

The Partitive Measure Phrase in HPSG

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Yi, Eun-Kyung. 2005. The Partitive Measure Phrase in HPSG. *SNU Working Papers in English Language and Linguistics* 4, 137-151. This paper investigates the syntactic and semantic properties of the English partitive measure noun phrases. This type of phrases fall on the crossroads of measure phrases and partitive phrases. Traditionally it has been explained as a kind of partitive phrases. However, it has been an elusive goal to pin down its syntax theoretically in terms of 'usual' partitive phrases. Among the critical issues are the semantic transparency, odd agreement patterns, and the special status of the partitive preposition *of*. This paper goes over each problem and classifies measure words into three types, based on syntactic behaviors. To incorporate those classifications I modify the lexical hierarchy for nouns and posit constraints for new types within the framework of Head-driven Phrase Structure Grammar (HPSG). (Seoul National University)

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1. Introduction

In the literature 'the measure phrase' has been widely used to refer to the phrases containing *measure words* (or measuring words) such as *mile*, *sheet*, or *herd*. Measure phrases appear in various syntactic contexts. (Measure phrases will be italicized throughout this paper.)

- (1) a. The ceiling is *two feet high*.
- b. A *three carat diamond* is worth a house.
- c. Emily had *a cup of green tea*.

The measure phrase can tell about the size, number, or amount of something either in a predicative way as in (1a) or in an attributive way as in (1b). Otherwise it forms a noun phrase combined with an *of*-prepositional phrase. Three types of measure phrases are obligatorily

fixed in word orders and in the choice of syntactic categories. In this paper, the type of (1c) will be discussed in detail and will be called *the Partitive Measure (Noun) Phrase*. The word string of this phrase can be summarized as in (2).

- (2) (Cardinal number) + measure word + of + bare plurals/mass noun

This also can be expressed as NP_1 of NP_2 in terms of syntactic categories. NP_1 contains a cardinal number and a measure word. Both agree in number. NP_2 is a noun phrase which should be possibly or potentially measured by the measure word in NP_1 . It must be in the form of bare plural if the noun is countable. It must be a singular form, if it is not. This type of phrase is seemingly very common in English. This structure is often explained such that a noun phrase subcategorizes a prepositional phrase as its complement (henceforth, NP-Comp(lement) phrase). What is interesting here is that the partitive measure phrase and 'usual' NP-Comp behaves differently both in syntax and in semantics.

- (3) a. Emily smashed a bottle of wine on the floor.
b. Emily drank *a bottle of wine* at the party.

Both in (3a) and in (3b), the verb subcategorizes the same NP, *a bottle of wine*, as its complement. When it comes to the internal structure of both NPs, it is hard to say they are the same. Semantically the verb *smashed* in (3a) subcategorizes a physical object, which is *a bottle* here. However, *drank* requires a semantic argument having the property of liquid, which is *wine* in (3b). In other words, the semantic head of the NPs are *a bottle* in (3a) and *wine* in (3b). It is obvious that *a bottle of wine* in (3a) is NP-Comp phrase. Here *bottle* is the physical object which is containing or designed for containing wine. On the other hand, in (3b) *bottle* is measuring or describing the amount of wine. In some sense it looks like a modifier of *wine*, confining the amount of it. In literature the measure noun, *bottle* in (3b) is often called 'transparent' in the sense that the verb takes its complement across it.

Traditionally the latter kind of NP has been named *partitive*. This label assumes the part-whole relations between NP_1 and NP_2 . There are similar but characteristically different phrases under the same label.

- (4) a. *Most of* the students have strong views of politics.
 b. *Some of* bread was stolen last night.
 c. *None of* these suggestions is very helpful.

Most of and *some of* in (4a)-(4b) represent a certain portion of something out of the whole. In terms of this, *none of* in (4c) means zero portion of something. These are semantically typical part-whole relations. This is analogous to the partitive measure phrase in (3b), *a bottle of wine*. But it would be more precise to say that *a bottle* is the measured quantity and *wine* is the material to be measured. The measure phrase talks about the particular amount with a particular measurer while partitives in (4) just denotes the approximate proportion of something. Instead of part-whole relations, we can express the measure phrase as in (5).

