nonatomic. This is the topic of the next two sections. In Sect. 4, I address atomicity. I show that the nouns in (9) are truly count, by contrasting them with mass nouns of the language. Also in this section, I argue that the Dëne count/mass distinction must be expressed in terms of atomicity. In Sect. 5, I address the role of number. I argue that number marking is not a necessary property of count nouns, i.e., count nouns need not be inherently singular, as proposed by Chierchia. I show that Dëne count nouns are not singular, but number-neutral.

4 A count/mass distinction based on atomicity

We saw above that Dëne has no numeral classifiers; bare nouns combine directly with numerals. But there are also nouns which are not compatible with numerals. Crucially, they require a measure or container construction—not a classifier—in order to combine with a numeral.

- (9)a. #sɔ́lághe ʔejëretth'úé (five milk)
 b. #sɔ́lághe béř (five meat)
 c. ʔʔnáke t'ólátúé (two beer)⁴
- (10)a. sɔ́lághe nedádhi béř 'five pounds of meat'
 five pound meat
 b. sɔ́lághe ʔejëretth'úé tɪlɪ 'five cartons of milk'
 five milk container (lit., 'five milk cartons')
 c. náke tutɪlɪ t'ólátúé 'two bottles of beer'
 two bottle beer

Chierchia has no explanation for this differential behaviour. I propose that there is a very simple explanation: the language has a count/mass distinction. The nouns compatible with numerals are count; they have meanings that provide minimal units for counting. The nouns that are not compatible with numerals are mass; their meanings do not provide minimal units for counting.

⁴ Just as in English, *náke t'ólátúé* is acceptable in a context which supports a shift to a count reading, 'two servings (e.g., glasses, bottles) of beer'. This is an instance of the well-known Universal Packager (Bach 1986, 10). It should be noted that the Packager is far from universal in Dëne. As far as I can tell, it is restricted to a handful of edible or drinkable substances for which conventionalized standard portions exist. See Jackendoff (1997, 53) for similar observations on English.

I also propose that this distinction should be analyzed as atomic vs. nonatomic reference. My proposal differs from Chierchia's in that (i) bare nouns can be count, and (ii) mass nouns have nonatomic denotations.

The first piece of evidence for my proposal comes from the meanings of the two classes of nouns. As the example lists in (11) and (12) show, the split in syntactic behaviour is accompanied by a nonarbitrary split in their meanings: the nouns incompatible with numerals denote liquids and other fairly homogeneous or unbounded substances, as well as some abstract concepts, while the nouns compatible with numerals denote things which typically occur as discrete entities.

(11) **Nouns incompatible with numerals**⁵:

ligofi 'coffee', *jietué* 'wine', *ʔejëreth'úé* 'milk', *bér* 'meat', *thay* 'sand', *dedhay* 'salt', *suga* 'sugar', *dza* 'mud', *tës* 'lard/grease/fuel', *yath* 'snow', *yú* 'cloth/clothing', *dâ* 'hunger, starvation',⁶ *bet* 'sleep, sleepiness'

(12) **Nouns compatible with numerals:**

the 'stone, pipe', *ke* 'shoe', *ʔerih't'ischënë* 'pen, pencil', *dechën* 'stick, bush, tree', *jéchogh* 'apple (or similar-size fruit)', *t'uli* 'rope', *ʔerih't'is* 'sheet(s) of paper, book', *thanakódhi* 'car', *yeh/yoh* 'house', *dejúli* 'mosquito', *sas* 'bear', *h* 'dog', *dëne* 'person, people'

Discrete entities represent clear minimal units for counting (e.g., a proper part of a house is not a house), liquids and other undifferentiated 'stuff' do not. The following semantic analysis suggests itself: the nouns in (11) are not countable because it is not clear what would constitute a minimal unit, or atom, in their denotation. This is also the intuition in Chierchia (1998a, b), but its formal implementation in terms of join *atomic* semilattices is problematic, since it wrongly predicts uncountability of all Dëne nouns.

I propose instead that the vagueness regarding atoms is better represented traditionally as in Link (1983) and Landman (1989): mass nouns denote join *nonatomic* semilattices (sets of quantities and their sums). This corresponds to Bunt's (1985, 46) characterization of mass nouns as those which "refer to entities as having part-whole structures [...] without making any commitment concerning the existence of minimal parts."⁷

⁵ Again, some of the beverage nouns can be shifted to a count meaning 'serving of x' in certain contexts and are then compatible with a numeral.

⁶ A homophonous noun *dâ* 'mole, shrew' is count.

⁷ This is not the same as saying that real-world referents of mass nouns have no or vague minimal parts. Opinions are divided on whether linguistic countability has a cognitive basis in properties of the real-world referents of count and mass nouns. I personally believe that there is evidence for such a basis, at least for concrete nouns (cf. Wierzbicka 1988; Wisniewski et al. 2003; Middleton et al. 2004). It is much more difficult to find a noncircular conceptual explanation for the mass or count behaviour of abstract nouns. The handful of Dëne abstract nouns I have tested appear not to be directly compatible with a numeral (e.g., *dâ* 'hunger, starvation', *bet* 'sleepiness', *yatu* 'word, prayer, language, religion', *nuhech'áné* 'our ways, our culture', and *hosthne* 'sin').

If the denotations of mass nouns are nonatomic, we can explain why they occur with *measure* or *container* constructions, rather than with classifiers, in counting contexts. Being nonatomic, mass nouns are not countable without first being partitioned or ‘portioned’ into discrete units, such as pounds or the amount of milk that fits into a milk carton. Measure and container constructions create atoms by measuring quantities into units, thus mapping a nonatomic into an atomic denotation (cf. Kang 1994; Krifka 1995; Chierchia 1998a, b).

