

Types of Numerical Nouns

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1. Introduction

In recent work on numerical expressions, Kayne (2005a) argues that, cross-linguistically, there are nominal suffixes which attach to numerical bases (such as *ten*) turning them into nouns. One such suffix is *-AINE*, which conveys an approximative meaning. Another is *-NSFX*, which simply nominalizes multiplicative numerals like *two hundred* or *three thousand*. Whereas in some languages, these suffixes are overt, i.e., French *centaine*, in others, i.e., English, they are mostly ‘silent’. Greek is of the former type, since, as we show, the nominal suffixes Kayne proposes have overt manifestations. Moreover, they contribute specific interpretation, and the numerals that bear them are not used as cardinals (with the exception of multiplicatives of *xilja* ‘1000’). We hold that the nominal status of (most of) these numerals is responsible for the fact that they participate in a pseudopartitive construction.

Cardinal numerals appear to constitute a class of their own in Greek. They are not nouns in any obvious manner and they do not seem to derive (from nouns) either.

- (1) Ena, dio, tria, deka, ikosi, trianda, saranda, ekato, diakosia, triakosia, tetrakosia, xilja.
1, 2, 3, 10, 20, 30, 40, 100, 200, 300, 400, 1000.

By contrast, items formed out of the above cardinals via the suffixation of *-ada* and *-ari-a* are (derived) numerical nouns, which, as we discover, are associated with various interpretations.

1.1 Numerical nouns in *-ada*

The numerical nouns in *-ada* (plural: *-ades*) are associated with three interpretations, as below:

a) the *SET* interpretation

When *-ada* attaches to cardinal numerals smaller than *xilja* ‘a thousand’, the resulting numerical noun refers to sets of entities, hence, *SET interpretation*. In (2a) the numerical noun refers to a pack of six beers, while in (2b) to people who came in groups of four. In this interpretation, *-ada* attaches to most cardinal numerals up to *ikosi* ‘twenty’ and, then, to *ekato* ‘a hundred’ and to *xilja* ‘a thousand’.¹ Thus, for these numerals there is both a cardinal numeral, (1), and a numerical noun available, each with different properties and interpretation. Crucially, as the contrast in (3) indicates, numerical nouns in *-ada* do not count, but refer to (pragmatically appropriate) sets:

- (2) a. Agorasa mia eksada bires. b. Irthan se tetraades.
bought-1s a/one six-ada beers came-3p in four-ades
‘I bought a six pack of beers.’ ‘They came in groups of four.’
- (3) a. Plirosa triakosia evro gi afto to forema.
paid-1s three-hundred euro for this the dress
b. *Plirosa tris ekatondades evro gi afto to forema.
paid-1s three hundred-ades euro for this the dress
‘I paid three hundred euros for this dress.’

¹ More precisely, to the cardinals 3, 4, 5, 6, 8, 10, 11, 12, 20, (and possibly 50 and 60).

In this interpretation, numerical nouns in *-ada* are preceded by the indefinite determiner (or cardinal ‘one’²) when singular, (4a), and by a cardinal numeral or a quantifier/quantificational adjective when plural, (4b), just like other nouns that denote measure or unit, (4c):

- (4) a. Agorasa mia eksada bires.
bought-1s a/one six-ada beers
b. Agorasa tris/merikes/soles/arketes eksades bires.
bought-1s three/some/many/several six-ades beers
c. Agorasa mia kuta bires.
bought-1s a/one box beers

b) the *High Number* interpretation

When certain nouns in *-ada* are in the plural (cf. *dek-ades*, ‘ten-ades’), not preceded by a numeral or some other modifier, they denote a *High Number* of entities, (5). In this interpretation, they are emphatically stressed, are based on powers of ten, and display (selective) recursiveness, (6):

- (5) a. Ekane dekades/ekatondades/xiljades lathi.
made-3s ten-ades/hundred-ades/thousand-ades mistakes
‘He made tens/hundreds/thousands of mistakes.’
b. Ekatondades/xiljades diadilotes simetixan stin poria
hundred-ades/thousand-ades demonstrators particip.-3p in-the march
‘Hundreds/thousands demonstrators participated in the march.’
(6) a. ekatondades xiljades lathi
100-ades 1000-ades mistakes
b. dekades xiljades lathi
10-ades 1000-ades mistakes
c. *dekades ekatondades lathi
10-ades 100-ades mistakes

We consider (5) and (6) as the counterparts of ‘tens’ etc. in English, as well as of ‘centaines’ etc. in French, (7), represented as in (7e) by Kayne (2005a). Note that Kayne associates *-AINE* with an approximative interpretation, an interpretation that we attribute to a different nominalizing suffix in Greek, as will be discussed in 1.2.

