English prepositional numeral constructions

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Abstract

This paper discusses the syntactic properties of 'prepositional numeral constructions (PNCs)' in English, which is exemplified by *about 250 babies* and *over 16,000 animals*. In PNCs a preposition is followed by a numeral. Previous analyses have claimed that the preposition and the numeral make a prepositional phrase in PNCs, but we argue that this is not a satisfactory approach. In HPSG there are some possible analyses that might be proposed, but there are reasons for supposing that the best analysis is one in which the preposition is a functor, a non-head selecting a numeral head.

1 Introduction

This paper discusses the syntactic properties of 'prepositional numeral constructions' (Corver & Zwarts (2006); henceforth PNCs) in English.[1] PNCs involve a preposition, a numeral and a noun. Typical examples are in (1), cited from BNC-BYU.[2]

(1) a. about 250 babies
    b. around 300 performances
    c. over 16,000 animals
    d. under 300 pupils

(1a), for example, has a preposition *about*, a numeral *250* and a noun *babies*.

This paper focuses on the syntactic properties of PNCs. We will look at some important data first, and then we will see how HPSG can deal with them.

2 Basic Data

The following two pieces of evidence show that PNCs are NPs. First, PNCs can involve a determiner like normal NPs. (2a) and (2b) are from BNC-BYU and (2c) from COCA[3].

(2) a. *the* around 2,800 delegates
    b. *the* over three hundred entries

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[1]For semantics, see Nouwen (2010) and Corver & Zwarts (2006).

[2]Davies (2004–)

[3]Davies (2008–)

c. *these* about 7,000 protesters

In (2a) and (2b) the PNCs contain determiner *the* and in (2c) the PNC contains plural determiner *these*.

Second, PNCs can be an antecedent of a pronoun.

(3) a. There were **about thirty men** and *they* had two prisoners.
(BYU-BNC: FRX W_fict_prose)

b. In each one of these tanks, we have **around 500 silversides** and *they* are very torpedo-shaped.
(COCA: 2006 SPOK NPR_ATCW)

In the examples in (3) the PNC *about thirty men* (3a) and *around 500 silversides* (3b) are the antecedents of pronoun *they*.

The following data show that the noun following the numeral is the head of a PNC. When a PNC is a subject, the number agreement with the verb depends on the grammatical number of that noun: (4a) has singular agreement because *year* is singular, and (4b) has plural agreement because *years* is plural.

(4) a. [Over one *week*] has/*have passed.

b. [Over three *weeks*] have/*has passed.

In (4a) the subject is *over one week* and the verb is *has*. It has singular agreement because *week* is the head and it is singular. In (4b) the subject is *over three weeks* and the verb is *have*. It has plural agreement because the head is *weeks* which is plural.

The pre-numeral element in PNCs is a preposition although it might look like an adverb, like *approximately* and *roughly* in (5b).

(5) a. *around/about* eighty books

b. *approximately/roughly* eighty books.

In (5a) *around* and *about* might look like *approximately* and *roughly* in (5b), because they are all in the same, pre-numeral position, and they are also similar in meaning. The pre-numeral element in PNCs, however, behaves like a normal spatial preposition in that it can be modified by *somewhere* (Corver & Zwarts 2006:822). (6) is an example of a spatial preposition and *somewhere*.

(6) (...) the Thames will break through **somewhere** *around* Poplar High Street (...). (BNC-BYU: HW8 W_fict_prose)

In (6) the spatial preposition *around* is modified by *somewhere*.

The examples in (7) illustrate PNCs modified by *somewhere*.

(7) a. We've bought (**somewhere**) *around* fifteen books.
(Kayne 2010:48)

b. (⋯) there was **somewhere** *over* one meter of ice melting at this particular site in the ensuing year.
(COCA: 2001 SPOK NPR_Science)

c. (...) **somewhere** *under* 748 people are struggling specifically with food.
(http://socialismoryourmoneyback.blogspot.jp/2014/02/uk-now-face-real-hunger-problem.html)

In (7a), for example, the PNC *around fifteen books* is modified by *somewhere* in the same way as the spatial preposition in (6).