Interestingly, other languages with bare nouns show a parallel split between count and mass nouns. For example, there is a systematic distinction between count and mass nouns in Thai (Hundius and Kölver 1983), Mandarin (Doetjes 1997; Cheng and Sybesma 1999), and Cantonese (Cheng and Sybesma 1999). In Mandarin, for instance, only count nouns are compatible with the general classifier *ge* ‘CL_{unit}’ (Doetjes 1997). Unlike more specific classifiers, *ge* does not provide any information, e.g., in terms of shape or consistency, on *what* the units are, and “the choice of what counts as a unit can only be made on the basis of the denotation of the noun” (Doetjes 1997, 33). More generally, count nouns in Mandarin and Cantonese are compatible with classifiers which simply *name* existing minimal units, while mass nouns require measure or container classifiers which *create* minimal units (Cheng and Sybesma 1999). This is completely parallel to Dëne, modulo the absence of classifiers in that language.⁸

Doetjes and, following her, Cheng and Sybesma (1999) have modeled the count/mass distinction in Mandarin in exactly the same way as I propose for Dëne: count nouns provide a criterion for counting, namely minimal parts or atoms. They denote complete join atomic semilattices. In my terms, they are number-neutral; Doetjes calls them “count mass” or “collective”. True mass nouns, called by Doetjes “mass mass”, do not indicate minimal parts, hence no criterion for counting. They denote “portions of matter, ordered with respect to each other by the *part-of* relation” (Doetjes 1997, 38).

Further evidence for the presence of count nouns in Dëne and other bare noun languages comes from pluralization. As we saw in Sect. 2.2, Chierchia predicts that by virtue of being mass, bare nouns cannot take plural marking. But this is actually not accurate. For example, bare nouns can optionally be plural-marked in Indonesian, Hungarian, Turkish, Korean, and to some extent in Mandarin (Chung 2000; Ortman 2000; Kang 1994; Rullmann and You 2006). This suggests that bare nouns cannot be equated with mass nouns. Doetjes (1997, 32) argues that only nouns with clear minimal parts, i.e., with atomic denotations, can take a plural marker: “The plural ending in *the books* indicates that there is more than one book. It does not give information about what unit could be considered to be a singular book, and therefore we know

⁸ See also Wiese (1997, 2000) on the difference between accessing/selecting/naming existing units/atoms, and creating units. It should also be noted that measure and container constructions do not create individuals. For example, a given amount of water can be partitioned into litres or cups in any number of different ways; litres, cups, and similar units are not individuals.

that this information must somehow be present in the denotation of the count noun *book*.”

Again, there is an interesting parallel in Dëne. While Dëne does not have nominal plural marking, it has inherently plural verbs. These verbs are formed from stems which require a plural theme argument, such as *-lá/-la* ‘handle pl O impf/perf’.⁹ Interestingly, the substance-denoting nouns are not compatible with inherently plural verbs, only the nouns denoting discrete objects are:

- (13)a. tthe yeghánla
stone/pipe 4O-P-mom-handle pl O perf
‘S/he gave him/her several pipes.’
- b. jíechogh gheldel ni
apple (‘big berry’) perf-consume pl O perf past
‘S/he ate several apples.’
- (14)a. #thay nínla
sand adv-mom-1sgS-handle pl O perf
[Intended: ‘I brought some sand.’]
- b. #?edlánélt’e jíetué ghíldel
how many/much wine perf-1plS-consume pl O perf
[Intended: ‘How much wine did we drink?’]
- cf. ?edlánélt’e tutih jíetué ghíldel
how many/much bottle wine perf-1plS-consume pl O perf
‘How many bottles of wine did we consume?’

This pattern is explained if the nouns in (13) are count (atomic reference) while those in (14) are mass (nonatomic reference). Assume the nouns in (13) denote complete join atomic semilattices. Since their denotation includes pluralities, they are compatible with the plural verbs; the verbs will simply restrict their denotation to pluralities (see Sect. 6.2 for a formalization). For Chierchia, however, all bare nouns have the same type of denotation (“mass”/atomic semilattices), and the difference between (13) and (14) has no explanation.

The fact that bare, number-neutral nouns can assume a (strictly) plural interpretation, either by a nominal plural marker or by a plural verb, also suggests a different conception of the plural operation. Chierchia (1998a, b) assumes that the plural operation applies to inherently singular nouns and creates pluralities from the singularities (see Sect. 2.2 above). The operation is defined such that it yields the empty set when applied to number-neutral nouns, cf. (15): For number-neutral nouns, A is $*A$, thus PL applies to $*A$. But $PL(*A) = **A - *A$, which is $*A - *A$, which is \emptyset .

⁹ Dëne also has verbs/stems with inherent singular and inherent dual participant number. Examples are seen in (6) and (7) above. The stems *-lá/-la* ‘handle pl O impf/perf’ are members of a set of so-called classificatory verb stems, many of which are inherently singular or plural. For the classificatory verbs, see Davidson et al. (1963), Carter (1976), Cook (1986), and S. Rice (1998).

The possibility of pluralizing number-neutral nouns suggests that the plural operation applies to inherently number-neutral nouns and selects the pluralities/excludes the singularities. Formally, this could be expressed as in (16):

$$(15) \text{ For any } A \subseteq U, \text{PL}(A) = *A - A \quad (\text{Chierchia 1998a, 60})$$

$$(16) \text{ For any } A \subseteq U, \text{PL}(A) = *A - At \quad (\text{Rullmann and You 2006})$$

Unlike Chierchia's definition of PL, (16) does not yield the empty set when applied to number-neutral nouns. (16) also presupposes a denotation which includes atoms and hence predicts that only nouns with atomic denotations can be pluralized, as proposed by Doetjes (1997). Certainly, in Dëne only count, i.e., atomic, nouns are compatible with plural-participant verbs, as shown in (13) and (14) above.¹⁰

Let me sum up this section. The countability and pluralization patterns of bare nouns, as well as their lexical meanings, strongly suggested that bare nouns can be mass or count, i.e., that Dëne has a count/mass distinction. Following Doetjes (1997) and Cheng and Sybesma (1999), I proposed that bare mass nouns denote join nonatomic semilattices and bare count nouns denote join atomic semilattices. In other words, bare count nouns are defined as number-neutral. (In Sect. 6.1, I will demonstrate formally how number-neutral nouns are counted.) The close examination of bare nouns also led me to propose a different definition of the plural operation, one that can be applied to nouns with number-neutral denotations.

Defining bare count nouns as number-neutral entails abandoning the number-based view of the count/mass distinction, on which number-neutral equals mass and count is defined as inherently singular. In the next section, I examine the semantics of Dëne count nouns in detail and show that they are truly number-neutral rather than inherently singular—a final piece of evidence against the number-based view.

5 Dëne count nouns are number-neutral, not inherently singular

In languages with number inflection, the singular exponent of a noun often is identical to the bare or stem form. The singular appears to be more basic, with the plural derived from it. For this reason, count nouns are often thought of as being inherently singular. As Chierchia (1998a, 54) writes, “count nouns single out in the lexicon the relevant atoms or minimal parts (by making them the exclusive components of their extension).” On this assumption, it is only a small step to the idea that nouns which are not inherently singular (but, for example, inherently number-neutral) are not count.

