

# ON THE SYNTAX AND SEMANTICS OF NUMERALS IN ENGLISH

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0. In his 1977 monograph, an extensive study of  $\bar{X}$  syntax, Jackendoff attempts to accomplish cross-category generalizations by proposing a set of syntactic distinctive features which distinguish among lexical categories, and by postulating a general rule schema called the *Uniform Three-Level Hypothesis* (henceforth, UTLH) which restricts the class of types of possible phrase structures.<sup>1</sup>

In this paper, I will be concerned with one of the issues discussed there, the grammar of numerals, with particular attention to a construction such as (1).

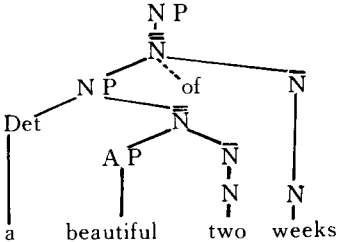
(1) a beautiful two weeks (Jackendoff)

This type of construction has received little attention within generative grammar, mainly because the traditional system of phrase structure rules does not provide any structural basis for it.<sup>2</sup> I will pursue Jackendoff's claim that the UTLH offers an appropriate underlying structure for this type of construction and generalizes the grammar of numerals into that of NP specifiers.

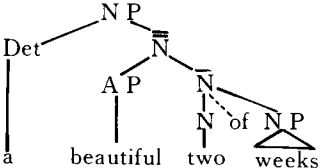
Section 1 reviews Jackendoff's analysis and an alternative analysis proposed by Takahashi (1981). In section 2, I argue for Jackendoff's analysis, presenting further empirical support for it. Section 3 discusses a problem that arises with respect to the scope of an adjective occurring within the NP specifier. I will show that an independently motivated condition proposed by Akmajian and Lehrer (1976) gives solution to this problem.

1.0 Assuming that numerals are nouns, the UTLH provides two alternative analyses of (1); one employs the structure in (2), and the other that in (3), as underlying structures.<sup>3</sup> I will call the former the *Pseudopartitive Analysis* (henceforth, PPA) and the latter the *Partitive Analysis* (henceforth, PA).

(2) *Pseudopartitive Analysis*



(3) *Partitive Analysis*



Jackendoff (1977) proposes the PPA, which assumes that the sequence *Det-AP-Numeral* constitutes an NP occupying the  $\overline{N}$  specifier position, and Takahashi (1981) proposes the PA, which assumes a numeral to be the head of the matrix NP with a plural noun being a complement to it. Though these two analyses are both permitted by the UTLH, the assumptions on which they are based are different.

1.1 In support of the PPA, Jackendoff argues that numerals have a number of syntactic properties in common with seminumerals and group nouns. Consider the following examples.

- (4) a miserable few people (Jackendoff)  
 (5) a tremendous group of people (*idid.*)

(4) is a construction with a seminumeral, and (5) is an example of group noun pseudopartitives. Given that *of* in (5) is a pleonastic element which does not enter into structural distinction, these constructions are similar to (1).

This observation gives rise to the assumption that there is a uniform underlying structure for all those constructions, (1), (4) and (5). The underlying structure is (2), which directly reflects the structure of group noun pseudopartitives.

There are, however, some minor differences among numerals, seminumerals and group nouns: *of* does not occur with numerals and seminumerals, while it does with group nouns, and the indefinite singular article never occurs with numerals unless they are preceded by adjectives. Such differences can be adjusted by certain local transformations sensitive to syntactic features. *Numeral of-Deletion* deletes *of* when the head of the NP specifier contains the feature [+ Num], and *Cardinal a-Deletion* deletes the article *a* when the head specified with the feature [+ Card] immediately follows it.

1.2 Takahashi argues that Jackendoff's analysis is not correct. His arguments are based on the following observations: (i) the scope of an adjective intervening between the article and a numeral includes the plural noun following the numeral, and (ii) in general, a plural noun in combination with a numeral behaves like a mass noun, which often requires the indefinite singular article when pre-

ceded by an adjective.

As for (i), it is really the case that in (1), the scope of the adjective *beautiful* includes the noun *weeks*. By using Takahashi's example, the meaning of (1) can be represented as (6).