As (8) shows, adverbs *approximately* and *roughly* do not allow modification by *somewhere*.

(8) ***somewhere** *approximately/roughly* eighty books

Thus, the initial element of PNCs allows modification by *somewhere*. We can conculde, then, that they are prepositions, not adverbs.

The fact that a complex preposition can appear before the numeral also indicates that the prenumeral element is not an adverb (Corver & Zwarts 2006:823-4).

(9) a. *from* ten *to* fifteen judges
b. *in excess of* ninety delegates
c. *up to* twenty minutes (Huddleston & Pullum 2002:357)

The examples in (9) have complex prepositions like *in excess of* or *up to*, and they are clearly not adverbs. As one would expect, they can be modified by *somewhere*.

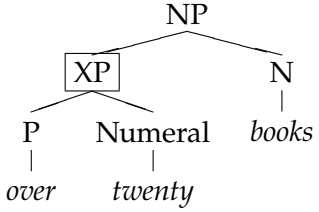
(10) a. **somewhere** *from* 500,000 *to* 650,000 people
(http://www.memphismagazine.com/December-2006/The-Return-of-the-Spanish-Lady-pt-II/)

b. **somewhere** *in excess of* 50 scuds
(COCA: 1991 SPOK ABC_Nightline)

c. **somewhere** *up to* 100,000 people
(http://www.huffingtonpost.ca/glen-pearson/sudan-independece_b_873072.html)

The above points indicate that a PNC has something like the following structure.

(11)



(11) shows that a preposition and a numeral combines to make a constituent, and that constituent combines with a noun.

The following example shows that this is a right analysis.

(12) a. [over thirty] but [under fifty] students
b. [over thirty] but [not more than forty] students[4]

In the examples in (12) *over thirty* is conjoined with another prenominal phrase *under fifty* and *not more than forty*, respectively. These examples show that *over thirty* makes a constituent.

What is the prenominal constituent (XP in (11)), then? A possible analysis might be that it is a PP, composed of a prepositional head and a numeral as its complement. In the next section we will see that there are some objections to this analysis.

3 PP analysis of the prenominal phrase

Aarts (2011) states that the prenominal constituent is a PP.

(13) [$_{NP}$ [$_{PP}$ over twenty] Iranians] (Aarts 2011:119)

In (13) *over twenty* is a constituent and it is a PP. Corver & Zwarts (2006) also argue that the prenominal constituent is a PP. They claim that the N and the prenominal phrase are merged inside the NP and make a small clause. The prepositional numeral then moves up to Spec NumP for checking its cardinality feature with the Num head.

(14) [$_{NumP}$ [$_{PP}$ around 20]$_i$ [$_{Num'}$ NUM [$_{NP}$ children t$_i$]]]
(Corver & Zwarts 2006:828)

However, the PP analysis of the prenominal element is not without problems. First, unlike a normal PP, it is in the prenominal position. (15) shows that the normal PP *on the desk* should be in the postnominal position.

(15) a. *[on the desk] books[5]
b. books [on the desk]

However, PNCs should be in the prenomial position, not postnominal position.

(16) a. [over thirty] books

[4]Bob Borsley, p.c.

[5]The italicised phrases in the following examples are PPs, but we follow Sadler & Arnold (1994:189) in assuming that they are the result of some word formation process.

(i) an *on board* entertainment console

(ii) an *up-to-the-minute* new report (Sadler & Arnold 1994:189)

b. *books [over thirty]

(16a) shows that *over thirty* should be in the prenominal position. This indicates that *over thirty* is different from a normal PP, which should be postominal.

The second problem is related to the following generalisation: modifiers with complements are systematically excluded from the prenominal position in English (Sadler & Arnold 1994:190).

(17) a. a child [grateful [for the present]]
b. *a [grateful [for the present]] child (Sadler & Arnold 1994:189)

In (17a), *grateful for the present* is a modifier for *child*, and it is in the postnominal position because *grateful* is a head and *for the present* is its complement. (17b) shows that *grateful for the present* cannot be a prenominal modifier: it contains a complement. If the prenominal element in a PNC was a PP, it would pose a serious challenge for the above generalization because a PP contains a complement and it should be excluded from the prenominal position.