- (7) a. Tens/hundreds/thousands of errors were found in the essay.
b. ...des centaines d’erreurs.
c. They must have tens of thousands of dollars.
d. *They must have thousands of tens of dollars.
e. ten-AINE-s of thousand –AINE –s of mistakes

c) the *Cardinal Numeral* interpretation

The suffix *-ada* may also attach to the cardinal *xilja* ‘a thousand’. The outcome, *xiljada*, although morphologically a noun, is a cardinal numeral, since, just like any other cardinal, it is used to count. Thus, the numerical nouns in (8) have an interpretation identical to their English counterparts (cf. the contrast between (8b) below and (3b) earlier).

- (8) a. Xrisimopiisan dio xiljades piata gia ti gamilia deksiosi.
used-3p two thousand-ades plates for the wedding party
‘They used two thousand plates for the wedding party.’
b. Plirose tiseris xiljades evro gia tin kenourja tu motosikleta.
paid-3s four thousand-ades euro for the new his motorcycle
‘He paid four thousand euros for his new motorcycle.’

² The indefinite determiner *enas, mia, ena* ‘a’: masc, fem, neut, is identical to the cardinal ‘one’ in Greek.

The pattern in (8) constitutes the only instance in Greek which falls under Kayne's claims with respect to the presence of a nominal suffix, -NSFX, namely that -NSFX nominalizes a cardinal without canceling its primary counting function.³ In English this suffix is unpronounced, (9a), while in Greek it is overt and is only associated with 'a thousand' as its multiplicand:

- (9) a. three hundred -NSFX
b. tris xilj-ades (three thousand-ades)

To conclude this section, one should bear in mind that the suffix *-ada/-ades* is normally associated with the SET or the High Number interpretation. It is also worth pointing out that the SET interpretation conveyed by periphrastic forms involving derived numerical nouns, i.e., like nouns in (2), is available for those cardinal numerals for which a synthetic form (i.e., a form from (1)) is also available.

1.2 Numerical nouns in *-arja*

The suffix *-arja* attaches to multiplicatives of 'five', i.e., ten, fifteen, twenty, twenty-five, etc. and the derived noun is necessarily preceded by the indefinite determiner *kamia* 'anyone', or, more rarely, by the (feminine) indefinite article *mia*:

- (10) Efaga kamia/mia dekarja/dekapendarja sokolates.
ate-1s *kamia*/one(a) ten-arja/fifteen-arja chocolates
'I ate some ten/fifteen chocolates.'

The interpretation of the above numerical expression is that of approximation, namely, (10) conveys the information that 'I ate *about ten (or fifteen) chocolates*'. Thus, *-arja* seems to contribute the approximative interpretation Kayne (2005a) associates with -AINE.

Kamia (masc: *kanis*, fem.: *kamia*, neut.: *kanena*) is included in the set of Negative Polarity Items of Greek (Giannakidou 1998); (11b) is ungrammatical because *kamia* appears in an affirmative environment. As (11a) suggests, *kanis/kamia/kanena* can also appear as an independent DP constituent. *Kanis/kamia/kanena* may also be licensed by non-veridical operators (Giannakidou 1998; Agouraki 1999), such as mood, (12).

- (11) a. Den irthe kamia (fititria).
Neg came-3s *kamia* (student-fem)
'No student came.'
b. *Irthe kamia fititria.
came-3s *kamia* student-fem
(12) Fere kanena pagoto!
bring-2s-IMPER *kanena* ice cream
'Bring some ice cream!'

To conclude, the obligatory presence of *kamia* with the numerical nouns in (10) does not match the conditions of its presence in (11) and (12), but seems to be licensed by the suffix *-arja*. At the same time, numerical nouns in *-arja* require the presence of the indefinite *kamia*.

