

Grammatical number in numeral-noun constructions

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1 Introduction

What is the syntactic relation between a numeral and a noun in a numeral-noun construction (NNC)?

- (1) two books

Two major approaches:

Spec-head: A projection of the numeral is the specifier of an XP in the extended projection of the noun (Corver & Zwarts 2006, Giusti 1997, Jackendoff 1977, Selkirk 1977)

Head-complement: The numeral is a head that takes as its complement an extended projection of the noun (Borer 2005, Cardinaletti & Giusti 1991, Giusti 1997, Ionin & Matushansky 2006, Ritter 1991, Shlonsky 2004)

Common implicit assumption: With few exceptions, NNCs have a uniform structure, language-internally and cross-linguistically. (Corver & Zwarts 2006, Ionin & Matushansky 2006, Zweig 2006, and many others)

Notable exception: Adjectival numerals In many languages, low numerals differ from higher ones and display typical adjectival syntax (Corbett 1978, Zweig 2006).

Modern Hebrew: 1 is adjectival, higher numerals are not.

- (2) a. sefer exad adom / sefer adom exad
book one red.SG / book red.SG one
'one red book'
- b. arba'a sfarim adumim
four books red.PL
'four red books' (Modern Hebrew)

But: 'Adjectival numeral' is often a gradient notion (Corbett 1978). Determining the lexical category of cardinal numerals is a separate issue.

Claim: Even non-adjectival numerals appear in more than one kind of structure.

Goals of this talk

1. To argue for the existence of *both* spec-head and head-complement numeral-noun constructions involving non-adjectival numerals

2. To show that the choice between these two constructions is constrained by the presence of morphosyntactic NUMBER

2 A dual analysis – some previous proposals

In Hebrew (and Arabic), numerals, like nouns, can appear in one of two forms: free or bound. Danon (1996, 1998): the free form is a specifier; the bound form is a head.

- (3) a. šlošà (sfarim)
three(FREE) books
'three (books)'
- b. šlòšet *(ha-sfarim)
three(BOUND) the-books
'the three books'
- (4) a. macevà
tombstone(FREE)
- b. macèvet *(šayiš)
tombstone(BOUND) marble
'a marble tombstone' (Modern Hebrew)

- Shlonsky (2004): all pronominal numerals in Hebrew and Arabic are heads; post-nominal numerals in Arabic are specifiers. (See also Borer 2005)
- Bailyn (2004), Pereltsvaig (2006): numerals in Russian are specifiers when the noun phrase receives structural case, and heads when it receives inherent/oblique case.

No real attempt has been made to generalize beyond language-specific analyses.

3 Against a uniform analysis

3.1 Some numerals are heads

Nelson & Toivonen (2000): In Inari Sami, a noun following a numeral between 2–6 bears accusative case, while a noun following a higher numeral is partitive.

Other languages in which the case of the noun depends on the numeral include Russian (and other Slavic languages) and Standard Arabic (Ionin & Matushansky 2006, Shlonsky 2004, Zabbal 2005).

- (5) šest sagov'
six step-GEN.PL
'six steps' (Russian; from Ionin & Matushansky 2006)

Multiplicative numerals Ionin & Matushansky (2006) (IM): Multiplicative numerals (like *three thousand* or *five hundred*) involve a recursive head-complement construction (roughly: [three [thousand [books]]]). This analysis is supported by case morphology in Russian. Potential problem: case distribution in NNCs bearing oblique/inherent case (Asya Pereltsvaig, p.c.).

3.2 Some numerals are not heads

Phrasal numerals Corver & Zwarts (2006): 'prepositional numerals' like *around ten* or *between ten and twenty* are single constituents, which serve as specifiers of a functional projection within the noun phrase. (See also Danon 1996, 1998 for similar, but language-specific, claims).

Case In many languages, presence of a numeral has no effect on the case of the noun:

- (6) Menq tv-el enq ayd harc-ə tasə masnaget-i.
We(NOM) give-PF.PART AUX that question-DEF.ACC ten specialist-DAT
'We gave that question to ten specialists.' (Eastern Armenian)
- (7) tesaron jinekon
four.GEN women.GEN
'of four women' (Greek; from Hurford 2003)

Free and bound numerals in Hebrew Most free numerals, as in (3a), are used when no overt noun is present, or with indefinite nouns; bound numerals are used mostly with definite nouns, as in (3b). The numeral 2, however, is used in the *bound* form *šney* even with indefinite nouns: (8); nevertheless, it cannot be coordinated with a free numeral like *šloša* ('three'): (9a).