It seems, then, that the PP analysis of the prenominal element of PNCs is unsatisfactory.

4 The prenominal phrase is a numeral

In this section we will see some pieces of evidence that the prenominal phrase of PNCs is headed by the numeral, not the preposition. First, it occurs in the prenominal position like normal numerals.

(18) a. [thirty] books
b. *books [thirty]

(19) a. [over thirty] books
b. *books [over thirty]

The examples in (18) shows that *thirty* should be in the prenominal position, and (19) shows that *over thirty* should be in the prenominal position too. They show that *over thirty* behaves in the same way as *thirty* in terms of positioning.

Second, it can appear in the position which is typically filled by a numeral. In the noun phrase constructions in (20) the head noun is plural but it has an indefinite article, and there are an adjective and a numeral between them. In (20a) for example, the head noun is *years*, which is plural, but it has an indefinite article. Between the indefinite article and the head noun there are an adjective (*amazing*) and a numeral (*fifty*).

(20) a. an amazing [fifty] years

b. a negligible [ten] people
c. an estimated [100] men
d. an additional [100] jobs

It is possible to say that the prenominal position of these constructions is a position for numerals. This numeral position can be filled by a combination of a preposition and a numeral, as illustrated by the following examples.

(21) a. an amazing [over fifty] years
b. a negligible [under ten] people
c. an estimated [around 10,000] students
d. an additional [about 100] jobs

In (21a), for example, *over fifty* fills the same position as *fifty* in (20). This means that the combination of a preposition and a numeral functions as a kind of numeral, and that means the numeral heads the combination.

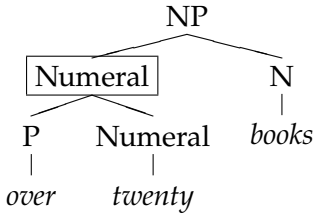
Third, the prenominal phrase involving *one* can function as a determiner, like the numeral *one*.

(22) a. *(one) year
b. *(around one) year

In (22a) *year* is a singular countable noun, and it is ungrammatical if it does not have a determiner *one*. In (22b) *around one* functions as a determiner, exactly like *one*. This means that *around one* works exactly like *one*, which means *one* is the head.

The above pieces of data show that the prenominal phrase of a PNC behaves like a numeral. This means that the numeral heads the prenominal phrase. What we want is roughly structures like (23).

(23)



(23) shows the combination of a preposition and a numeral functions as a numeral.

5 HPSG Analyses

It is important to note that only a limited variety of prepositions can appear in PNCs. With their spatial meaning, the pairs of prepositions in (24) are almost interchangeable.

(24) a. The water came up *above*/*over* our knees. (Swan 2005:3)
b. I'd like to travel *around*/*round* the world. (*ibid.*:50)
c. Look in the cupboard *below*/*under* the sink. (*ibid.*:85)

With their spatial meaning, *above* and *over* in (24a), *around* and *round* in (24b) and *below* and *under* in (24c) have almost the same meaning, and they are interchangeable in these sentences.

However, only one of each pair is available in PNCs.

(25) a. She had *over*/**above* thirty pairs of shoes. (Sinclair 2004:5)
b. He owns *around*/**round* 200 acres. (*ibid.*:39)
c. There were *under*/**below* twenty people at the lecture. (Swan 2005:86)

The examples in (25) show that *over*, *around* and *under* can be used in PNCs but *above*, *round* and *below* cannot.

These pieces of data show that we need a framework which provides representations detailed enough to grammatically differentiate *over*, *around* and *under* from *above*, *round* and *below*, respectively, and to capture the idiosyncratic properties of the former type of prepositions. HPSG is such a framework.

The lexical description of a normal preposition which takes a noun as its complement is something like the following.