2. A syntax for numerical nouns

The main idea to be developed in this section is that not all numerical nouns we described have the same structure: those in *-ada* with the SET interpretation and the approximative nouns in *-arja* have the properties of nouns introducing the pseudopartitive (PsP) construction. Numerical nouns with High Number reading fall either under the pseudopartitive construction or pattern with cardinals and quantifiers. Finally, the syntax of cardinal numerals in *-ada*, namely, multiplicatives of 'a thousand', is

³ Kayne (2005a:5) claims that 'in all languages, the multiplicand of a multiplicative numeral must be associated with a nominal suffix.'

contingent on one's analysis of ordinary cardinals (see Cardinaletti & Giusti 2005; Ionin & Matushansky 2006, for different proposals). Because of space limitations we will not discuss the last two types of numerical nouns any further here.

2.1 The pseudopartitive (PsP) construction in Greek

The fundamental property of the PsP in Greek (Stavrou 1983, 2003; Alexiadou, Haegeman & Stavrou 2007 – henceforth, Alexiadou et al.) is the juxtaposition of two nominals, which, crucially, share the same case, and no linking morpheme, such as the English *of*, intervenes. The first noun is preceded by the indefinite article, (13a), or a cardinal numeral or quantifier, (13b).

- (13) a. Agorasa mia kuta potiria.
bought-1s one pack-fem-acc glasses-neut-acc
'I bought a pack of glasses.'
- b. Agorasa tria/pola kutia bires.
bought-1s three/many boxes-neut-acc beers-fem-acc
'I bought three/many cans of beer.'

Nouns with this function include quantifier-like nouns (*zevgari* 'pair'), measure nouns (*kilo* 'kilo'), group nouns (*plithos* 'crowd'), classifier-like nouns (*kuti* 'box', *kuta* 'pack', *bukali* 'bottle') and partitive nouns (*meros* 'part', *komati* 'piece', *feta* 'slice'). All these nouns: a) are obligatorily preceded by a cardinal numeral or quantifier (cf. Chierchia 1998; Cheng & Sybesma 1999: 530), b) designate a certain quantity, amount, or number taken from the denotation of the noun that follows them. Quoting Larson (2003:251), who refers to Cartwright (1975): with the use of a measure phrase 'we count the *objects* that a count noun applies to and obtain a *number*. We sum the *quantities* that a mass noun applies to and we obtain their *amount*' (cf. also Kayne (2005b)), c) are relational, in that they require a noun which they measure or quantize. In this sense they are always complement taking (Chierchia 1998: 72; Löbel 1999), and d) are of the semi-lexical or semi-functional type displaying a varied degree of lexicality (or functionality) (van Riemsdijk 1998).

2.2 Numerical nouns with the SET interpretation

If we apply the diagnostics for the Greek PsP in Stavrou (1983, 2003), we conclude that the numerical nouns in *-ada*, in their SET interpretation, head the PsP construction.

- The numerical noun and the lexical noun share the same case, which depends on the (external) case assigner of the whole nominal phrase, (14). By contrast, in other nominal complexes involving two noun phrases, only the case of the first noun alternates depending on its structural position, (15).

- (14) a. *Dio dekadēs metaximatistes* ine malon arketi.
two ten-ades-nom transformers-nom are probably sufficient
'Twenty transformers are probably sufficient.'
- b. I genitria exi dinami *dio dekadon metaximatiston*.
the generator has power two ten-ades-gen transformers-gen
'The generator has the power of twenty transformers.'
- (15) a. *I katastrofi tis polis* itan odiniri.
the-nom destruction-nom the-gen city-gen was painful
'The destruction of the city was painful.'
- b. Den kserume ti prokalese *tin katastrofi tis polis*.
Neg know-3p what caused the-acc destruction-acc the-gen city-gen
'We don't know what caused the destruction of the city.'

- No determiner, quantifier or other modifier can intervene between the numerical and the lexical noun, (16a), unlike with other noun-complement complexes, (16b). The only modifiers that can precede the lexical noun are classificatory adjectives (or adjectives that are so used/interpreted), (16c):

- (16) a. Tris eksades (*afta ta) potiria.
 three six-ades these the glasses
 '(These) three sets of six glasses.'
- b. I katastrofi aftis tis polis.
 the-nom destruction-nom this-gen the-gen city-gen
 'The destruction of this city.'
- c. Tris eksades kristalina/??orea potiria.
 three six-ades crystal/nice glasses
 'Three sets of six crystal/nice glasses.'

