PARTITIVES *

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1. Introductory remarks.

The best way to learn about the parts of speech is to study the constructions in which they occur. In the case of determiners, the simplest, and in a sense the archetypical case is the construction Det CN VP, where CN is a common noun and VP a (finite) verb phrase. This is the subject predicate construction familiar from, e.g., syllogisms, in which the determiner is part of the subject. The ubiquity of this particular environment has suggested the relational approach to determiner interpretations now emerging in recent papers by Van Benthem and Zwarts[1], which treats determiners semantically as second order relations (i.e. as relations between predicates, the CN and VP constituents providing the predicates in question). The universal quantifier all, for example, is interpreted as the subset relation, the existential quantifier some as the overlap relation (that is, A and B are in this relation, iff their intersection is nonempty), etc.

In the present paper, another, considerably more intricate, construction will be discussed, whose structure has to be determined before a semantics can be designed for it. This construction, known as the partitive, is characterised in English by the scheme Det_1 of Det_2 CN. Before going ahead with the real work, it may please us to rest awhile in our armchairs and contemplate the relational perspective suggested by the earlier basic environment. If we look at determiners as relational expressions, we expect them to behave like other relational expressions, such as verbs and prepositions. Transitive verbs relate two noun phrases in the construction NP V NP, and prepositions relate noun phrases to predicates, as in the construction types N Prep NP and VP Prep NP (examples are man with a gun and talks in his sleep).

Now it is a well-known fact about transitive verbs and prepositions, that some of them can be used intransitively, i.e. without an object. For instance, smoke can be used both ways:

(1) She smoked a cigar.
(2) He kept on smoking.

For prepositions, similar examples can be given:

(3) He did not eat or drink since Saturday.
(4) I don't think I have ever seen him since.

If the analogy is correct, then we expect to find determiners that can be used without their CN arguments. And such determiners exist, of course:

(5) All were present.

It is due to this intransitive use, no doubt, that traditional grammar does not recognise determiners as a separate class of words, and that most determiners are classified as pronouns. For example, Jespersen (1924: 82 ff.) considers the articles to be pronouns, as well as e.g. both uses of this in the following sentence:

(6) This is the best part of this play.

Jespersen explicitly criticises the view, which seems to be shared by many modern investigators, that the first occurence of this is a pronoun, whereas the second is a determiner (or, as Jespersen calls it, a "demonstrative adjective"). Let us assume here that both uses of this belong to one category, which we will call Det (for "determiner"), which has as its subcategories the transitive determiners and the intransitive, or pronominal determiners. In other words, although we make the necessary distinctions, we recognise the close relationship between pronominals and determiners.

In the case of verbs, traditional grammar usually distinguishes three main types: the transitive verbs, the intransitive verbs and the pseudotransitive verbs, which can be used with or without an object. For example, eat is pseudotransitive, devour is transitive and snore is intransitive. A similar classification can be given for the English determiners, cf. Table 1.

Note that the personal pronouns you and we are classified as pseudotransitive determiners, since they occur in the construction Det N, witness Postal's (1966) examples

(7) You guys better be gone.
(8) We Americans are a proud people.

Not all personal pronouns can occur in this position, however, so Postal's claim that all personal pronouns are underlyingly transitive determiners appears to be a little too strong.

Transitive	Intransitive	Pseudotransitive
every	everything, everybody	
	anything, anybody	any
		each
		all
no	nothing, nobody, none	
		neither
	somebody, something	some
a		
the		
		either
		several
		many
		few
		a few
		much
		little
		most
		this
		that
		these
		those
		one, two, three, ...
	he, him	his
her	she, her, hers	
its	it	
my	I, me, mine	
your	yours	you
our	ours	we, us
their	they, theirs, them	
		what
		which
	who	whose

Table 1: A classification of the English determiner system

Table 1 is a fairly representative, though by no means exhaustive, overview of the English determiner system. There is some dialectical variation, of course. For example, certain dialects use the accusative pronoun them as a determiner (instead of those). Some writers (e.g., Keenan & Stavi, to appear) would include genitives such as John's and my father's. Unlike the specimina in table 1, however, these are not lexical determiners, but the products of the syntactic process of genitive-formation. The cardinal numbers one, two, three ..., have been listed in table 1, although they differ from determiners such as the and my in several respects, and might be classified as adjectives, rather than determiners (cf. Hoeksema 1983). However, since they can be used as pronouns, they have other properties in common with determiners. Perhaps a double classification of numerals as adjectives and determiners is the optimal solution (cf. Klein 198?). The same holds for the items many, much, few, little and most.

The occurence of pseudotransitive determiners, that is, the occurrence of items that can be used both prenominally and pronominally, is not a peculiarity of English, but a phenomenon we find in many other languages as well.