(26) $\begin{bmatrix} \textsc{head} & \textit{preposition} \\ \textsc{comps} & \langle \begin{bmatrix} \textsc{head} & \textit{noun} \end{bmatrix} \rangle \end{bmatrix}$

(26) says that normal prepositions take a noun as their complement. It is clear that the prepositions in PNCs have quite different properties from those of normal prepositions. They do not form a prepositional phrase with the following numeral. Rather, the numeral functions as a head and the phrase behaves as a numeral.

In the rest of this section we will look at three possible HPSG analyses of the prepositions in English PNCs. The first and second analyses appear to be unsatisfactory, but the third seems to give a satisfactory account of the facts.

5.1 Weak head analysis 1

We will first consider an analysis in which PNCs in English are treated in the same way as the similar constructions in Polish. Przepiórkowski (2013) analyses the Polish preposition *po* in examples like (27) as a weak head .

(27) W pokojach będą po dwa fotele. [Polish]
in rooms be-FUT.PL DISTR two-NOM.PL armchair-NOM.PL

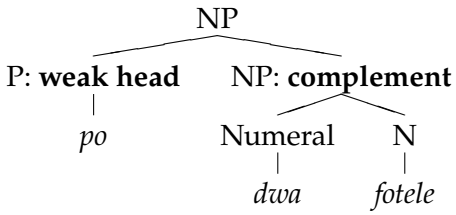
'There will be two armchairs in each room.'

(Przepiórkowski 2013:166)

The word *po* is a preposition encoding distance distributivity: it 'attaches to the noun phrase denoting the distributed quantity and looks elsewhere in the sentence for the set to distribute over' (Przepiórkowski 2013:162). I in (27) the preposition is followed by numeral *dwa* 'two', and the numeral in turn is followed by noun *fotele* 'armchair'. The resulting phrase looks really like an English PNC. In this sentence this phrase functions as a subject: it is nominative and induces plural agreement with the verb.

Przepiórkowski (2013) claims that *po* in (27) is a weak head (Tseng 2002, Abeillé et al. 2006) taking *dwa fotele* 'two armchairs' as its complement. This produces a right branching structure like the following schematic representation.

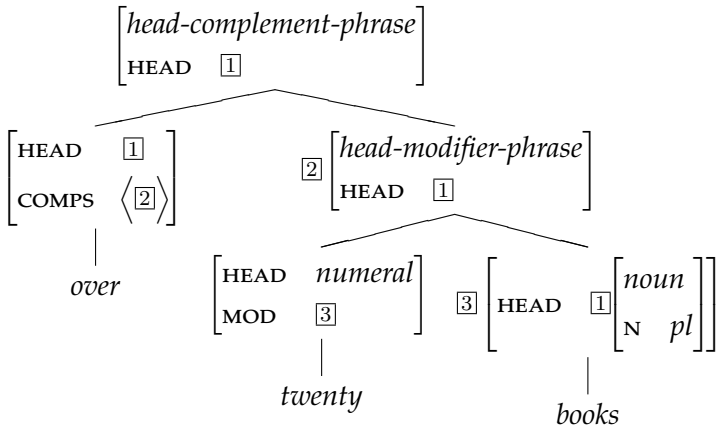
(28)



A weak head inherits most of syntactic and semantic properties of its complement and those properties are passed on to the phrasal level. This propagation of information from non-heads to phrases can account for the fact that the prepositional phrase can act as a nominative noun phrase and induces plural agreement with the verb: *po* inherits the grammatical case and number of the complement NP and passes them onto the mother node.

An analysis of PNC prepositions in English as a weak head would produce structures like (29). As there is no clear evidence that English numerals head noun phrases, it is assumed that numeral *twenty* is a modifier, making a head-modifier phrase with the head noun *books*. As a value of a HEAD feature, the information about number (indicated as a value of NUMBER (N)) is inherited from *books* to *twenty books*. The weak head preposition *over* takes *twenty books* as its complement and the information about the number is inherited to *over* as part of the HEAD value. That information is propagated to the top node, and the whole phrase can behave like a plural noun phrase.