- (5) (measurer) of (material) ¹⁾

In addition to semantics, partitives in (4) are critically different from the partitive measure phrase in number agreement patterns. The agreement value of partitives with *most* and *some* is equal to that of NP₂ within them. In (4a) the verb is plural because NP₂, *the students*, are plural while in (4b) the verb is singular because NP₂, *bread*, is mass noun. Moreover *none* in (4c) takes a singular verb regardless of the number agreement value of NP₂. This phenomena is absolutely predictable in syntax. ²⁾ However, the partitive measure phrase behaves strangely or irregularly to some extent concerning the number agreement.

- (6) a. *A truckload of Commandos were taken to the rear, where they could relax for a couple of days.*
 b. *A small clump of scarlet tulips brings a disproportionate flash of brilliance to a spring dalliance.*
 c. *When I opened it, a load of bits of paper fall out and flutter to the ground.* ³⁾

1) Schwarzschild (2002) refers to material as *substantive*.

2) Kim (2002) discusses more about number agreement patterns of these kinds of phrases.

3) Examples in (6) are quoted from Wright and Kathol (2003). According to them, the sentences are selected from British National Corpus.

The partitive measure phrase defines its number agreement value either by NP₁ or NP₂. In (6a), the verb is plural, which may result not from *a truckload* (NP₁) but from *Commandos* (NP₂). On the contrary, the verb in (6b) agrees with NP₁ in number. Most strangely the verb, *fall*, is going with the second measure word when partitive measure phrases are stacked in (6c).

Moreover, partitive words such as *some* in (4) and measure words are fundamentally different in syntactic categories. The former belong to *pronoun* which is a closed class whereas the latter belong to *common noun* which is a productive or open class.

As shown above, the partitive measure phrase has particular characteristics both in syntax and semantics, although it looks almost same as NP-Comp phrases or partitives at first glance. In this paper, I propose a new look at the internal syntax of partitive measure phrases and try to formalize it in Head-driven Phrase Structure Grammar (HPSG). In advance, I will go over the previous studies especially of Selkirk (1976), Wright and Kathol (2003), and Kim (2002) in the next section 2. ⁴⁾

2. Previous studies

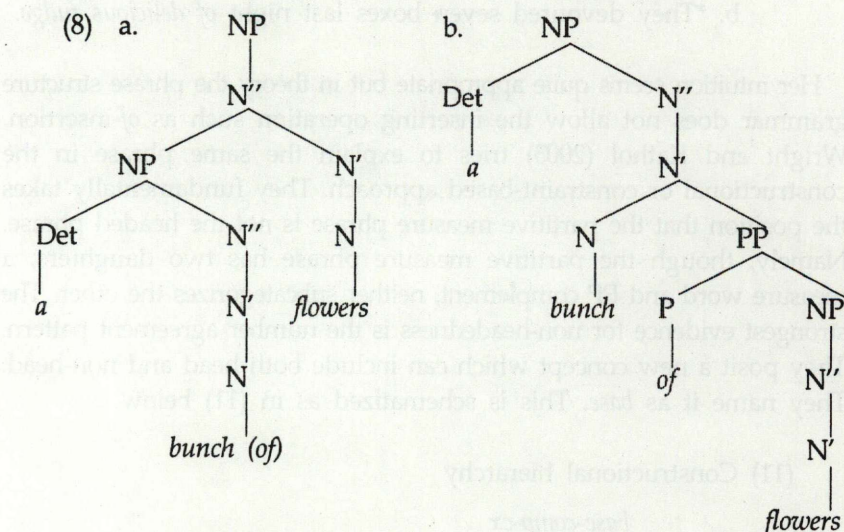
Selkirk (1976) widely discusses partitive noun phrases. Though the arguments are rooted in the Transformational Grammar tradition, her insight in partitive measure phrases are quite worth mentioning here. In Selkirk (1976), the measure phrase (here the partitive measure phrase) is said to have partitive-like syntax, but it is actually not partitive but simple noun phrase such as NP-Comp phrase. In this respect, the existence of preposition *of* may be cumbersome in the argumentation.

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- 4) Selkirk(1976) distinguished partitives from pseudopartitives based on some differences of syntactic behavior. The former has a definite noun phrase in NP₂ and the latter has bare plurals or bare mass nouns in NP₂.