For example, Latin nullus 'no, none' can be used as a pronoun, as in the example

(9) Nulli secundus ("Second to none")

or as a determiner, as in the proverb

(10) Nulla dies sine linea ("No day without a line")

The same is true for such items as ullus "any, anyone", alius ("other"), omnis ("each"), ille ("that"), etc.

In Danish, nogen is used both as "somebody" and "some", cf.:

(11) a. Er der nogen ? ("Is there somebody ?")
b. Det er nogen tid siden. ("It has been some time ago")

In Dutch, the demonstratives are pseudotransitive, as well as ieder and elk ("every"), veel ("many"), etc.

Lest it be thought, that such examples are limited to the famaliar indoeuropean languages, a few examples from modern Thai (taken from Campbell 1969) might be relevant as well. In Thai, demonstratives can be used as determiners as well as pronouns:

(12) a. /dinsǎɔ níi mâj dii/
pencil this Neg good
"This pencil is no good"
b. /chûaj khǐan nîi hâj phǒm/
help write this for I
"Help me write this"

(I have used Campbell's phonemic spelling in these examples.)

This will suffice as an indication of the crosslinguistic significance of the fact that many determiners have both a transitive and an intransitive use. Let us now consider the question how we are to account for this particular fact.

The most obvious way, it appears, would be to assume a lexical stipulation to the effect that some determiners can be used intransitively as well. In other words, we just list

(13) every ⟶ NP/N (= Det)
all ⟶ NP/N, NP
it ⟶ NP

The other way to deal with these items that seems to be available would be to assign the category NP/N to pseudotransitive and transitive determiners, and the category NP to all pronouns. The pseudotransitive determiners would then differ from the transitive ones by allowing their common noun arguments to be zero. This approach is related to that of Postal (1966), although it is not formulated in the transformational frame-work adopted by Postal.

The empty noun seems to be interpreted as a pronominal or anaphoric expression of the CN type, comparable to English <u>one</u>. For example, in the following piece of discourse the empty common noun must be interpreted as the predicate <u>boy</u>, introduced in the previous sentence:

(14) The boys were waiting in the adjacent room. Each Δ had a piece of paper in front of him with his name on it.

In this example, we could have equally well used the overt pronoun one, instead of the dummy noun Δ.

However, I will suggest that this particular example is entirely misleading in that it is depending on the peculiar behaviour of the quantifier each. ~~For a discussion of this determiner, see the Appendix to this paper~~.

A more representative example shows the difference between the anaphoric common noun one and zero. Suppose you are sorting Christmas gifts for your children, and you are saying to your husband:

(15) This train is for Jimmy, this train is for Grace and this one is for Judy.

It is clear that one refers to trains in this situation. It would be inappropriate to use it for dolls, for example. On the other hand, if you had said: "This is for Judy", instead of "This one is for Judy", the thing refered to need not be a train at all. It might well be a doll. This indicates that no contextually relevant set, mentioned in previous discourse or otherwise, is needed for the interpretation of the dummy noun.

If the dummy common noun is not interpreted anaphorically, the question arises how it is, if at all. Let us assume that it is interpreted as the universe of discourse (U), or rather, depending on the determiner, as the set of persons in the universe of discourse, or the universe of discourse itself. In the latter case it is comparable to Barwise and Cooper's logical constant thing, which has the same interpretation in their logical language L(GQ).

The different possibilities as regards quantification over the entire universe of discourse U and its restriction to the set of persons (pers(U)) are very obvious in examples such as:

(16) All is quiet (domain of quantification: U)

(17) All were quiet (domain of quantification: pers(U))

Corresponding to Barwise and Cooper's expression thing, we could postulate another constant body (as in everybody, somebody, nobody), which is interpreted as pers(U). The dummy noun would then be translatable as thing in some cases, and as body in other cases. Exactly which conditions determine the choice between the two options is not clear to me; it may be a matter of lexical idiosyncracies in part. In some cases, one is not used anaphorically either, but functions as a synonym of body, cf. everyone, no one, someone. These expressions appear to be lexicalised as words and do not arise as free syntactic combinations, comparable to neither one, or this one. This means that we have to interpret everyone etc. as a whole, and not compositionally.

To summarise, we have seen that many languages have pseudotransitive determiners, i.e. determiners which can be used as pronouns. There are two ways (at least) to deal with this phenomenon. The first is simply to let the elements in question be elements of two categories, NP/N, and NP. The second approach would be to treat transitive and pseudotransitives alike as elements of NP/N, with a lexical stipulation for each determiner that it can, or cannot, be followed by the empty common noun. The second approach is somewhat more cumbersome than the first one, and would be objectionable to some linguists on the ground that it involves the introduction of an abstract (inaudible) element. However, since the second approach suggests a straightforward analysis of the partitive construction, the attention paid to it is not unwarranted.