¹⁰ Of course, mass nouns are expected to be pluralizable to the extent that they can be shifted to a count meaning, e.g., by the Universal Packager (Bach 1986, 10) or the Universal Sorter (Bunt 1985, 11).

But this is not the only logical possibility. Another possibility, expressed, e.g., by Langacker (1991), is that singular exponents of count nouns are no more basic than plural exponents. Both are independently derived from a numberless or number-neutral noun stem.¹¹ Now, if there is no number inflection, the number-neutral denotation of the stem is not “carved up” into singular and plural. Therefore, the denotations of noun phrases headed by bare nouns will comprise singularities and pluralities, i.e., be number-neutral.

A close examination of those Dëne bare nouns which are compatible with numerals shows that the number-neutral view is the correct one. The first piece of evidence comes from examples (5)–(7) in Sect. 3. There we saw that Dëne bare nouns are compatible with singular and plural semantic contexts. This already suggests that both singular and plural interpretations are part of the meaning of Dëne nouns. However, proponents of the singular view might object that in (5)–(7) the plural readings are due to the plural contexts and not part of the inherent meaning of the nouns. To counter this objection, let us turn to the second piece of evidence: (17) shows that the plural reading is also available when there is no plural information in the context (e.g., in the verb):

- (17)a. Bal h̥e nághélnígh
Val fish perf-buy O
‘Val bought fish.’ [Speaker comment: “It doesn’t say how many.”]
- b. Larry chu Mo ?ej̥ere náheghélnígh
Larry and Mo bovine 3dl-perf-buy O
‘Larry and Mo bought some cattle/a cow/some cows.’
- c. horelyú sekui h̥ neʔ̥i
all child dog look at O impf
‘All the children are looking at a dog/dogs.’
- d. ʔ̥íghá is nánáthildá
quickly mitt perf-patch O
‘It didn’t take me long to patch the mitt(s).’
- e. dzól xéʔ̥ senádé
ball with impf-pl play
‘They (several) are playing with a ball/with balls.’
- f. John bebesé
John 3-knife-poss
‘John’s knife or knives’

As apparent from a speaker’s comment on (17a), in such examples, it is simply not known how many entities are involved. The plural reading is as available

¹¹ Langacker gives as evidence that in languages which have both overt singular and overt plural morphology, the plural form is not built on the singular form, i.e., it does not contain the singular morpheme. A view which takes the singular as basic and derives the plural from it does not predict the nonexistence of such “doubly-marked” plurals.

as the singular one. If Dëne nouns were inherently singular, the availability of the plural reading would be unpredicted—there is no element in the context that could derive the plural reading. I conclude that Dëne nouns comprise singular and plural readings “from the outset.”

It is in fact somewhat misleading to talk about “singular and plural readings of Dëne nouns.” The singular/plural division is just an artifice of the metalanguage English. A number-neutral translation, perhaps like ‘cattle’ for *ʔejëre* in (17b), comes closer to the meaning of Dëne nouns.¹² This brings me to the third piece of evidence for the number-neutral view: the fact that singular and plural cannot even be considered distinct semantic specifications of Dëne nouns. This is shown by a semantic test which exploits the fact that in conjunction, both conjuncts must receive the same interpretation (cf. Cruse 1986). For example, *John and Mary each found a bat* can only mean that both found a baseball bat or that both found an animal; it cannot mean, for instance, that John found an animal and Mary found a baseball bat. This indicates that *bat* has two distinct semantic specifications. In contrast, *John and Mary each found (some) money* can mean that John found some coins and Mary found some bills; thus ‘coins’ and ‘bills’ are not distinct semantic specifications of *money*.

Regarding this test, Dëne nouns pattern like *money* and not like *bat*: (18) is true of all situations in which both the girl and the boy are playing with a ball/balls, irrespective of the number of balls each has. Some possible interpretations are given below the sentence.

- (18) ts'ekuaze chu dëneyuaze chu dzół xěł ʔełch'ázı senáhedhër
 girl and boy and ball with refl-away 3dl-sg/dl play
 ‘The girl and the boy are each playing with a ball/balls in a separate place.’

Some possible interpretations:

- girl has one ball, boy has one ball
- girl has two balls, boy has one
- girl has one ball, boy has three
- girl has two balls, boy has three

This test confirms that the plural reading is as present as the singular one, and moreover that singular and plural are not separate semantic specifications of Dëne nouns.¹³

In sum, Dëne nouns compatible with numerals denote complete join atomic (sub)semilattices, i.e., they are number-neutral. I conclude that the assumption that count noun stems are inherently singular cannot be right, at least not in the sense of making “the relevant atoms or minimal parts [...] the exclusive

¹² Although, unlike *cattle*, Dëne nouns do not require a classifier such as *head of* to talk about individual units of cattle, i.e., cows.

¹³ *Dzół* is embedded in a PP in order to avoid the verb specifying its number value, as often happens with subjects and objects (see next footnote).

components of their extension” (Chierchia 1998a, 54). Instead, I propose that count noun stems are inherently number-neutral. If a language has number inflection, the morphosyntax divides noun denotations into singular and plural ones. In the absence of number inflection, i.e., of an obligatory morphosyntactic contrast, no semantic contrast exists either, as we can see in Dëne.¹⁴ Corbett (2000, 10ff) gives examples of bare number-neutral nouns from Bayso, Fula (Fouta Jalon dialect), Japanese, Even/Lamut, and Tagalog. These languages either lack plural forms of nouns completely, as does Dëne, or only have optional plural forms for nouns. Just as I do, Corbett takes the lack of an obligatory singular–plural contrast as evidence that the bare noun is number-neutral (in his terms, has general number).

In the next section, I will demonstrate formally how bare number-neutral nouns, as in Dëne, are counted. I will also address the appearance of classifiers in languages like Chinese. I will argue that the difference between Chinese and Dëne is due to a difference in the semantics of the numerals.

6 The role of numerals

6.1 Accessing atoms

What happens in counting? That is, what happens when a numeral and a (count) noun combine? Numerals minimally denote a natural number, i.e., they are minimally of type n (cf. Krifka 2003). Nouns denote a set (of atoms and sums), thus are of type $\langle e, t \rangle$. How should something of type n apply to a set? For example, without additional information, nothing prevents a numeral from returning the appropriate number of sums from a number-neutral set (Dëne bare noun) or a set of pluralities (English plural noun). There must be an additional step or function in the semantic composition that prevents such wrong results. Obviously, this step or function consists of specifying the objects to be counted as atoms.