(6) That two weeks is beautiful.

According to Takahashi, the PA can explain this fact since both *two* and *weeks* are structurally in the domain of *beautiful*; that is, in structure (3), *two* and *weeks* form  $\bar{N}$  to which *beautiful* is a sister constituent. The PPA, on the other hand, fails to account for the same fact on any structural basis, since in (2), *weeks* occurs outside the NP dominating *beautiful*.

(ii) explains the co-occurrence of *a* with a plural noun in a construction like (1). Consider (7) and (8).

(7) Three years is but short. (Jespersen)

(8) It takes me a long time to go there.

In (7) the subject NP *three years* agrees with the singular verb form as if it were a mass noun; while in (8), the mass noun *time* preceded by the adjective *long* occurs with the indefinite singular article. These facts can account for the occurrence of *a* in a construction such as (1); that is, a plural noun preceded by a numeral, which has the property of a mass noun, requires the indefinite singular article when an adjective precedes it. Takahashi claims that the structure in (3) expresses these properties.

In sum, Takahashi's arguments depend largely on the idiosyncratic properties of numerals, though structure (3) corresponds to the structure which Jackendoff proposes for true partitives. Takahashi emphasizes the significance of structural prop-

erties that characterize peculiarities of numerals.

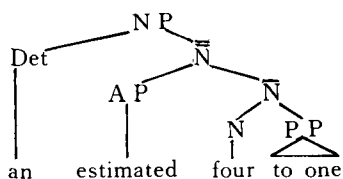
2.0 As far as examples like (1) are concerned, Takahashi's arguments seem to hold. However, further examples show that they are no longer valid. In what follows, I will argue that the PA poses serious problems, and present evidence that supports the PPA.

2.1 Consider first an example such as (9).

- (9) Boys outnumber girls by *an estimated four to one*.  
(*Newsweek*)

The italicized part of sentence (9) can obviously be taken to be an NP, in which the PP *to one* follows the numeral *four*.<sup>4</sup> Since the head noun of this NP is unambiguously *four*, and  $\bar{N}$  is a node which can take a complement, the underlying structure based on the UTLH must be something like (10).

(10)



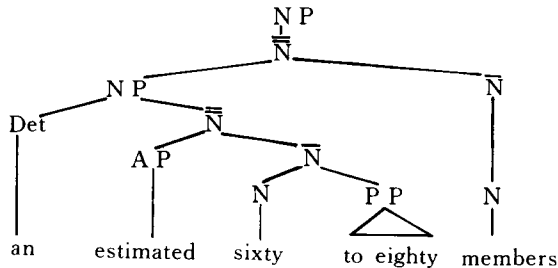
Note that in (10), the PP *to one* occupies the same structural position as the NP *weeks* does in (3). The PA would not make any structural distinction between these constituents: both are complements to a numeral.

There is another case in point, in which not only a PP but also a plural noun follows a numeral.

- (11) There are *an estimated sixty to eighty members* in the committee.

Given the argument advanced in the preceding paragraph, the PP *to eighty* occupies the complement position to *sixty*. The PA could not assign any structural position to the noun *members* since the complement position to *sixty* has already been occupied. No such problem arises with the PPA, which imposes a structure like (12) on the italicized part of (11).

- (12)



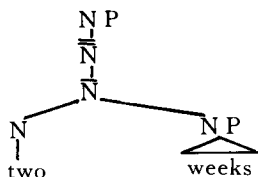
The PPA analyzes NPs like this in exactly the same way as those like (1): the noun *members* is the head noun of the matrix NP, and the other lexical items form an NP embedded in the specifier position.

2.2 Let us now return to the argument that Takahashi advanced in order to account for the occurrence of the indefinite singular article in a construction like (1). He claims that its occurrence follows from the structural property of (3); a numeral and a plural noun form a constituent which has the property of a mass noun. If his argument were correct, the structure of an NP such as (13) and the substructure of (3) corresponding to it would have to be identical.

(13) two weeks

Thus the structure of (13) would be something like (14).