2. The problems.

Partitive noun phrases such as one of the firemen, all of our friends and most of the horses have been studied in the early work on generalised quantifiers, especially in Barwise and Cooper (1981) and Zwarts (MS).

Both Barwise and Cooper and Zwarts assume the following structure for these expressions:

(18) $[_{NP}$ Det $[_{N}$ of NP]]

This structure has two attractive features: it is simple, and it is remarkable, especially with regard to the labels of the nodes.

The structure proposed by Zwarts for Dutch partitive noun phrases differs only in one, trivial, aspect: the partitive preposition in Dutch is van, not of:

(19) $[_{NP}$ Det $[_{N}$ van NP]]

Why is the labelling of these structures remarkable ? Since of and van are prepositions, we would expect of NP and van NP to form prepositional phrases, not common nouns. In other words, we would expect to find a label which correlates two of the boys etc. to other noun phrases involving of phrases, such as the night of her revenge.

Another structure has been proposed for partitive noun phrases by Keenan & Stavi (to appear). They prefer the following phrase structure analysis:

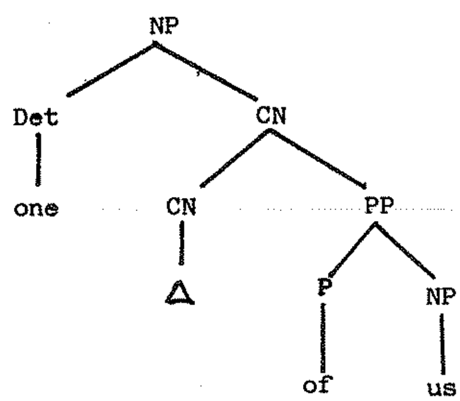
(20) $[_{NP} [_{Det}$ Det_1 of Det_2] N]

According to this analysis, two of the, some of these, all of my, etc. are complex partitive determiners.

Again we are confronted with an analysis which does not recognise of the boys in two of the boys as a prepositional phrase; in fact, it does not even recognise it as a constituent.

A third analysis, which is more in the line of the previous section of this paper, makes use of the dummy noun in order to arrive at a fairly run-of-the-mill kind of phrase structure:

(21)



The first problem about partitives that we must face, is therefore their correct structural analysis.

The next thing to note about partitive noun phrases, is the nonoccurrence of certain determiners in their initial position. A few examples will illustrate this point:

(22) a. *The of my friends
b. *No of your rivals
c. *A of those clocks

Barwise and Cooper (1981) deal with this state of affairs by demanding that the determiner of a partitive noun phrase agree with its head in a syntactic feature which I will refer to as the partitive feature. They propose to assign every determiner this feature iff it can introduce a partitive noun phrase. For example, <u>one</u>, <u>all</u> and <u>most</u> will receive the partitive feature, whereas <u>the</u>, <u>no</u> and <u>a</u> (the determiners introducing the noun phrases in (22) above) will not receive this feature. This treatment, of course, is descriptively adequate, but in view of its stipulatory character it does not bring us very far in terms of explanation. So we arrive at our second problem concerning partitives: What governs the distribution of the partitive feature ?

Another property of partitives that we have to account for is the distribution of noun phrases within the <u>of</u>-phrase (that is, of course, if we accept the existence of such a phrase; otherwise we have to restate the question). Again, a few examples suffice to illustrate that not every noun phrase may appear in that position:

(23) a. *One of some friends
b. *All of neither girl
c. *Some of many saints

Compare this with:

(24) a. One of my friends
b. All of your plans
c. Some of the sheep

According to Barwise and Cooper (1981), only definite noun phrases of a certain kind may occur after partitive <u>of</u>. Later on, we will look in more detail at their proposal. For the moment, we will just list the difference in grammaticality between the examples in (23) and those in (24) as a further problem that any theory of partitives should account for.

Finally, since semantic matters can hardly be separated from syntactic matters, especially in the field of determiners, it is convenient to have an interpretation procedure for partitives. Consequently, the interpretation of partitives will be our fourth major topic of inquiry.

To summarise, we have arrived at **four** main questions concerning partitive noun phrases:

(I) What is the correct structure of partitives ?
(II) Which determiners may appear in front of *of* ?
(III) Which noun phrases occur as objects of *of* ?
(IV) How are partitive noun phrases interpreted ?

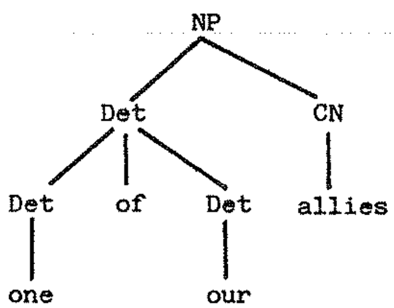
By answering these questions, new ones will arise, and some of the answers will turn out to be mutually dependent. Although the data to be considered here are restricted to English and Dutch, it is hoped that the analysis is valid for related languages, such as German or French,[2] as well.