In many languages, including English and Dëne, numerals perform this step or function unaided. For this reason, I propose that, in general, the meaning of numerals includes an atom-accessing function. This has in fact

¹⁴ Dëne does, of course, have optional means of indicating whether a noun has singular or plural—or dual—reference. The most common means, at least in isolated sentences, are verbal. Number information may be conveyed by a verb root inherently specified for participant number, or/and by the distributive prefix *dá-* or the third person prefix *he-*. *dá-* indicates (distributive) plural in all persons, *he-* indicates dual in third person, but sometimes also shows up in verbs otherwise marked as plural. At first glance, *dá-* and *he-* may appear paradigmatic, i.e., obligatory elements of a morphosyntactic singular–dual–plural contrast. However, closer study of paradigms, sentences and texts reveals that *dá-* and *he-* are optional and not part of an obligatory morphosyntactic contrast. See Cook (1996, 2004) and Wilhelm (2007) for detailed discussion.

been argued by Kang (1994) for Korean and also by Krifka (1995) for English.¹⁵ Following their ideas, I give numerals a semantics as in (19), where *OU* is a function which gives the number of ‘object units’ (i.e., atoms) in a plurality.

- (19) English *three*, Dëne *taghe* ‘three’:
 $[[three]]/[[taghe]] = \lambda P \lambda x [P(x) \ \& \ OU(x) = 3]$
 ‘a function from a set *P* (of atoms and sums) onto that subset of *P* containing the sums of three object units/atoms’

This definition of numerals entails that nouns with atomic denotations are in principle countable, irrespective of whether they are singular, plural, or number-neutral.¹⁶ Crucially, the *OU* function does not *create* atoms. It can only access the atoms/minimal units provided by a noun’s denotation. This explains why numerals (and also numeral classifiers) cannot combine with mass nouns, as discussed in Sect. 4. Since mass denotations are nonatomic, *OU* has nothing to apply to, and the result is semantic ill-formedness.

Without *OU*, a numeral denotes just a number, and there is no clue how to apply this number to the denotation of a noun or noun phrase. I submit that this is precisely what happens in classifier languages. In classifier languages, *OU* is not part of the lexical meaning of numerals, but is expressed through separate elements, the classifiers. Many classifiers are quite specific and require the units of counting to be, e.g., long and thin things, flat things, fruits, humans, etc. (cf. Hundius and Kölver 1983, 205 for a list of Thai classifiers). But often there is also a general or default classifier that simply means ‘unit’, for example Mandarin *ge* (Doetjes 1997, 33). The semantics of a classifier can be given as follows:

- (20)a. General classifier: Mandarin *ge* ‘unit’
 $[[ge]] = \lambda n \lambda P \lambda x [P(x) \ \& \ OU(x) = n]$ where *n* is a natural number
 b. Specific classifier: Mandarin *zhi* ‘branch’ (i.e., long and thin unit)
 (Doetjes 1997, 31)

$$[[zhi]] = \lambda n \lambda P \lambda x [P(x) \ \& \ OU_{\text{BRANCH}}(x) = n]$$

¹⁵ Here are their original formalizations. Kang gives a generalized quantifier denotation for the entire noun phrase. The subscripted *i* of the cardinality function stands for atomic individual parts.

- (i) *twu haksayng-i* ‘two student-Nom’ (Kang 1994, 7)
 $\lambda P \exists x [P(x) \ \& \ *student'(x) \ \& \ Card_i(x) = 2]$

Krifka’s denotation of the numeral is based on the assumption that bare nouns are names of kinds. In addition to selecting atoms, the numeral also contains a “realization” relation *RT* which shifts the denotation from kind to predicate. I ignore this complication in my formalization, since I am not convinced that bare nouns essentially name kinds. (*OKU* means “object or kind unit”, *i* stands for a possible world *i*.)

- (ii) *three* (Krifka 1995, 406)
 $\lambda y \lambda i \lambda x [RT_i(x,y) \ \& \ OKU_i(y)(x) = 3]$

¹⁶ *OU* applies vacuously to nouns with singular denotations, e.g., in the case of *one ball*.

- (21)a. Mandarin numeral *san* ‘three’
 $[[san]] = 3$
 b. Mandarin numeral *san* ‘three’ + classifier *ge* ‘unit’
 $[[san-ge]] = \lambda P\lambda x[P(x) \ \& \ OU(x) = 3]$

The denotation given in (21b) is identical to the one given in (19) above. But in (19), *OU* is part of the meaning of the numeral. What (19) actually says is that Dëne and English numerals have “a ‘built-in’ classifier” (Krifka 1995, 406).

In sum, I propose that in general, counting involves an atom-accessing function *OU*. Languages differ in whether *OU* is part of the meaning of numerals or expressed separately by numeral classifiers. In other words, I propose that there is crosslinguistic variation in the semantics of numerals, and that this variation is responsible for the difference between Chinese and Dëne/English. Chinese, Dëne, and English are the same, however, in that in each of them the count/mass distinction is based on atomicity, and not on number properties such as inherent singularity.

6.2 Comparison with Chierchia

In Chierchia’s proposal, counting also involves accessing atoms. But the account does not predict the countability of Dëne nouns because the conception of access to atoms, and by consequence also the conception of numerals, is too narrow. I will first discuss the problems with the conception of access to atoms, then the conception of numerals.

Access to atoms. For Chierchia, atoms are accessible if a noun has a singular denotation, or if a noun denotes a set derived by the plural operation from a set of atoms. Formally, a set *A* is countable if *SG(A)* is defined (*At* is the set of atoms in the domain):

- (22) For any set *A*: (Chierchia 1998a, 71)

$$SG(A) \begin{cases} A, \text{ if } A \subseteq At \text{ or if } A = PL(B), \text{ for some } B \subseteq At \\ \text{undefined, otherwise} \end{cases}$$

Since number-neutral noun denotations are neither a (sub)set of atoms nor built up from a set of atoms by a plural operation, *SG(A)* is undefined. (In this case, a classifier must intervene between the numeral and the noun. The classifier maps a plurality into a set of atoms made up of members of the plurality, i.e., it singles out a set of atoms from the denotation. In other words, the classifier turns a purportedly uncountable number-neutral denotation into a singular, countable one.)