- (8) a. šney sfarim
two(BOUND) books
'two books'
- b. *šnayim sfarim
two(FREE) books
- (9) a. *šney o šloša sfarim
two(BOUND) or three(FREE) books

- b. šnayim o šloša sfarim
two(FREE) or three(FREE) books
- c. šney sfarim o šloša
two(BOUND) books or three(FREE)

Free/bound forms in multiplicative numerals: IM's analysis makes the wrong prediction with respect to the choice of free or bound form for the 'decimal' part ('thousand' etc). In simple NNCs, the decimal numerals 10, 100, 1000 etc must be used in the bound form if they are pluralized ('tens', 'hundreds' etc) and followed by a noun: (10a). In multiplicative numerals, the *free* form of the pluralized decimal numeral is used:

- (10) a. alfey / *alafim sfarim
thousands(BOUND) / thousands(FREE) books
- b. šlošet alafim / *alfey sfarim
three(BOUND) thousands(FREE) / thousands(BOUND) books

Thus, according to IM's analysis, the grammatical DP in (10b) contains an embedded XP, *alafim sfarim*, which is otherwise ungrammatical.

Furthermore:

- 'X(BOUND) hundreds/thousands' versus 'X(FREE) milion'
- idiosyncratic form (*šva, tša*) for X in 'X(BOUND) hundreds/thousands'

Conclusion 1: A multiplicative numeral in Hebrew forms a constituent that excludes the noun (contra IM's analysis).

Conclusion 2: A uniform head-complement analysis is incompatible with Hebrew multiplicative numerals.

Word order Prediction of the uniform head-complement analysis: numerals should precede nouns in head-initial languages, and follow nouns in head-final languages. This prediction, however, turns out to be false:

- Head-final languages in which numerals systematically *precede* nouns: Amharic, Basque, Hindi, Persian and Turkish. Dryer (1992): "the two orders of numeral and noun are equally common among OV languages".
- Head-initial languages in which numerals follow nouns: Swahili and Thai. Dryer: this pattern is particularly common among the languages of Africa.

Word order in partitive constructions Greenberg (1978: 284): “If a language has NG order in the possessive construction, it has QN order in the partitive construction” (generalization 45); in English, NG *house of the man* correlates with the QN order in *three of the oranges*.

In some head-final languages, word order in partitive NNCs differs from the order in non-partitive NNCs:

- (11) a. liburu-etatik bost
book-PL.ABL five
'five of the books'
b. bost liburu
five book
'five books' (Basque)

Conclusion: In partitive constructions, but not in 'simple' NNCs, word order clearly supports analyzing the numeral as the head.

3.3 Head-complement NNCs and partitivity

Claim: Partitives are only one instance of head-complement NNCs; not all head-complement NNCs have a partitive interpretation.

Serbo-Croatian: Partitive/non-partitive ambiguity in NNCs Arsenijević (2006):

- (12) Ivan uze šest miš-eva.
Ivan took six mice.GEN
'Ivan took six mice.' / 'Ivan took six of the mice.' (SC; Arsenijević 2006)

Welsh: a non-partitive reading in either a 'simple' or a 'partitive' construction, with no semantic difference between these two construction types (Sadler 2000):

- (13) a. tri ddyn
three man
'three men'
b. tri o ddynion
three of men
'three men' (Welsh)

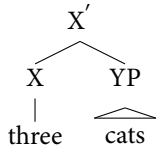
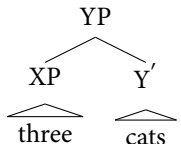
English: The same form that is used in partitive constructions (*n of...*) is also used in constructions with no partitive meaning:

- (14) a. ten of the books
b. tens of books

Claim: Head-complement NNCs (with or without a prepositional element) exist with both partitive and non-partitive readings.

3.4 Intermediate summary: Two structures

Crosslinguistic variability in the choice between the 2 options in (15):

- (15) a.  (head-complement)
- b.  (spec-head)

(15a) often resembles partitives, but does not necessarily have a partitive reading.

4 Constraining the choice of construction

Is there any systematic pattern governing the choice between the two types of NNC?

Hypothesis: The choice is constrained by the availability of case and NUMBER features.