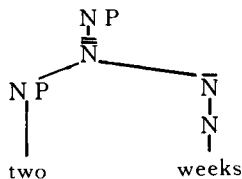
(14)



This structure, however, seems unnatural. Suppose that *two weeks* is parallel to *many weeks* in many respects. It is clear that *many* serves as a quantifier to *weeks*, and it is reasonable to assume that like *many*, *two* in (13) functions as a quantifier, whatever its lexical category may be. The noun *weeks* is felt to be a head noun. If (13) had a structure like (14), an NP such as *many weeks* would also be assigned a structure identical to (14), with the quantifier *many* being the head of the NP.

Even the fact that NPs like (13) agree with the singular verb form does not constitute evidence for proposing a structure like (14), for they also agree with the plural verb form. The structure of (13) is not (14) but (15) as Jackendoff proposes.

(15)



In (15) *two* appears in the  $\bar{N}$  specifier, with *weeks* being the head

of the matrix NP. <sup>5</sup>

With the PPA, the occurrence of *a* in a construction like (1) can be accounted for in terms of the property of a numeral itself. Since a numeral has the property of a mass noun in itself, the occurrence of an adjective within the same NP requires the article *a*. It does not make any difference whether a numeral and a plural noun form a constituent. The property of a numeral is solely responsible for the placement of the indefinite singular article.

**2.3** The PPA also provides a consistent explanation for a certain syntactic phenomenon, a deletion process which Jackendoff (1971) refers to as  $\bar{N}$ -Deletion.

(16) a. I like Bill's wine, but Max's wine is even better.

b. I like Bill's wine, but Max's  $\emptyset$  is even better.

(Jackendoff)

The (b) sentence is derived from the (a) sentence by deleting the head noun of the NP *Max's wine*. Consider then the following example.

(17) a. For six months I have had to wait; a weary six months they have been. (Jespersen)

b. For six months I have had to wait; a weary six  $\emptyset$  they have been.

If the NP *a weary six months* in (17) has a structure identical to (2), the deletion process deriving (17b) from (17a) is the same as that involving (16); it is an instance of  $\bar{N}$ -Deletion. The PA, however, cannot relate (16) and (17) since the process taking place in (17) would be described as something different from that involving (16).

**2.4** As already mentioned in Section 1, one of the bases on which



Jackendoff argues for the PPA is the similarity of numerals to seminumerals and group nouns. His proposal that seminumerals and group nouns appear in structures identical to (2) depends on Selkirk (1976) who proves that measure phrases such as *a number of* do not occur in partitives but are noun phrases embedded in the specifier position.<sup>6</sup> There seems to be little doubt that seminumerals and group nouns occur in NP specifiers.

Takahashi, however, claims that numerals differ from seminumerals and group nouns, and that constructions like *a beautiful two weeks* rather share properties with partitives. Insofar as syntax is concerned, we can say nothing further about the similarity between numerals and seminumerals and group nouns. But consideration of an adjective's scope suggests that there is close similarity between them. I will discuss the issue in the next section, and it confirms the assumption based on the PPA.

**3.0** Given the structural basis as has been discussed in the previous section, we now turn to the problem of characterizing the scope of an adjective occurring in the NP specifier.

**3.1** It has been observed that in an example such as (1), the scope of an adjective includes the plural noun following a numeral. There are many other examples of a similar sort.

- (18) a more delightful three weeks (Jespersen)  
       a dusty four miles of road (Jackendoff)

Along with these examples, constructions are possible in which the adjectives follow numerals.

- (19) three delightful weeks  
       four dusty miles of road

Further, the adjectives in these examples can occur in the predicate position.

- (20) That three weeks is more delightful.  
That four miles of road is dusty.

These adjectives selectionally relate to the plural nouns following numerals, since the following example violates selectional restriction.

- (21) ?a more delightful three inches

In other words, these adjectives modify the nouns which serve as head nouns of the matrix NPs.

There are, however, examples of a different sort.

- (22) a mere forty-six years (Time)  
a miserable seventy-five pounds (Ichikawa)  
a bare six inches (Jespersen)

These examples differ from those in (18) in some respects. First, the adjectives in (22) cannot follow numerals.

- (23) \*forty-six mere years  
\*seventy-five miserable pounds  
\*six bare inches

Second, they cannot occur in the predicate position.