What *SG* effectively does is restrict countability to singular-only or plural-only nouns. And precisely here lies the problem with Chierchia’s view of access to atoms: while atoms are clearly accessible if $A \subseteq At$ (singular nouns), they are not accessible directly if the noun is plural. As we saw, the plural operation is defined such that the atoms are removed from the denotation: $PL(B) = *B - B$ (cf. Chierchia 1998a, 60). So if $A = PL(B)$, *A* does in fact not

contain any atoms. The atoms can only be accessed by somehow “reversing” or “looking past” the plural operation. It is mysterious why no classifier is needed to perform this function, as it is needed with number-neutral nouns (recall that classifiers map pluralities into sets of constitutive atoms).

Thus, while formally feasible as in (22), it is conceptually highly unappealing to say that atoms are accessible in an atomless set. Moreover, if atoms are accessible in a set without atoms, there is no conceptual reason why they should not be accessible in a set *with* atoms, i.e. if $A = *B$, for some $B \subseteq \text{At}$. So, conceptually speaking, if a numeral is able to access the atoms in a plural-marked noun, it should also be able to access them in a number-neutral noun. This is where the conception of access to atoms turns out to be too narrow.

Languages such as Dëne show that this conceptual objection is indeed justified. Atoms can be accessed in number-neutral nouns; number-neutral nouns can be countable. More generally, the definition of count nouns as those which are singular-only or plural-only, i.e., nouns that are marked for number, is too narrow.

Numerals. Since numerals require access to atoms, Chierchia builds $\text{SG}(X)$ into the (generalized quantifier) meaning of a numeral, as a condition on the set it may apply to.¹⁷ As a consequence, the problems associated with $\text{SG}(X)$ are carried over to numerals: numerals in general are now conceived of as lacking the ability to access atoms in a set that may also contain sums of atoms. But this conception of numerals is too narrow. It may be true that in languages like Mandarin, numerals by themselves cannot access the atoms in a number-neutral denotation, hence the obligatory classifiers. But in addition to this, there are many languages in which numerals *can* access the atoms. Dëne, Korean, Turkish, Hungarian, and Armenian are examples, as I argued above. Following Krifka (1995), I proposed that all languages that do not have obligatory numeral classifiers have numerals with a general atom-accessing ability.¹⁸

Thus, we cannot take Mandarin-type numerals as the only or as the unmarked kind of numeral. Looking across languages, it rather seems as if Dëne- and English-type numerals, with a built-in atom-accessing function, are the unmarked type, and that Mandarin-type numerals are deficient.

¹⁷ Here is Chierchia’s formalization:

(i) $n(X)(Y) = \exists u[u \in \text{SG}(X) \wedge |u| \geq n \wedge u \in Y]$ (Chierchia 1998a, 71)
(where for any X , $|X|$ is the cardinality of X)

¹⁸ Wiese (1997, 2000) also proposes that number-neutral nouns are not countable directly. For Wiese, not unlike Chierchia, these nouns denote aggregates, atomic sets whose members are not “individuated” and hence not accessible to numerals. Individuation is achieved by a classifier. Wiese thus predicts that all number-neutral nouns require a classifier for counting. This forces her to claim that languages without apparent classifier (such as Dëne and Hungarian) have a phonologically empty general classifier in the extended nominal projection. I believe that my analysis, on which numerals may “semantically incorporate” the classificatory function, matches the data more closely while avoiding empty syntactic heads. Moreover, Wiese’s account, like Chierchia’s, suggests an artificial difference in the countability of plural-inflected and number-neutral nouns.

6.3 Evidence for *OU*

Interestingly, there is empirical evidence that my analysis is the correct one. First, a closer look at Dëne numerals suggests that they do in fact have a classificatory function. For the numbers up to 10, Dëne has an extra set of numerals specifically for humans, in addition to the basic set. For numbers over 10, only the basic set is available. Humans are counted with the human set up to 10, and with the basic set thereafter.

(23)	<i>basic</i>	<i>human</i>	(Cook 2004, 110)
	(ʔ)łághe ‘one’	ʔłágħı ‘one person’	
	náke ‘two’	nádëne ‘two people’	
		(cf. dëne ‘person, people’)	
	taghe ‘three’	tagħı/tanı/tąı ‘three people’	
	dıghı ‘four’	dıghı/dıghını/dını ‘four people’	
	słághe ‘five’	słágħı/słáanı/słáıı ‘five people’	
	(ʔe)łk’étaghe ‘six’	(ʔe)łk’étanı/(ʔe)łk’étanı ‘six people’	
	łáısdı/totą ‘seven’	łáısdıghı/totą ‘seven people’	
	(ʔe)łk’édı ‘eight’	(ʔe)łk’édıghı/(ʔe)łk’édııı ‘eight people’	
	(ʔe)łótą ‘nine’	(ʔe)łótą ‘nine people’	
	honéna ‘ten’	honéıą ‘ten people’	
	(ʔ)łághe ch’adhěl ‘eleven’	—	
	náke ch’adhěl ‘twelve’	—	
	etc.		

These data can be interpreted as follows: Dëne basic numerals contain a general classifier that accesses the atoms or object units in the denotation. This classifier does not specify the type of object unit. Dëne human numerals have incorporated an additional classificatory element that specifies the type of object unit to be accessed as a human being. For reasons perhaps of salience or perhaps for historical reasons, this happens only up to the number 10.

A further indication that English and Dëne numerals contain a covert classifier is the following: In English and Dëne, but not in Mandarin and other languages with obligatory numeral classifiers, numerals can be used pronominally. In the latter, only the numeral-classifier combination can be used pronominally.¹⁹ Compare English and Dëne with Mandarin:

- (24) *English*
I bought two new blankets. One is black and one is red.

¹⁹ A look at the literature shows that a common function of numeral classifiers is to track reference, similar to pronouns (Aikhenvald 2000, Grinevald 2000). And Greenberg (1990[1972]) observes that the noun can be omitted from a numeral classifier construction if it is recoverable.

(25) *Dëne*

- a. Tth'ıdzıné k'e ts'éré nádághı́nı́gh.
 yesterday blanket distr-perf-1sgS-buy O
ʔı́lághe delzën-ʔú ʔı́lághe delk'os.
 one black and one red
 'Yesterday I bought blankets. One is black and one is red.'
- b. [From a story about beaver hunting. Context: ... After I did that, I talked to the people (*dëne*). "Here I have barred the beaver den. We will see."]
ʔı́lághe sa tsáʔaghe għa wage, desı.
 one-human me-for beaver hole P opt-dig/poke 1sgS-say
 "One person will dig through the beaver den," I said.'