- a bunch of flowers (pseudopartitive)
- a bunch of the flowers (partitive)

This separation seems to have been accepted in the literature. In this paper, the arguments will be restricted to pseudopartitive measure phrases. But here I call it just 'partitive'. I will not insist that this proposal is also true of Selkirk's partitive measure phrases. I just leave it open whether partitive measure phrases can be treated equally or not. This is a question for further study.

However, it is easily solved by the device 'transformation' in her theoretical framework. She says that the transformation process inserts the preposition *of* in the context NP ___ N'. According to her, *a bunch of flowers* can have the syntax either of (8a) or (8b) below. The example in (8a) is the simple noun phrase while the example in (8b) is the NP-Comp phrase as mentioned in the previous section 1.



She also gives some evidence showing that the preposition *of* is just a grammatical (and semantically empty) element inserted between noun phrases in a simple noun phrase.

- (9) a. I gave her a bunch of flowers.
 b. I gave her many flowers.
 c. I gave her many of flowers.

(9a) has a partitive measure phrase, *a bunch of flowers*. If (9a) is paraphrased or replaced by a partitive word such as *many*, (9b) would be far more natural than (9c). (9c) is simply the partitive. In other words, the measure word *bunch* is very closely linked with the preposition *of* than the simple partitive word is.

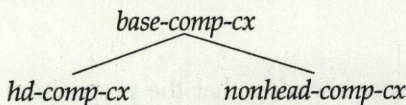
Another syntactic characteristic she proposes is the possibility of extraposition of the prepositional *of*-phrase. She says that *of*-phrase of

the partitive measure phrase cannot be extraposed. The example in (10b) also shows that when some element intervenes between NP₁ and NP₂, the sentence becomes ungrammatical. These are relevant evidence for the assumption that the preposition *of* can be more tightly merged with the measure word than with the following noun phrase.

- (10) a. They devoured seven boxes *of delicious fudge* last night.
 b. *They devoured seven boxes last night *of delicious fudge*.

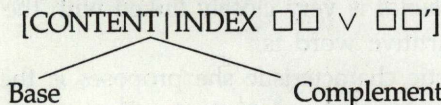
Her intuition seems quite appropriate but in theory the phrase structure grammar does not allow the inserting operation such as *of*-insertion. Wright and Kathol (2003) tries to explain the same phrase in the constructional or constraint-based approach. They fundamentally takes the position that the partitive measure phrase is not the headed phrase. Namely, though the partitive measure phrase has two daughters, a measure word and PP complement, neither subcategorizes the other. The strongest evidence for non-headedness is the number agreement pattern. They posit a new concept which can include both head and non-head. They name it as *base*. This is schematized as in (11) below.

(11) Constructional hierarchy



In this constructional hierarchy, they conclude that partitive measure phrases are one instance of *nonhead-comp-cx*. This type of construction has a type constraint, which is carefully organized to explain the agreement feature in particular. The index of the mother is defined disjunctively, which means that it can inherit either from base daughter or complement daughter. In the case of headed phrase, it can inherit only from the head-daughter.

(12) Nonhead-complement construction



[CONT □□]

[CONT □□]

An interesting point here is that when the index of the mother inherit from the base daughter (tagged with □□, the measure word in the partitive measure phrase), it is still different from the original index of the base daughter (tagged with □□'). This is quite descriptive, but I think it is unclear and inappropriate for syntactic types.

I can point out that there seems no crucial or practical reason for positing *base* except conceptually unifying head and non-head. They posit no type constraint for *base-comp-cx*. For the constructional approach to be effective, there should be a more general constraint for the highest in the hierarchy and then more specific constraints in one level lower and so on. But it is not properly justified here.