(29)

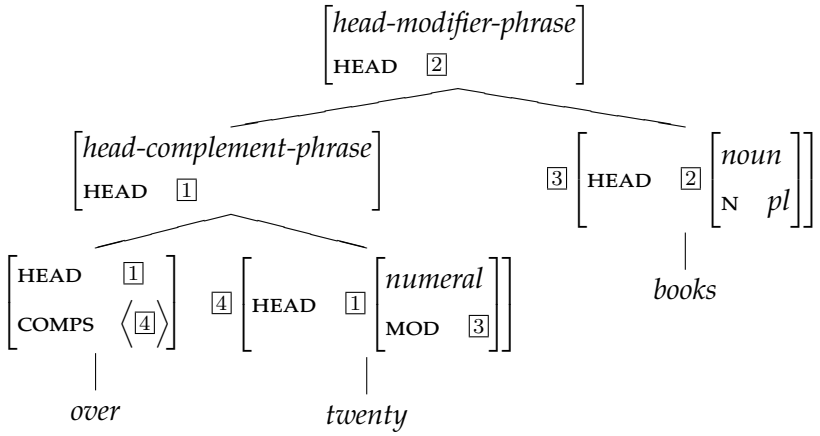


It seems that Przepiórkowski's (2013) analysis works for the Polish data, but the examples observed in section 1 pose a problem for analysing English PNCs along these lines. In that section we claimed that the PNC is an NP with a left branching structure, in which the head noun is preceded by a combination of the preposition and the numeral, as described in (23). In the weak head analysis 1 the PNC is an NP, but it is headed by a (weak head) preposition which takes a combination of the numeral and the noun as its complement. This analysis produces a right branching structure and is incompatible with our conclusion about the constituent structure of PNCs (23).

5.2 Weak head analysis 2

One might argue for an analysis in which the weak head preposition takes a numeral as its complement and the resulting phrase combines with the head noun. This analysis would produce structures like (23).

(30)



In (30) the weak head *over* takes *twenty* as its complement. As a weak head *over* inherits the value of HEAD feature of its complement. This allows the

phrase *over twenty* to have the same MOD value as *twenty* and combination with *books* is possible.

However, there is an objection to this analysis. As discussed in section 3 modifiers with complements are systematically excluded from the prenominal position in English. In (30), however, *over twenty* containing a complement *twenty* is a modifier of *books*. Thus, this structure is incompatible with the generalisation.

We conclude, then, that the approaches employing weak heads are unsatisfactory.

5.3 Functor analysis

We will turn to an analysis which we think provides a satisfactory analysis of the data. In this analysis prenominal elemensts, such as adjectives and determiners, are uniformly treated as 'functors' (Van Eynde 2006, 2007, Allegranza 1998). Functors are non-heads which select heads. The combination of the functor and its head (called 'head-functor phrase') is subject to the following constraint (Van Eynde 2006:164).

(31) *head-functor-phrase*

$$\rightarrow \begin{bmatrix} \textsc{daughters} & \langle \left[\textsc{sel} \quad \boxed{1}\right], \boxed{2}\left[\textsc{synsem} \quad \boxed{1}\right]\rangle \\ \textsc{head-daughter} & \boxed{2} \end{bmatrix}$$

Constraint (31) states that in a phrase of type *head-functor-phrase* the non-head daughter selects the head daughter. The selection is indicated as the value of the SELECT (SEL) feature.

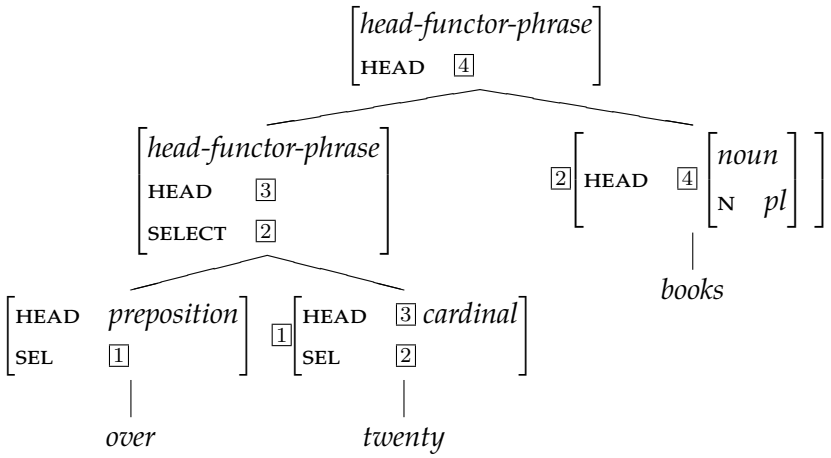
With these assumptions the lexical description of prepositions in PNCs is something like the following.