4.1 Morphosyntactic NUMBER

Observation: In a wide variety of typologically unrelated languages, morphological number marking on the numeral or on the noun correlates with a different structure from the one that is used where there is no number morphology.

4.1.1 NUMBER on numerals

PLURALIZED NUMERALS: *tens, hundreds, thousands...*

In many languages, NNCs with pluralized numerals differ structurally from other NNCs:

- (16) a. million books
b. millions *(of) books

- (17) a. hat gyerek
six child
'six children'
- b. gyerek-ek szaz-a-i
child-PL hundred-POSS3SG-PL
'hundreds of children' (Hungarian)
- (18) a. on kitap
ten book
'ten books'
- b. on-lar-ca / *on-lar kitap
ten-PL-MANNER / ten-PL book
'tens of books' (Turkish)

Plural morphology on numerals in Hebrew With indefinite nouns, pluralized numerals appear in the bound form:

- (19) a. esrot / *asarot sfarim
tens(BOUND) / tens(FREE) books
'tens of books'
- b. asara / *aseret sfarim
ten(FREE) / ten(BOUND) books
'ten books' (Modern Hebrew)

Danon (1998): The numeral *šnayim* ('two'), unlike other simple numerals (and like pluralized numerals), is used in the bound form *šney* in a NNC:

- (20) šney / *šnayim sfarim
two(BOUND) / two(FREE) books
'two books' (Modern Hebrew)

šnayim has plural morphology – the suffix *-ayim*.

Number constraint (1st version): Morphosyntactic NUMBER on the numeral forces a head-complement NNC.

Problem: in Hebrew, the numerals 20, 30, 40..., 200 and 2000, seem morphologically plural (end with the suffix *-im/-ayim*); yet they do not seem to appear in a bound form:

- (21) šlošim (sfarim)
thirty books

Unlike other numerals, however, these numerals do not have a distinct bound form (**šlošey*), which is obligatory in (non-partitive) head-complement NNCs in Hebrew.

Number constraint (2nd version): Morphosyntactic NUMBER on the numeral forces a head-complement NNC if possible.

4.1.2 NUMBER on nouns

In many languages, a morphologically *singular* noun is used in the presence of a numeral (Ortmann 2000).

Ionin & Matushansky (2006): The presence or absence of plural marking on nouns in NNCs is 'vacuous', as it seems to add nothing to the interpretation of the noun phrase.

Observation: Plurality *is* marked in partitive and other head-complement constructions in these languages. Examples: Welsh NNCs (13); Basque partitives (11); Hungarian pluralized numerals (17)

Generalization: Even if a language disallows number morphology in 'simple' (spec-head?) NNCs, it allows/requires it in (some?) head-complement NNCs.

4.1.3 NUMBER features and semantic number

Do numerals like *ten* carry a NUMBER feature?

PLURAL? If *ten* is PLURAL, then what is *tens*? What feature distinguishes between *ten* and *tens*? And why isn't PLURAL expressed morphologically on *ten*?

SINGULAR? If *ten* is SINGULAR, then what does this feature contribute to the compositional semantics of the DP? Can it be interpreted?

Proposal:

- NUMBER features on nouns and numerals are interpreted 'normally'.
- Not all numerals and nouns carry NUMBER features.
- Semantic number is not always encoded as NUMBER features.

4.2 Case

Case morphology or 'dummy' prepositions depend on the type of NNC:

Case constraint: Head-complement NNCs involve DP-internal case assignment to a projection of the noun that excludes the numeral; no such case assignment takes place in spec-head NNCs.

5 Crosslinguistic variation

Case: Languages vary with respect to the availability of the following case assignment mechanisms in head-complement constructions:

- direct case assignment by the numeral
- prepositional case

Number: Languages vary with respect to the presence of morphosyntactic NUMBER features on numerals and nouns:

- In some languages, all numerals/nouns carry a NUMBER feature
- In some languages, numerals/nouns may appear with no NUMBER feature

5.1 Examples

5.1.1 English

Numerals (like nouns and adjectives) cannot assign case, so head-complement NNCs in English require using the prepositional element *of*.

- Pluralized numerals: head-complement (forced by the number constraint)
- Other NNCs: spec-head (no constraint; *of* as last resort?)

5.1.2 Hebrew

Numerals in their free form cannot assign case; numerals in the bound form assign case.