- (24) \*That forty-six years is mere.  
\*That seventy-five pounds is miserable.  
\*That six inches is bare.

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Third, they selectionally relate to numerals. Compare the (a) and (b) sentences in (25).

- (25) a. Thanks to cholera and infant dysentery, life expectancy is a mere 46.5 years. (*Time*)  
b. ?Thanks to the latest medical developments, life expectancy is a mere 70 years.

Although the (b) sentence would not be strange in a world where life expectancy is expected to be a hundred years or so, the occurrence of *mere* with 70 is not permitted in the world we live in, as far as life expectancy is concerned. In examples like (22), the scope of adjectives is restricted within NP specifiers.

In addition to the examples given above, we consider slightly more complicated cases. Consider then (26).

- (26) a good three days

This phrase can be interpreted in two different ways as illustrated in (27) and (28).

- (27) A: How long did it take to drive to Canada?  
B: It was a good three days.

- (28) A: What kind of weather did you have on your vacation?  
B: We had a good three days.

It is obvious that the ambiguity in (26) results from the difference in scope: (27) shows that the adjective *good* modifies the number of days, with its scope restricted to *three*, while (28) shows that the adjective describes the weather on those days, with its scope including the noun *days*.

It follows from the observations above that the semantic property of an adjective plays an important role in determining its scope; the choice of an adjective which selectionally relates to a numeral restricts its scope to a numeral, and the choice of an adjective which selectionally relates to the noun following a numeral allows its scope to extend to that noun. The examples cited in Miura (1973) also support the importance of semantic properties.

- (29) a. It is a full fifteen years since he left Japan.  
b. It is fifteen full years since he left Japan.
- (30) a. He is a full fifteen years old.  
b. \*He is fifteen full years old.

The adjective *full* happens to have the meaning that can co-occur with either a numeral and the noun *years* when it means the 'period of time'. Thus, both the (a) and (b) sentences are grammatical in (29). However, the adjective *full* cannot co-occur with the noun *years* when it means 'age'. So only (30a) is grammatical, in which case the scope of *full* is restricted to *fifteen*.

Now that the meaning of an adjective and its relation to either a numeral or a plural noun determines the scope of the adjective, it is necessary to stipulate a certain semantic condition on the NP specifier. But before going into the discussion of the issue, it is worth considering the scope of an adjective in related constructions, namely the constructions with seminumerals and group nouns.

**3.2** It is interesting to note that seminumerals and group nouns show the same paradigm as numerals with respect to the scope of an adjective. Consider the following examples.

- (31) a. a thrilling few minutes

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- b. a miserable few spectators  
(32) a. a beautiful bunch of flowers  
b. a whole bunch of bananas

In both (31) and (32), the phrases in (a) represent the case in which the scope of an adjective includes the head noun of the matrix NP, whereas those in (b) represent the case in which the scope is restricted to the head of the NP specifier. The distinction between the phrases in (a) and (b) parallels that between (18) and (22). It should also be noted that the semantic property of an adjective determines its scope in these examples.

There are, however, examples like the following, which may seem to falsify the statement just made.

- (33) a. a tremendous number of students  
b. \*a hardworking number of people

(33b) is ungrammatical because of the adjective *hardworking* which selectionally relates to the noun *people*. The noun *number* allows only adjectives whose scope is restricted to it.<sup>7</sup> But this does not constitute counterevidence against what has been stated in the preceding paragraph. Rather, the fact presented in (33) offers some support for the analysis pursued here, since the ungrammaticality of (33b) seems to involve the interaction of the semantic properties of *number* and *hardworking*. In the next subsection, this will be clarified on the same basis as the other cases we have been discussing. In any case, there is an obvious parallelism between a numeral and a seminumeral and a group noun.

**3.3** I have thus far shown that the scope of an adjective involves the semantic property of the adjective. When an adjective which has a selectional relation to a numeral occurs in the NP specifier

headed by a numeral, the scope of the adjective is restricted within that NP specifier. On the other hand, when an adjective occurs which has a selectional relation to the head noun of the matrix NP, its scope includes that noun. The former case follows naturally from the structural property of the structure based on the PPA; the adjective and the noun it modifies occur in the same NP. But the latter stipulates some adjustment, since an NP node intervenes between the adjective and the noun it modifies.