• In the PsP construction the verb may agree in number with either the first or the second noun when these have different number specification, (17a), (Stavrou 1983, 2003; Alexiadou et al.), while in ordinary two-referent DPs, the verb agrees with the first (: head) noun, (17b):

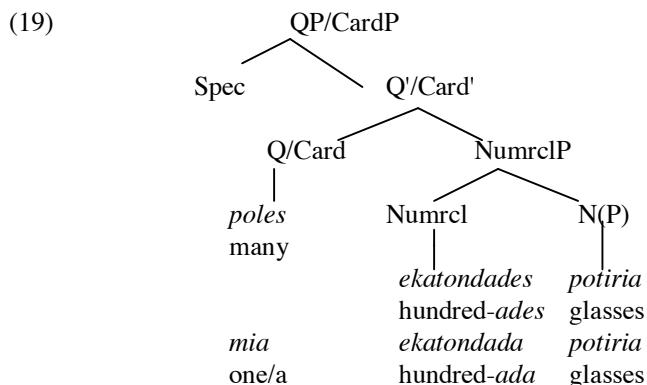
- (17) a. Ena buketo luludja itan pesmeno/-a sto patoma.
 a bunch flowers was/were thrown on-the floor
 'A bunch of flowers was on the floor.'
- b. I katastrofi ton vivlion mas stenoxoris-e/*-an.
 the destruction-fem the-gen-pl books-gen pl us depressed-3s/*-3p
 'The destruction of the books made us sad.'

Numerical nouns in their SET interpretation behave in a similar manner, with the verb having a tendency to agree with the second noun, something that we attribute to the high degree of functionality of the numerical noun:

- (18) a. ??Mia dekada potiria den ine arketi.
 a ten-ada glasses not is/are enough-sg
- b. Mia dekada potiria den ine arketa.
 a ten-ada glasses not is/are enough-pl

As has been claimed by a number of researchers (Selkirk 1977; Akmajian & Lehrer 1976; van Riemsdijk 1998; Löbel 1989; Vos 1999; Stavrou 1983, 2003; Alexiadou et al.), the fundamental property of the PsP construction is that *it is a unitary nominal phrase* with a single referent, despite the inclusion of apparently two 'nouns'.

In light of the evidence considered so far, we propose the structure in (19) for numerical nouns with SET interpretation (cf. Stavrou 2003; Alexiadou et al., for PsPs with classifier/measure nouns).



[QP=Quantifier Phrase, CardP=Cardinal Phrase, NumrclP=Numerical (noun) Phrase, N(P)=Noun Phrase]

In (19) case agreement between these three heads amounts to head-head agreement, which takes place in what is considered an extended maximal projection (M-projection) by van Riemsdijk (1998).

Two claims are made in Stavrou (2003) with respect to the PsP construction:

(i) (19) represents an indefinite nominal projection, lacking a DP layer. The head Q/Card parallels D in ordinary DPs, in turning the nominal (viz. a predicate) into an argument. A similar structure is proposed by Cheng & Sybesma (1999) for Mandarin CI+N sequences with an indefinite reading.

(ii) the complex [Q/Card +classifier/measure noun] behaves on a par with a (simplex) Q like *poli* ‘much’, *ligi* ‘few’ etc., or like cardinals, i.e., like *tria* ‘three’, *deka* ‘ten’, etc.

We assume that Numrc1+N sequences in (19) are also interpreted as indefinite nominal phrases. Below we present some suggestive, primarily syntactic, evidence to the effect that the sequence Q/Card+Numrc1 also behaves on a par with (simplex) Qs or like cardinals. The sequence Q/Card+Numrc1 and (simplex) Qs or cardinals (a) behave alike with respect to Split Topicalization, (20), (b) answer questions of quantity, (21), (c) occur in copulative clauses across the copula (22), and, (d) license N-ellipsis, (23).