Kim (2002) also makes comments on measure phrases in view of the phrase structure grammar. He concludes that measure phrase is another type of partitive constructions. And the number value of the partitive measure phrase is determined by the number of NP₁ rather than of NP₂. Therefore it is more similar to *neither* or *each* type than to *most* or *some* type. (He calls the former Type I and the latter Type II.) And he gives an example of lexical entry for *pound* as in (13).⁵⁾

(13) <*pound*>

HEAD	<i>noun</i>
SPEC	<Det>
COMPS	<PP[<i>of</i>]>

The lexical entry in (13) says that *pound* requires a specifier and subcategorizes a PP whose form is *of*. This entry is not different from that of a common noun which induces NP-Comp phrases. His assumption about the measure phrase agreement does not satisfactorily reflect the data at all. Fundamentally, he posits type I and II under

5) Kim (2002) proposed that partitive constructions are divided into two types. Type I includes *none of*, *each of*, *either of* etc. These partitive phrases always have singular number agreement value because of NP₁ itself. Type II includes *some*, *any*, *most* etc. The number value of this type is determined by NP₂. And he said measure phrases are more like Type I. And he did not make comments on the distinction between partitives and pseudopartitives.

pronoun in the lexical hierarchy, which is not true of partitive measure phrases because the measure words belong to *non-pronouns*. Therefore, another systematic analysis is required for measure nouns within the non-pronoun category. Kim's (2002) proposal concerning partitive pronouns, however, provides useful foundations for the present analysis.

In section 3, I will try to modify the lexical hierarchy of non-pronouns and posit new type constraints for measure nouns. Wright and Kathol (2003)'s disjunctive approach will be adopted in a modified way here. Selkirk (1976)'s insightful idea about functional (or meaningless) *of* insertion will be explained by a given device within HPSG.

3. A proposal

3.1 Classification

To begin with, I need to classify various partitive measure phrases into a few categories on the basis of syntactic patterns. Previous studies have dealt with many kinds of measure phrases without clear distinctions. Roughly we have seven types of measure phrases in (14)-(20). They may behave somewhat differently in syntax or require complements of different properties. In terms of countability and number, the characteristics of NP₂ are defined in parentheses.

- (14) a *lot* of books / milk (COUNT+/-)
- (15) a *number* of books (COUNT+)
- (16) a *thousand/ hundred/ million* of people
(COUNT+)
- (17) a *drop* of alcohol; a *grain* of rice; a *slice* of bacon
(COUNT-)
- (18) a *bunch* of flowers; a *flock* of birds; a *herd* of cattle
([COUNT+][NUM pl])
- (19) a *page* of a book; a *piece* of a loaf; a *verse* of a poem
([COUNT+][NUM sg])
- (20) a *foot* of wire; a *meter* of cloth; a *kilo* of apples
([COUNT+][NUM pl] or [COUNT-])

The italicized word in those examples are measure nouns. If it requires

a countable noun and plural form for NP₂, it is described as [COUNT +][NUM *pl*] as in (18). Obviously they may be grouped by those properties. Besides NP₂, there are also several tests of NP₁ to show the syntactic differences among them. One of them is to see if a measure word can combined with cardinal numbers, *two* or above. Two obvious exceptions are filtered out in (21). And the basic counting words such as *thousand* are also odd in this test as in (22).

(21) two **lots* / **numbers* of books (from (14), (15))

(22) two **thousands* / *thousand* of people (from (16))

The second test is to see if the measure words are used in bare plurals. Five types out of seven proves grammatical, but the rest two are odd as in (23).

(23) **numbers* / **kilos* of apples (from (15), (20))

Though *lot* and *number* show the same result in (21), they contradict in (23). It is hard to find some other examples which show the same pattern as them. They would rather be regarded as idiosyncrasies or idioms. This is supported again by the pattern of modification. *Lot* cannot have a pre-modifier but *number* can in (24).

(24) a **big lot* / *large number* of books

Now the seven types are reduced to three. They are repeated and re-grouped below. (17), (18) and (19) are merged in a type.

(25) Type I: a *drop* of; a *bunch* of; a *page* of -(17),(18),(19)

Type II: a *thousand*/ *hundred*/ *million* of -(16)

Type III: a *foot* of; a *meter* of; a *kilo* of -(20)

As shown in (22), type II is distinguished from the others in that they do not undergo the plural inflection (or adding the plural suffix *-(e)s*) when specified by a cardinal numeral above one. The measure nouns in type III are discriminated by its ungrammaticality of bare plurals shown in (23).

There is some additional evidence for their syntactic distinctions. The

measure nouns in type I are still grammatical when specified by the definite article while the others are not in (26).