(adapted from Li and Scollon 1976, 389)

(26) *Mandarin*

(A. You, p.c., 2006)

- a. Wo mai-le liang-tiao xin tanzi. Yi-tiao hei-de, yi-tiao hong-de.
 I buy-ASP two-CL new blanket one-CL black-DE one-CL red-DE
 'I bought two new blankets. One is black and one is red.'
- b. *Wo mai-le liang-tiao xin tanzi. Yi hei-de, yi hong-de.
 I buy-ASP two-CL new blanket one black-DE one red-DE
 (Intended: 'I bought two new blankets. One is black and one is red.')
- c. *Wo mai-le liang-tiao xin tanzi. Tiao hei-de, tiao hong-de.
 I buy-ASP two-CL new blanket CL black-DE CL red-DE
 (Intended: 'I bought two new blankets. One is black and one is red.')

(27) *Mandarin*

(A. Tremblay, p.c., 2006)

[looking at a pack of cigarettes a friend is holding]

- a. qǐng gěi wǒ yì zhī
 please give 1sg one CL
 'Please give me one.'
- b. *qǐng gěi wǒ yì
 please give 1sg one
 (Intended: 'Please give me one.')

If in Mandarin the numeral indicates only a cardinality, without relating it to 'object units', its inability to be used pronominally is explained.²⁰ English and

²⁰ The numeral+CL restriction is loosened in two ways in Mandarin (A. You, A. Tremblay, p.c., 2006). First, in spoken Mandarin the numeral *yì* 'one' can be omitted from the numeral+CL+noun construction (higher numerals cannot be omitted). Second, in less formal (spoken) register the numeral alone can be used pronominally:

- (i) Wo mai-le liang-tiao xin tanzi. Yi hei, yi hong. (A. You, p.c., 2006)
 I buy-ASP two-CL new blanket one black one red
 'I bought two new blankets. One is black and one is red.'

Dëne numerals, on the other hand, resemble pronouns in containing some specification like ‘object unit’ or ‘entity-referring expression’.

It should be noted that my proposal only predicts that numerals cannot occur without classifiers, not that classifiers cannot occur without numerals. The latter is possible in many languages according to Greenberg (1990[1975]). For example, in Cantonese a classifier plus noun (without numeral) is used to express a definite interpretation of the noun phrase (Cheng and Sybesma 1999).²¹ In languages where this is possible, classifiers have acquired a determinative function in addition to the atom-accessing *OU* function. For example, Cheng and Sybesma argue that in Cantonese classifiers are associated with the iota operator, the operator commonly used to derive definite from predicative denotations (cf. Partee 1987; Chierchia 1998a for the iota operator). The association of classifiers with the iota operator may also explain why Cantonese plural definite noun phrases, which are formed with the plural classifier *di*, can only combine with the numeral *yì* ‘one’ and not with any higher number. The iota operator selects the (unique) greatest element of a set. For a set *A* of singularities and pluralities, this will be the largest sum/plurality in *A*. It is conceivable that after this operation has occurred, a numeral must treat this largest sum, rather than the atoms it is made up of, as the new basic unit for counting. Since there is only one greatest sum, only the numeral ‘one’ is possible.

A general piece of evidence that in classifier languages numerals and not nouns are deficient is the fact that in such languages, classifiers appear to form a constituent with numerals, not with nouns. Thus, Greenberg (1990[1975], 227) states:

“There are many indications that in the tripartite construction consisting of quantifier (Q) [=numeral], classifier (Cl), and head noun (N), Q is in direct construction with Cl and this complex construction, which will be called the classifier phrase, is in turn in construction with N.”

Among the indications are (i) that of the possible orders of Q, Cl, and N, only those in which Q and Cl are adjacent to each other occur, i.e., Q and Cl may not be separated by N; (ii) that the order of Cl and Q in a given language is usually fixed, while the order of classifier phrase and N may vary; and (iii) that in many languages Q and Cl form a prosodic unit or even a single word.

Finally, my proposal that *OU* can be part of the lexical meaning of numerals offers a possible account of the verb stems with inherent participant number seen in earlier examples. If *OU* is a lexical option, nothing prevents it

Footnote 20 continued

Note that in this case, *de* must also be omitted in the second sentence of (i). I leave these facts of (informal) spoken Mandarin for future research. Perhaps the language has begun to change into a language without obligatory classifiers. In this case, I predict that numerals will acquire the “classifying function” as part of their meaning.

²¹ I thank an anonymous referee for pointing out the possibility of classifiers without numerals, and specifically the Cantonese facts discussed here. I ignore that in Cantonese, classifier + noun may also have indefinite readings in limited contexts. See Cheng and Sybesma (1999) for details and analysis.

from being part of the lexical semantics of elements other than numerals, for example verbs. Using *OU*, the denotations of verbs, or rather verb stems, with inherent participant number can be expressed as follows (abstracting away from aspect):

- (28)a. *-tsɿ* ‘make sg O perf’:
 $\lambda e \lambda x \lambda y$ [make(e) & Ag(e,x) & Theme(e,y) & $OU(y) = 1$]
- b. *-ghɑ* ‘make pl O perf’:
 $\lambda e \lambda x \lambda y$ [make(e) & Ag(e,x) & Theme(e,y) & $OU(y) \geq 2$]
- c. *-dhër* ‘sg/dl stay/live’:
 $\lambda e \lambda x$ [stay/live(e) & Theme(e,x) & $OU(x) \leq 2$]
- d. *-dé* ‘pl stay/live’:
 $\lambda e \lambda x$ [stay/live(e) & Theme(e,x) & $OU(x) > 2$]
- e. *-la* ‘handle pl O perf’:
 $\lambda e \lambda x \lambda y$ [handle(e) & Ag(e,x) & Theme(e,y) & $OU(y) \geq 2$]
- f. *-del* ‘consume pl O perf’:
 $\lambda e \lambda x \lambda y$ [consume(e) & Ag(e,x) & Theme(e,y) & $OU(y) \geq 2$]

Let me sum up. In this section, I have made explicit what is often taken to be a natural part of the meaning of numerals, namely a specification of the units to be counted as atoms. I have formalized this as an atom-accessing function *OU*. This formalization accurately predicts that nouns with atomic denotations are countable and nouns with nonatomic denotations aren’t. I have also argued that languages differ in whether *OU* is part of the meaning of numerals or expressed separately by numeral classifiers. Crucially, obligatory classifiers occur not because the nouns are mass or otherwise uncountable, but because the numerals lack *OU*.