- (20) a. Vivlia agorase pola/tria fetos.
books bought-3s many/three this-year
b. Vivlia agorase ikosipende/mia ekatondada fetos.
books bought-3s twenty-five/ a hundred-ada this-year
- (21) a. Posa vivlia diavases to kalokeri?
how-many books read-2s the summer
b. Pola/tria/ mia dekada.
many/three/a ten-ada
- (22) a. Ta vivlia pu agorase me to xartziliki tu ine pola /deka.
the books that bought-3s with the pocket-money his are many/ten
b. Ta vivlia pu agorase me to xartziliki tu ine mia ekatondada.
the books that bought-3s with the pocket-money his are a hundred-ada
- (23) a. I Maria agorase ena forema fetos ala i aderfi tis pola/ tria [~~foremata~~].
the Mary bought one dress this-year but the sister her many/three ~~dresses~~
b. I Maria agorase ena forema fetos ala i aderfi tis mia dekada [~~foremata~~].
the Mary bought one dress this-year but the sister her a ten-ada ~~dresses~~

Giannakidou & Stavrou (1999) have shown that ellipted N can be licensed by any overt agreeing specifier (adjective, quantifier, cardinal numeral). (23b) supports this claim, if, as we assume, numerical nouns preceded by card or Q behave on a par with ordinary cardinals/Qs. We take the structure in (19) to also be assigned to numerical nouns in *-arja*, with further inclusion of an Approximative projection above NumericalP, by the head of which the numerical noun is licensed.

Interestingly, English also appears to have numerical nouns paralleling those with the SET interpretation in Greek; these nouns appear to have a zero nominalizer:

- (24) a. a six/dozen of beer (i.e., a pack containing six/twelve cans of beer)
b. a six of cigarettes (i.e., a box/pack containing six packs of cigarettes)
c. a six of stilton (i.e., a set of six (little) packages of stilton)

The fact that *six/dozen* above is followed by ‘of’ suggests that, in English too, these items form part of the pseudopartitive construction, which, in turn, points to their nominal nature. Since they are morphologically numerals, one is led to conclude that they are ‘silently’ nouns, in the sense that they involve a silent counterpart of the Greek suffix *-ada*, which imparts the SET interpretation. This idea is also reminiscent of what Kayne (2005b) claims for partitive *de* in French (*peu de livres* ‘few of books’, *peu d’ argent* ‘little of money’), namely, that these cases involve an unpronounced noun, NUMBER, or, AMOUNT, akin to overt nouns number, amount, etc.

Quite surprisingly, there are instances (in American English) in which this nominalizing suffix is overt--(24d) matches (24b). However, the occurrence of this suffix is restricted, in the sense that it seems to appear only after monosyllabic numerals, hence the ungrammaticality of (24e):

- (24) d. a sixer of cigarettes e. ?*a hundreder of cigarettes⁴

⁴ We owe the data and related comments to Jerry Sadock.

2.3 Numerical nouns with the High Number interpretation

In what we have called the High Number interpretation, the (plural) numerical nouns *dekades* ‘tens’, *ekatondades* ‘hundreds’, *xiliades* ‘thousands’, denote a great number or a high concentration of items. Sequences like the ones in (5)-(6a-b) are actually structurally ambiguous, as they may be interpreted either as numerical heads in the PsP construction (19), or, as quantifiers, like *pola*, ‘many’, or cardinals, like *tria*, ‘three’. We consider this ambiguity to be related to the overt nominal morphology of the numerical expression, but in what follows we focus on the latter interpretation for reasons of space.

2.3.1 High Number numerical nouns as quantifiers

Three pieces of evidence show that High Number nouns also pattern with Qs or cardinals:

a) *Dekades* in (25a) has the distribution of an (quantificational) adjective. (25b) demonstrates the agreement pattern which holds between the noun and the article, as well as the prenominal adjective. Crucially, the article here does not agree with *dekades* but with the lexical noun, suggesting that *dekades* does not behave like a numerical head in the PsP of (19):

- (25) a. Ta/*I dekades lathi tu odigisan stin apolisi tu.
 the-pl-neut/fem ten-ades-fem mistake-pl-neut his led to-the firing his
 ‘His tens of mistakes led to his firing.’
 b. Ta/*I pola lathi tu me eksorgisan.
 the-pl-neut/fem many-pl-neut mistake-pl-neut his me infuriated
 ‘His many mistakes infuriated me.’

b) Possessive clitics normally encliticize on the head noun, (26a), (Alexiadou & Stavrou 2000; Kolliakou 1998; Stavrou & Horrocks 1989). When an adjective or some other prenominal modifier is present, the clitic may optionally encliticize on the adjective, (26b), (which is often the preferred option, provided prosodic well-formedness conditions are obeyed). Likewise, clitics may encliticize either on the noun, (26c), or on a quantifier that precedes it, (26d).