- Pluralized numerals, *šney* ('two'), numerals+definite: head-complement (sometimes forced by the number constraint)
- Other numerals: spec-head

5.1.3 Standard Arabic

Numerals in their free form cannot assign case; numerals in the bound form assign case. Numerals in the bound form determine the morphological case of the noun that follows (genitive for 1–10; accusative for 11–99), thus instantiating in a very clear way the properties of the head-complement construction.

- Any numeral in a NNC: head-complement (=bound form)
- Numerals in isolation: free form

5.1.4 Welsh

- Pluralized numerals: head-complement using the preposition *o* ('of'), forced by the number constraint: (22)
- Other numerals: free alternation between head-complement (with NUMBER on the noun) and spec-head (no NUMBER on the noun): (13)

- (22) a. cannoedd o lyfrau
hundreds of books
'hundreds of books'
- b. *cannoedd llyfr
hundreds book

5.2 Extensions and apparent counterexamples

5.2.1 Russian

Nouns can assign case, so the head-complement construction 'comes for free'. Mostly head-complement NNCs, like Arabic (see also Zabbal 2005).

Problem 1: No 'real' pluralized numerals, only pluralized nominal 'numerals' (Asya Pereltsvaig, p.c.):

- (23) a. desjat' / desjatok knig
ten.NUM / ten.N books.GEN
'ten books'
- b. desjatki knig
tens.N books.GEN
'tens of books' (Russian)

Observation: nominal plurality on numerals is a relatively rare option.

Problem 2: According to Bailyn (2004), Pereltsvaig (2006), numerals in Russian are heads only when the whole DP bears oblique/inherent case.

5.2.2 Finnish

Mostly head-complement NNC, where the noun (which is morphologically singular) receives partitive case from the numeral:

- (24) kolme kirjaa
three book.PART
'three books' (Finnish)

Pluralized numerals: the noun is in the plural; same case on the numeral and on the noun:

- (25) a. sadat tähdet
100.PL.NOM star.PL.NOM
'hundreds of stars' (nominative)
- b. satoja tähtiä
100.PL.PART star.PL.PART
'hundreds of stars' (partitive) (Finnish)

Counterexample to the number constraint?

- Case concord means this is not a head-complement NNC
- Both the numeral and the noun carry number morphology

Solution: these are not *two independent* NUMBER features, but one; multiple realizations are the result of agreement.

This applies also to the following construction (from Hurford 2003):

- (26) neljät silmät
4.PL.NOM eye.PL.NOM
'four pairs of eyes' (Finnish)

The number constraint (revised): Presence of *two independent* NUMBER features on the noun and on the numeral forces a head-complement NNC if possible.

5.2.3 Dutch

Dutch and some other Germanic languages: pluralized numerals seem to combine with plural nouns in the same way that unpluralized numerals do:

- (27) honderd(en) koeien
hundred(s) cows
'a hundred cows/hundreds of cows' (Dutch)

According to the analysis proposed above, this must be a head-complement construction; but what about case assignment?

Unlike English, no preposition similar to *of* is needed with measure nouns:

- (28) een kudde koeien
a herd cows
'a herd of cows' (Dutch)

Therefore, whatever makes (28) possible with respect to case applies also to (27).

5.2.4 Indonesian; Armenian

Indonesian seems to use the same kind of structure with pluralized numerals as with nonpluralized ones:

- (29) a. se-ratus pohon
one-hundred tree
'a hundred trees'
- b. ratus-an pohon
hundred-PL tree
'hundreds of trees' (Indonesian)

But: the plural marking on pluralized numerals is morphologically different from nominal plurality: suffix *-an* on numerals, vs. reduplication for nouns (*pohon pohon*, 'trees').

Possible solution: Pluralized numerals in Indonesian don't really carry a morphosyntactic NUMBER feature as nouns do, which is what the number constraint is sensitive to.

Similarly, in Armenian: pluralized numerals do not have the same plural morphology as nouns do; based on case marking, these seem to form spec-head NNCs:

- (30) tasn-yak grq-er
ten-PL? book-PL
'tens of books' (Eastern Armenian)

6 Conclusion

- Theoretical generalizations from one language to all languages should be empirically justified (obviously?)
- NUMBER features play a role in constraining syntactic structure
- NUMBER features \Rightarrow semantic number, but not vice versa

Open questions and further directions

- Possible explanation for the number constraint: Every NUMBER feature has to be licensed by case.
- What is the lexical category of numerals? How are they different from nouns?

Feedback and data from additional languages would be highly appreciated! ☺

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