(26) Type I: the *drop* of water, the *bunch* of flowers

Type II: *the *thousand* of people

Type III: *the *feet* of wire

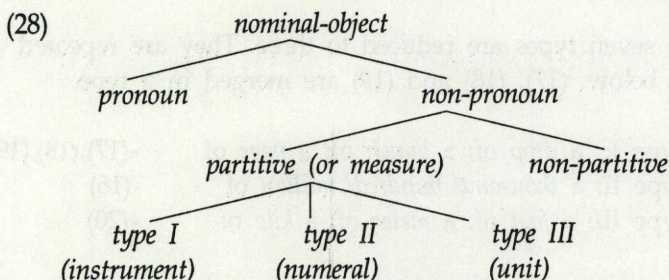
The patterns in (26) imply that the measure words in type II and III inherently mean intangible measuring concepts while those in type I are multifarious in that they can either refer to physical objects or to measuring concepts. This is supported by examples in (27). Only those in type I can be modified by adjectives which describe size, quality, or feature of the measured units. However, the pure measure words in type II and III does not permit pre-modifiers.

(27) Type I: a pure *drop* of; a *huge* bunch of; a blank *page* of

Type II: *a large *thousand* of

Type III; * a big *foot* of ⁶⁾

By those observations so far I can re-organize the lexical hierarchy of *nominal-object*. It is divided into *pronoun* and *non-pronoun*. *Non-pronoun* also has binary daughters, *partitive* and *non-partitive*. Under *partitive*, those three types are nested.



In the parentheses of the terminal nodes, I name three types as *instrument*, *numeral*, and *unit*, respectively. It is *instrument* for type I

6) If modified, foot can only mean the physical part of human body, not measuring concept.

because it seems like a pseudo-noun functioning as a measuring instrument. Type II is *numeral* in that it counts something numerically. Finally *unit* is for type III in that it refers to the scientifically fixed unit for measuring something.

The number agreement patterns of those types also vary. For *numeral*, the number agreement of partitive measure phrase is determined by NP₂ only in (29).

- (29) Two *thousand* of people *is / are...

On the other hand, the number agreement value for *instrument* and *unit* is determined either by NP₁ or NP₂ as explained in detail in section 1. Some new examples are given in (30) and (31).

- (30) a. A *flock* of birds *are* flying away.
b. A *flock* of birds *is* flying away.

- (31) a. I bought a *kilo* of apples yesterday. *They* are quite red.
b. I bought a *kilo* of apples yesterday. *It* costs 10 dollars.

Finally, before I move on to the next section formalizing those in HPSG, I need to make comments on what the partitive *of* is in the measure phrase. As I mentioned in section 2, Selkirk (1976) argued that *of* is semantically empty and syntactically functional, which, I agree, is quite appropriate. However, what is puzzling is that her theoretical framework solved this with transformational *of*-insertion, which is not compatible with the phrase structure grammar. In HPSG, this kind of preposition *of* can be defined as *argument-marking preposition* compared with *predicational preposition*. An argument-marking preposition is just a marker which subcategorizes NP as its complement. Then the whole PP shares the index of the complement NP. It may be similar in definition to Selkirk's. The predicational preposition is appropriate for NP-Comp phrases such as (3a). The lexical entries for both types of preposition are presented in (32).

(32) Entries for preposition (simplified versions)

<i>argument - marking - prep</i>	<i>predicational - prep</i>
HEAD <i>prep</i>	HEAD <i>prep</i>
SEM [INDEX $\boxed{1}$]	ARG-ST $\langle \text{NP, NP} \rangle$
ARG-ST $\langle \text{NP} [\text{INDEX } \boxed{1}] \rangle$	

According to those observations, I will try to formalize the type constraints and rules for the partitive measure phrases in HPSG in the next sub-section.

3.2 Formalizing in HPSG

First, I present lexical entries for *lot* and *number* which are idiosyncratic.