Note that a numeral is semantically specified only with a number. So if an adjective which has the property of modifying quantity occurs with a numeral, a modifier-modified relation holds between them. In contrast, if an adjective which has the property of describing a noun occurs with a numeral, it does not find any modifiable property in the numeral, since a numeral is unspecified with the meaning describable by an adjective. Suppose that this latter case takes place in the NP specifier. The meaning of the adjective is added to that of a numeral, which constitutes the meaning of the NP specifier that serves as the modifier to the head noun of the matrix NP.

Let us now consider an observation made by McCawley (1968), which seems irrelevant at first sight but turns out to be parallel to the present consideration. Consider the following examples.

- (34) a. \*My buxom neighbor is the father of two. (McCawley)  
b. My buxom neighbor is pregnant.  
(Akmajian and Lehrer)  
c. My neighbor is the father of two. (McCawley)

McCawley points out that the (a) sentence in (34) is ungrammatical because of the adjective *buxom* which violates a selectional restriction imposed by the predicate *is the father of two*. In (34b)

the same adjective meets a selectional restriction imposed by the predicate *is pregnant*. In the case of (34a), the head noun *neighbor* is not involved in the violation of selectional restriction, since

(34c) is grammatical.

Suppose that examples like (34) parallel NPs with NP specifiers. This claim is not far from reality, since sentences and noun phrases have a number of syntactic properties in common. The following examples illustrate this point.

(35) [<sub>NP</sub> [<sub>NP</sub> a beautiful two] weeks]

(36) [<sub>S</sub> [<sub>NP</sub> my buxom neighbor] is pregnant]

If S is a projection of VP, the subject NP of a sentence is assumed to be a specifier to VP which serves as the head of S.<sup>8</sup> Given this parallelism between sentences and noun phrases, (35) is parallel to (36): *beautiful* is to *weeks* as *buxom* is to *is pregnant*. Both (35) and (36) can be treated in the same way.

Concerning McCawley's examples, Akmajian and Lehrer (1976) argue that selectional restrictions involve a head noun and a predicate, proposing the following condition.<sup>9</sup>

(37) "A given feature *F* from the modifier is transferred to the head if and only if the head is lexically unspecified with respect to that feature." (Akmajian and Lehrer, p. 16)

In the case of (34a), a selectional restriction is violated since the gender feature contained in the adjective *buxom* has been transferred to the head noun *neighbor* which is unspecified with respect to the gender feature.

Akmajian and Lehrer's condition can apply for NP specifiers. In the case of (35), *two* is not specified with respect to the se-

semantic features contained in the adjective *beautiful*. Thus those semantic features are transferred to *two* under condition (37). With the adjective's semantic features being added, *two* modifies *weeks*, the head noun of the matrix NP.

The transfer of features from the modifier to the head also takes place in the NP specifier with a seminumeral or a group noun as its head. In particular, condition (37) explains the grammaticality/ungrammaticality of the examples cited before as (32) and (33), repeated here as (38) and (39) respectively.

- (38)(=32) a. a beautiful bunch of flowers  
          b. a whole bunch of bananas  
(39)(=33) a. a tremendous number of students  
          b. \*a hardworking number of people

It is the lexical property of *number* that causes the ungrammaticality. The noun *number* is not semantically empty with respect to the semantic features contained in an adjective which selectionally relates to the head noun of the matrix NP. Thus, *number* does not allow the semantic features to transfer from the modifier, while nouns like *group* and *bunch* do.

4. To summarize, I have shown that the grammar incorporating the structure based on the PPA characterizes certain peculiarities of a construction with a numeral. A numeral occurs as the head noun of the NP specifier and shares this property with a seminumeral and a group noun. The scope of the adjective preceding a numeral is another peculiarity, which has to do with the semantics of NP specifiers. Since noun phrases are similar to sentences to a considerable degree, Akmajian and Lehrer's condition which was independently motivated to explain selectional restrictions between subject and predicate can also characterize the peculiarity concern-



ing the scope of an adjective occurring in the NP specifier. Further, the fact that an obvious parallelism between a numeral and a seminumeral and a group noun can be found not only in constituent structures but also in an adjective's scope offers a strong support for the idea that they occur in the same structure, the structure based on the PPA. In consequence, the grammar of numerals can be generalized into that of NP specifiers.