7 Conclusion

7.1 Evaluation of Chierchia (1998a, b)

In this paper, I have documented the number-related properties of Dëne nouns. The striking thing about Dëne nouns is that although bare, many of them are countable directly. This challenges Chierchia’s claim that all bare nouns are mass, which follows from his number-based account of the count/mass distinction.

Dëne shows that bare nouns are not necessarily mass; they may be mass or count. The latter are directly compatible with numerals, the former require a measure or container construction for counting. Since number does not play a role in the Dëne nominal system, the count/mass distinction cannot be expressed in terms of number properties in this language. Dëne count nouns are not inherently singular but number-neutral, denoting complete join atomic semilattices. It follows that number-neutrality cannot be the defining property of mass nouns. Rather, the defining property of Dëne mass nouns is that they

have nonatomic denotations: they denote complete join semilattices in a nonatomic domain.

A close examination of bare noun languages with numeral classifiers supports my argument that the difference between count and mass nouns lies in atomicity. Here, too, nouns denoting substances require a measuring or container construction—rather than a classifier—for counting. Doetjes (1997) and Cheng and Sybesma (1999) propose that these nouns have nonatomic denotations, while the nouns compatible with numeral classifiers have atomic, number-neutral denotations. They distinguish between classifiers, which merely name existing units, and measure or container constructions, which create units for counting. In my terms, the former provide access to atoms, while the latter map nonatomic onto atomic denotations (see also Kang 1994; Krifka 1995).

In short, the difference between count and mass nouns lies in atomicity, not in number. The nonatomic domain cannot be dispensed with if we want a formalization of the count/mass distinction that holds across all languages, including those without number and classifiers.

What are the implications of (re-)defining the count/mass distinction in terms of atomicity rather than number for Chierchia's second proposal, the introduction of a semantic parameter for nouns? The present analysis is not incompatible with the parameter, but it makes it unnecessary, because the different mappings do not buy us anything anymore. To see this, assume that in Dëne all nouns are mapped to type e . Since we had to reintroduce a nonatomic domain, the corresponding predicative denotations can be atomic or nonatomic join semilattices. This correctly predicts both bare arguments and the count/mass distinction witnessed in Dëne (and in classifier languages). But we can achieve the same result by mapping nouns to type $\langle e, t \rangle$ (or with a mixed mapping). Again, since we had to reintroduce a nonatomic domain, nouns can start out as denoting atomic or nonatomic semilattices. Since countability is not tied to number inflection, such a language may have number inflection on count nouns or not. Assume it does not have number inflection. If the language additionally has no determiners (a possibility independently proposed by Chierchia 1998b, 360f for Slavic languages), nothing will mark a shift from $\langle e, t \rangle$ to e , and bare arguments will be possible.

In sum, once the obligatory connection between count nouns and number inflection is broken, there is no way to recover whether a bare noun started out as type e or $\langle e, t \rangle$. Thus, the parameter loses its original purpose of accounting for the distribution of bare nouns.

7.2 A revised typology of bare nouns and countability

Chierchia's is just one attempt to formalize a connection between countability and nominal number. These attempts rest on the incorrect view that languages have either nominal number inflection or obligatory numeral classifiers—a two-way typology of countability. But Dëne shows that a two-way typology is

not enough. Dëne represents a *third* type of language in the typology of bare nouns and countability/number systems. It is neither a classifying language like Chinese, nor a number-inflecting language like English. I call it a bare noun language.

Table 3 A three-way typology

	I: NUMBER INFLECTION	II: NUMERAL CLASSIFIERS	III: BARE NOUNS
Nouns:	sg vs. pl	Number-neutral	Number-neutral
Numerals:	<i>OU</i> function	no <i>OU</i> function	<i>OU</i> function
Example:	English	Chinese	Dëne

In a two-way typology, nouns provide the only source of variation. The need for classifiers is due to a deficient mass-like or ‘aggregate’ noun meaning in the respective languages (e.g., Wiese 1997, 2000; Krifka 2003; and much typological work on classifier languages, such as Greenberg 1990[1972]; Seiler 1986).

In a three-way typology, both nouns and numerals are sources of variation: nouns vary in whether they are number-neutral or not—but they are never semantically deficient. Number-neutrality, or the absence of number inflection, is the difference between type I and type II/III languages. Numerals vary in whether they contain an *OU* function or not. This creates the difference between type II and type I/III languages. Crucially, type II languages require numeral classifiers not because the nouns are deficient, but because the numerals are deficient, lacking *OU*. Instead, these languages have overt grammatical elements that contribute the *OU* function—the classifiers. They are obligatory in counting contexts because they provide the access to atoms that is the foundation of counting.

Informally, we could say that in type I and III languages, *OU* is lexicalized in the numerals, while it is grammaticized in type II languages. A language may over time lexicalize formerly grammatical classifiers; this may have happened in Dëne.

The exploration of the properties of Dëne sheds light on the source of variation in the typology: All three types of languages appear to operate on a semantic, lexically encoded distinction between nouns that have atomic denotations and hence are countable, and nouns that have mass/nonatomic denotations and hence are uncountable. Variation occurs through grammaticization, i.e., through what happens (or does not happen) in the syntactic domain. A language may grammaticize number (type I) or the atom-accessing function *OU* (type II).²² But crucially, a language does not have to grammaticize any countability-related notion (type III). Here I differ from accounts which require a grammatical expression of countability. For example, Doetjes

²² I leave open the possibility that number and classifiers are different manifestations of the same functional category.