- (26) a. ta oreá vivlia tu
 the nice books his-cl
 b. ta oreá tu vivlia
 the nice his-cl books
 ‘his nice books’
 c. pola vivlia tu
 many books his-cl
 d. pola tu vivlia
 many his-cl books
 ‘many books of his’

Returning to High Number numerical nouns, we see that the clitic can encliticize on the numerical noun, (27a), a fact that points to the adjectival distribution and function of these numerals. Notice that clitics cannot follow the numerical nouns with the SET interpretation, (27b), but only the lexical noun.

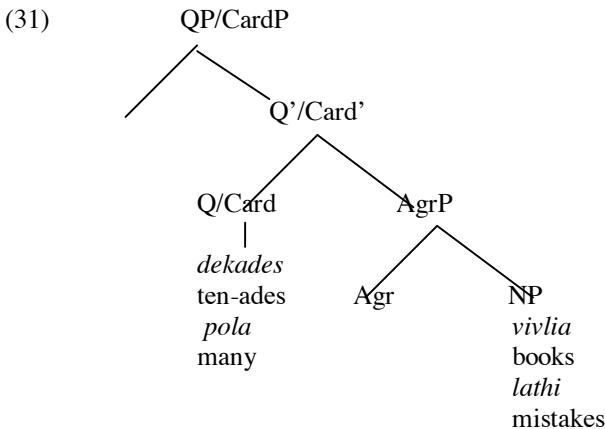
- (27) a. Sigxoresa (ta) xiljades tu lathi (tu).
 forgave-1s (the) thousand-ades his-cl mistakes (his-cl)
 ‘I forgave thousands of mistakes of his.’
 b. Zografisa tris dekades (*tu) potiria (tu).
 painted-1s three ten-ades (*his-cl) glasses (his-cl)
 ‘I painted three tens of glasses of his.’

c) Recall that only certain adjectives can appear between the numerical noun with SET interpretation and the lexical noun, cf. (16c), slightly altered as (28). However, any adjective can go between plural nouns in *-ades* in their High Number interpretation and the lexical noun, (29)-(30).

- (28) Agorase tris dekades kristalina/??orea potiria.
bought-3s three ten-ades crystal/nice glasses
'She bought three tens of crystal/nice glasses.'
- (29) Agorase dekades kristalina/orea potiria.
bought-3s tens crystal/nice glasses
'She bought tens of crystal/nice glasses.'
- (30) ta ekatondades entiposiaka/apithana/kakogusta/ftina/episima foremata
the hundred-ades impressive/incredible/bad taste/cheap/formal dresses

Taking the above into consideration, we hold that numerical nouns with High Number interpretation:

a) in indefinite bare DPs are Q heads on a par with other quantifiers (and cardinals), thus having the structure in (31). We adopt Giusti's (1991, 1997) and Cardinaletti & Giusti's (2006) system, in which Qs (and cardinals), when not preceded by the definite article, head a projection external to DP (their 'QP-hypothesis'). This is the distribution and function of nouns in (27a) in the version without the article, and in (29).



Note that numerical nouns in their High Number interpretation select an NP or nothing, (32a), thus, licensing noun ellipsis, just like Qs, (32b), something that ordinary adjectives cannot do, (32c):

- (32) a. Dekades (gates) efagan to psari.
ten-ades (cats) ate the fish
- b. Poles (gates) efagan to psari.
many cats ate the fish
- c. *Grizes (gates) efagan to psari.
grey (cats) ate the fish

b) when numerical nouns with High Number interpretation are preceded by the definite article, they function as descriptive adjectives with a quantity denotation. We hold that, in this function, they are specifiers of an agreement projection between DP and NP. This is their function in (25a), in (27a) in the version with the article, and in (30).

3. Conclusions

In this work we have identified two overt nominalizing suffixes in Greek, corresponding to the unpronounced -NSFX and -AINE suffixes that Kayne (2005a) has proposed for English numerical expressions.

We show that certain (sub) types of numerical nouns are of the semi-lexical type, on a par with measure or classifier nouns, and that, as such, they fall under the pseudopartitive construction. When in

the plural and emphatically stressed, numerical nouns convey a High Number interpretation, and we claim that in this case they also pattern with quantifiers (and cardinals).

Finally, we relegate the status of the isolated cases of numerical nouns which function as cardinal numerals, namely, those that involve *xilja* ‘a thousand’ as their multiplicand, to accounts of (complex) ordinary cardinals.

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