(33) Entries for *lot* and *number*

<i>lot</i>	<i>number</i>
HEAD $\left[\begin{array}{c} \text{noun} \\ \text{AGR } \boxed{1} \end{array} \right]$	HEAD $\left[\begin{array}{c} \text{noun} \\ \text{AGR } \boxed{1} \end{array} \right]$
VAL $\left[\begin{array}{c} \text{SPR } \langle \text{Def}[\text{DEF -}] \rangle \\ \text{COMPS } \langle \text{PP } \left[\begin{array}{c} \text{FORM of} \\ \text{AGR } \boxed{1} \end{array} \right] \rangle \end{array} \right]$	VAL $\left[\begin{array}{c} \text{SPR } \langle \text{Def}[\text{DEF -}] \rangle \\ \text{COMPS } \langle \text{PP } \left[\begin{array}{c} \text{FORM of} \\ \text{AGR } \boxed{1}_{pl} \end{array} \right] \rangle \end{array} \right]$

In (33) both *lot* and *number* require a specifier which is indefinite and have the same agreement value as their complement by structure sharing $\square\square$. However, *number* is always plural while *lot* does not have to.

Instrument (Type I) and *Unit* (Type III) have the same type constraint. They will be differentiated by a modifying rule in (37) below. The type constraint is drawn in (34).

(34) The entry for *Instrument* and *Unit*

$$\left[\begin{array}{l} \text{HEAD} \left[\begin{array}{l} \text{noun} \\ \text{AGR } [1 \vee 2] \end{array} \right] \\ \text{VAL} \left[\begin{array}{l} \text{SPR } \langle \text{cardinal-num} [\text{AGR } [1]] \rangle \\ \text{COMPS } \langle \text{PP} \left[\begin{array}{l} \text{FORM of} \\ \text{AGR } [2] \end{array} \right] \rangle \end{array} \right] \end{array} \right]$$

Here the agreement value is defined disjunctively following Wright and Kathol (2003). The agreement may correspond to either that of the specifier or of the complement.

Finally the type constraint for *Numeral* (Type II) is presented in (35). The agreement value is always structurally shared with that of the complement PP ($\square\square$). This requires indefiniteness by the negative INF.

(35) The entry for *numeral*

$$\left[\begin{array}{l} \text{HEAD} \left[\begin{array}{l} \text{noun} \\ \text{AGR } [1] \\ \text{INF -} \end{array} \right] \\ \text{VAL} \left[\begin{array}{l} \text{SPR } \langle \text{cardinal-num} \rangle \\ \text{COMPS } \langle \text{PP} \left[\begin{array}{l} \text{FORM of} \\ \text{AGR } [1] \end{array} \right] \rangle \end{array} \right] \end{array} \right]$$

Now type constraints are finished. However, there is one thing left. Partitive measure noun phrases often accompany modifying oddness. This is related with the problem of selectional restriction mentioned in (3) above. In some cases, the measure word is transparent as in (36).

- (36) a. Emily saw a huge flock of birds.
 b. Emily drank a hot cup of tea.
 c. Emily drank a bottle of wine.

In (36a) the adjective *huge* is modifying *flock* (NP₁), which is quite

'normal'. This, however, is not always true in partitive measure phrases. In (36b) the adjective *hot* is modifying *tea* (NP₂) not *cup* (NP₁). This possibility is restricted to *Instrument* (Type I). (As explained in section 3.1 the other types cannot have modifiers.) It can be defined as a rule as in (37).

(37) Modifying rule for *Instrument*

$$phrase \rightarrow \left[\begin{array}{cc} \text{HEAD} & \text{adj} \\ \text{MOD} & \boxed{1} \vee \boxed{2} \end{array} \right] \boxed{1}H[\text{VAL} [\text{COMP} \langle \rangle]] \boxed{2}PP$$

By (37) the adjective modifier is defined to modify either the measure word (NP₁) or the material word (NP₂) in PP.

4. Concluding remarks

The English partitive measure noun phrase has rather simple but unusual behaviors. They distinguish the measure noun phrase from the similar structures such as the NP-Comp phrase. It is hard to pin down its properties within the syntactic theories.

In this paper I have tried to explain the partitive noun phrase in the phrase structure grammar other than Selkirk (1976), in a more usual way than Wright and Kathol (2003), and more in detail than Kim (2002). I have classified measure words into three classes on the basis of syntactic patterns and imposed type constraints respectively. Among critical problems of this structure, the unusual pattern of agreement is solved by the disjunctive treatment. The 'transparency' problem is hinted by a modifying rule. For further study, the content value of this phrase can be more elaborated, which may solve the critical problems more clearly and systematically.

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