(32) $$\begin{bmatrix} \textsc{head} & \textit{preposition} \\ \textsc{sel} & \left[\textsc{head} \quad \textit{cardinal}\right] \end{bmatrix}$$

(32) states that prepositions in PNCs select a cardinal numeral. It is a sort of functor, which selects a head.

The internal structure of PNCs can be analysed as in (33).

(33)



The preposition *over* combines with *twenty* to form a head-functor phrase, utilising the SELECT specification (1). The head daughter's SELECT value is propagated to the mother node (2). The phrase *over twenty* combines with the head noun *books* to form another head-functor phrase, utilizing the SELECT value 2 inherited from *twenty*. The head daughter's HEAD value is the same as that of the mother node (3, 4 and 5).

In (33) *over twenty* has the same HEAD value as *twenty*, and it works as a numeral. The NP *over twenty books* has the same HEAD value as *books*. As a result, *over twenty books* behaves as a plural noun in the same way as *books*.

The functor analysis can handle the problems we noted with the previous analyses in section 3. First, this analysis can produce left branching structures, which we argued to be a right analysis. Second, the combinations of the preposition and the numeral are not PPs but phrases headed by the numeral so it is natural that they occur in the prenominal position in the same way as bare numerals. Finally, the numeral in the PNCs is not a complement of the preposition so it does not contradict the generalisation that prenominal modifiers do not take a complement.

The functor anaysis is more satisfactory than the weak head analyses because it can accommodate all the data observed in section 1 and does not contradict the generalisation that prenominal modifiers do not take a complement.

6 Further data

In section 4 we argued for the claim that in PNCs the combination of a preposition and a numeral functions as a numeral. This might lead one to wonder why the following phrases are bad.[6]

(34) a. *over over twenty books

[6]I would like to thank Emily Bender and Dan Flickinger for bringing these problems to my attention.

b. *a hundred over twenty

In (34) *over* combines with *over twenty*, which in our analysis should behave syntactically like normal numerals like *twenty* in (35).

(35) a. over [twenty] books
b. a hundred [twenty]

It appears that numerals and PNC prepositions should not combine with a numeral which has already been combined with a preposition. To capture this constraint, we introduce the MARKING (MRK) feature and argue that the MRK value of PNC prepositions is *pnc*. We assume that in a head-functor phrase the MRK value is inherited from the functor daughter to the phrase (Van Eynde 2006, 2007). The above constraint can be accommodated if we specify that numerals and PNC prepositions do not combine with an element which has *pnc* as its MRK value.

Thus, the lexical description of a PNC preposition in (32) should be modified as in the following.

(36)
$$\begin{bmatrix} \textsc{head} & \textit{preposition} \\ \textsc{sel} & \begin{bmatrix} \textsc{head} & \textit{cardinal} \\ \textsc{mrk} & \neg\, \textit{pnc} \end{bmatrix} \\ \textsc{mrk} & \textit{pnc} \end{bmatrix}$$

(36) states that prepositions of PNCs have *pnc* as its MRK value and select a cardinal numeral which does not have *pnc* as its MRK value.

7 Conclusion

We provided a detailed description of English PNCs and especially of the prepositions employed in the constructions. We then considered how PNCs should be analysed within the framework of HPSG. We looked at three different analyses: two in terms of weak heads and one in terms of functor daughter, and showed that the funtor analysis provides a satisfactory account of the data. We employed only existing and independently motivated theoretical apparatus.

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