## NOTES

\*This paper is a revised and extended version of the paper read at the regular meeting of Osaka Linguistic Circle at Osaka Shiritsu University, 1982. I am greatly indebted to Masatake Muraki for his invaluable comments and suggestions on the draft of this paper. I am also grateful to my informants for their judgements on data. All errors that remain are my own.

<sup>1</sup> Jackendoff formulates the *Uniform Three-Level Hypothesis* as follows:

$X_n \rightarrow (C_1) \dots (C_j) - X^{n-1} - (C_{j+1}) \dots (C_k)$ , where  $1 \leq n \leq 3$ , and for all  $C_i$ , either  $C_i = Y^m$  for some lexical category  $Y$ , or  $C_i$  is a specified grammatical formative.

<sup>2</sup> By the "traditional system of phrase structure rules," I mean the phrase structure rules that do not incorporate the X Convention originally proposed by Chomsky (1970).

<sup>3</sup> Throughout this paper, I will make use of a mixed notation merely for typographical convenience. For instance, I employ the symbol NP for  $N^m$ .

<sup>4</sup> One might argue that the sequence *four to one* is not a constituent but a single lexical item. But as is shown by the ungrammaticality of *an estimated four-to-one* with hyphens, this is a constituent.

<sup>5</sup> A question may arise as to whether a numeral is a noun or a quantifier in this case, since as in *fully two weeks* an adverb can precede a numeral. Further, as Jackendoff points out, the seminumeral *few*

allows an adverb to occur with it; cf. *a very few people*. I suppose certain distinctive features are involved there, but further research is necessary on this issue.

<sup>6</sup> Drawing evidence from several syntactic phenomena, Selkirk makes detailed arguments for the assumption that measure phrases like *a dozen* and *a number of* occur as NPs embedded in the specifier position.

<sup>7</sup> In addition to *number*, *lot* has the same property.

<sup>8</sup> Chomsky does not support this position. See Chomsky (1970), and Chomsky (1981). However, there seems to be little doubt that there is an obvious similarity between a subject NP and an NP specifier.

<sup>9</sup> McCawley argues that selectional restriction involves a subject NP and a verb. See McCawley (1968). Muraki (personal communication) also suggested the same idea to me. Careful consideration must be given to this issue. But as far as an adjective's scope is concerned, Akmajian and Lehrer's condition holds. See the discussion below.

## REFERENCES

- Akmajian, A. and A. Lehrer (1976), "NP-Like quantifiers and the problem of determining the head of an NP," *Linguistic Analysis* 2, 395-413, also reprinted in Yasui, ed, *Kaigai Eigogaku Ronsoo* 1978, pp. 1-21
- Chomsky, N. (1970), "Remarks on nominalization," in Jacobs and Rosenbaum, eds. (1970), *Readings in English Transformational Grammar*, Blaisdell, Waltham, Mass.
- (1981), *Lectures on Government and Binding*, Foris.
- Ichikawa, S. (1975), "Kazu to Ryoo," in T. Otsuka, ed., *Eigo no Gohoo*, Vol. 1, Kenkyu-sha.
- Jackendoff, R. (1971), "Gapping and related rules," *Linguistic Inquiry* 2, 21-35.
- (1977),  *$\bar{X}$  Syntax: A Study of Phrase Structure*, MIT Press.
- Jespersen, O. (1914-49), *A Modern English Grammar*, Winter.
- Miura, S. (1973), "Three full months, full three months," in Ando, et

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- al., eds., *Question-Box (second) Series* 17, 82-86, Taishukan.
- McCawley, J. D. (1968), "The role of semantics in grammar," in Bach and Harms, eds., (1968), *Universals in Linguistic Theory*, Holt, Rinehart and Winston.
- Selkirk, E. (1976), "Some remarks on noun phrase structure," in Culicover, Wasow and Akmajian, eds., (1977), *Formal Syntax*, Academic Press.
- Takahashi, T. (1981), "Comments on Jackendoff's analysis of numerals," *Linguistic Research* 1, 13-32, University of Tokyo.