(1997) and Cheng and Sybesma (1999), while recognizing the existence of count and mass nouns even in classifier languages, argue that being semantically count is not enough. A syntactic marker of countability or individuation—a classifier or number inflection—is also required. Borer (2005) goes even further. For her, individuation/countability does not exist in lexical semantics, but is only achieved by functional material in the syntax (classifiers, number inflection, certain determiners). These accounts fail to predict the countability of certain Dëne nouns (those with atomic denotations) *without* any grammatical element.²³

Now, if a language does grammaticize a countability-related notion (types I and II), the grammatical count/mass distinction will be based on the semantic one, but there will also be some mismatches between the two (cf. Wiltschko 2005). Well-known examples of mismatches are singularia tantum and pluralia tantum in number-inflecting languages. For instance, *scissors* is plural-only although it refers to a single object (contrast German: *Schere*_{SG} – *Scheren*_{PL}); and *hair* and *furniture* are singular-only although they refer to plural objects. Thus, the syntactic categories do not divide up a language's nouns in precisely the same way as the semantic categories they are based on. Only in a language like Dëne, where no countability-related grammatical categories exist, is the semantic count/mass distinction of nouns clearly perceivable, without being masked by semantics–syntax mismatches.

Dëne is not the only language which clearly operates on a lexicosemantic count/mass distinction. In Halkomelem Salish, count and mass nouns have identical syntax—both combine directly with numerals and the same quantifiers, both can be pluralized, both require the same determiners—but differential semantics (Wiltschko 2005). And West African languages such as Yoruba, like Dëne, have neither plural markers nor classifiers (see, e.g., Rowlands 1969 on Yoruba). These languages will be good test cases for the hypothesis of a universal semantic count/mass distinction.

In conclusion, Dëne nouns, although bare, are of significant theoretical interest. The present examination of their number properties has already uncovered four important insights: (i) number-neutral nouns are in principle countable; (ii) there is crosslinguistic variation in the semantics of numerals; (iii) a grammatical marker of countability is not a universal requirement; and (iv) besides a grammatical count/mass distinction, we have to acknowledge a potentially universal semantic count/mass distinction. It appears that the absence of grammatical categories can be as fruitful an area of study as their presence.

²³ Borer (2005) also has no explanation for the systematic occurrence of measure or container constructions with mass nouns, found not only in number-inflecting, but also in classifier and bare noun languages. If all nouns are mass and classifiers or number inflection 'individuate' in the sense of creating units for counting, measure and container constructions should be superfluous, or at least should not occur systematically with a certain semantic class of nouns. See Wilhelm (2006) for detailed discussion of Borer (2005).

Appendix: the suffix *-kui*

For the sake of completeness, I discuss here the suffix *-kui*, which occurs on many Dëne kinship terms and appears to be a plural marker, as shown in (29). However, even among kin terms, the distribution of *-kui* has a number of idiosyncrasies. For this reason, I do not take *-kui* to be an instance of plural/number inflection.

- (29)a. sare 'my older sister/parallel²⁴ female cousin'
 b. sarekui 'my older sisters/parallel female cousins'
 c. sedéze 'my younger sister/parallel female cousin'
 d. sedézekui 'my younger sisters/parallel female cousins'
 e. senahé 'my sibling/cousin'
 f. senahékui '(all of) my siblings/cousins'
 g. setsuné 'my grandmother'
 h. setsunékui 'my grandmothers'
 i. sųk'íe 'my mother's sister (=aunt)'
 j. sųk'íekui 'my mother's sisters (=aunts)'

First, *-kui* is not fully productive.²⁵ Some kinship terms, as in (30), have no form with *-kui*, or a form whose status is questionable. Similarly, (31) shows a noun that may take *-kui*, but is dispreferred relative to an entirely different noun with a similar meaning. And (32) shows a noun with *-kui* that has no corresponding singular form.

- (30)a. seyaze 'my child'
 b. *seyazekui (cf.: seskéne 'my children')
 c. setáze 'my stepfather/my paternal parallel uncle'
 d. ?setázekui 'my stepfathers/my paternal parallel uncles'
Speaker comments: seldom used; doesn't sound right
- (31)a. sechële 'my younger brother/parallel male cousin'
 b. sechëlekui 'my younger brother/parallel male cousin'
Preferred: sek'íke 'all my siblings/parallel cousins'
- (32)a. *seti (intended: 'my (living) parent')
 b. setikui 'my (living) parents'

Next, there are some nouns which, although containing *-kui*, denote singularities along with pluralities. Here *-kui* is fully lexicalized (the nouns are not words without *-kui*), semantically opaque, and does not impart plural meaning:

²⁴ 'Parallel' cousins are those who descend from parallel-sex sibling parents. E.g., my mother's sister's (or my father's brother's) daughter would be my *sare* if she's older than me.

²⁵ *-kui* might be more productive in other Dëne dialects, but still restricted to kinship terms (Sally Rice, p.c.).

- (33)a. sekui 'child/children'
 *se
 b. ts'ékui 'woman/women'
 *ts'é
 c. ts'áku 'old woman/old women'
 *ts'á

Finally, in those cases where *-kui* does appear to be a plural suffix, it is optional to varying degrees when plural information is given elsewhere. Compare the first clause of (34) with (35). In both examples, the numeral *t̩anı* as well as the verb *nádé* entail that there are three (or more) older sisters. In such contexts, *-kui* may appear, as seen in (35), but it is not obligatory, as seen in (34). This indicates that *-kui* is optional to at least some extent.²⁶

- (34) T̩anı sare Tsádhekué nádé,
 three my-older-sister Edmonton impf-pl stay/live
 ?ekú nádéne Łuechoghtué náhedhër.
 and two Cold Lake 3dl-impf-sg/dl stay/live
 'Three of my sisters live in Edmonton, and two of them live in Cold Lake.'
- (35) T̩anı sarekui Tsádhekué nádé sı.
 three my-older-sisters Edmonton impf-pl stay/live assert
 'My three older sisters live in Edmonton.'

In sum, the limited distribution of *-kui* is very different from the plural marking in Chierchia's typology, where plural occurs productively and obligatorily on all (count) nouns of a language. I conclude that Dëne does not have nominal number or plural inflection.

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²⁶ One possible explanation for the contrast between (34) and (35) is that the appearance of *-kui* is an artifice of elicitation. It is possible that speakers feel obligated to be as explicit as possible in elicitation, including the use of optional elements such as *-kui*. Only if faced with a fairly complex or long sentence such as (35), may they "forget" to use *-kui*. If this explanation turns out to be true, it supports the idea that *-kui* is in essence optional. Interestingly, the cognate kinship plural *-ke* is optional in the closely related language Slave (Rice 1989).

Another possible explanation of the difference between (34) and (35) is that *-kui* has collective meaning. Then its use would be appropriate in (35), where the entire "collection" of older sisters lives in Edmonton, but not in (34), where they form two (geographically) separate groups. In that case, too, *-kui* would not be a typical plural marker.

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