3. The constituent structure of partitives.

3.1. English partitives.

In section 2, we have met a few of the constituent structures that have been proposed in the literature for the partitive construction. Let us first consider the structural analysis favoured by Keenan & Stavi (to appear), which is repeated in (25) below:

(25)



According to Keenan & Stavi, strings such as *two of the five*, *the three tallest of the twenty*, *one or more of the five*, *none of the five* are members of the category of (complex) determiners. This particular analysis is not very new, since it has been proposed in the transformational studies of determiners in the early 1960's (cf. Stockwell, Schachter & Partee 1973: 113).

A major drawback of this analysis, mentioned by Stockwell, Schachter & Partee, is its failure to recognise of our allies in one of our allies as a prepositional constituent. A quick look at some other languages, for instance Dutch, informs us that partitives contain parts of speech that are typically associated with possessive prepositional phrases. Compare two of our allies and the power of the church with twee van onze bondgenoten and de macht van de kerk (the Dutch versions correspond in a word by word fashion to the English phrases). Where English uses partitive and possessive of, respectively, Dutch uses partitive and possesive van. But if partitive of is a preposition, it must form a group with its NP complement. This prepositional phrase, by the way, is also needed for sentences such as:

(26) Of the seventeen passengers, only a few survived.

Here the partitive of-phrase is preposed, which would seem to be possible only in case it is a constituent. However, the strength of this particular argument is weakened by the fact that the partitive construction with preposed of phrase differs in certain respects from the ordinary partitive construction (cf. Quirk et al. 1972: 893). Consider the following contrast:

(27) a. Of fourteen women, ten were single
b.*Ten of fourteen women were single

In such cases, the preposed partitive constituent appears to be related to the semi-partitive construction involving out of:

(28) a. Out of fourteen women, ten were single.
b. Ten out of fourteen women were single.

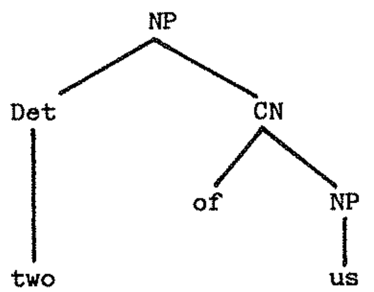
More important is the fact that certain partitive noun phrases cannot be handled at all by the Keenan & Stavi analysis, i.e. those noun phrases that contain pronouns, for example one of us, some of them, one of those.

In these examples, no second determiner (transitive determiner, that is), is present, which means that the structural description [$_{Det}$ Det of Det] cannot be satisfied.

Equally problematic are cases like none of the girls, each one of the poker players, etc., which do not satisfy this structural description either. Instead, one would have to permit determinees of the form [$_{Det}$ NP of Det] as well.

Examples of the latter kind are even more harmful for the Barwise & Cooper analysis, which is exemplified by the following constituency tree:

(29)



This example shows that pronouns after of do not cause trouble, but pronouns in front of partitive of do. There is no room for one in each one of us.

Furthermore, the objection that this analysis does not recognise the PP-nature of the partitive of-phrase militates against it. So we ought to reject it, as we reject the Keenan & Stavi structural analysis.

Let us now consider the third hypothesis about the correct constituent structure of partitive noun phrases, according to which the of-phrase is a PP-modifier of a, possibly empty, common noun. This hypothesis is in agreement with the fact that elements such as partitive of in English, van in Dutch, or de in French are prepositions. For this reason, this analysis is a priori more plausible than the other two. In addition, the occurrence of pronouns after partitive of, which we saw was a problem for the Keenan & Stavi hypothesis, is predicted to be possible.

More attention is needed for examples such as none of us. The most straight-forward analysis of this noun phrase would be [$_{NP}$ [$_{NP}$ none] [$_{PP}$ of us]].

However, this would appear to commit us to the claim that partitive PPs are NP-modifiers, instead of CN-modifiers. Note that the same problem arises with other postmodifiers, such as relative clauses. Montague (1973) has treated relative clauses as CN-modifiers, and his approach is considered by most Montague grammarians to be more in line with a simple and perspicuous semantics than other analyses, such as the NP-S analysis (see Janssen 1983, chapter VIII for discussion). However, for relative clauses with pronominal arguments, such as all you need (is love), the NP-S analysis seems to be called for, although in this particular example we could still adhere to the CN-S analysis by postulating an empty common noun. When the pronoun is none, this move is ruled out, and we would have to resort to an underlying form no one for this pronoun, and a fusion rule changing this into none. But this is inadequate for semantic reasons, for none is not always equivalent to no one. Consider for example the following pair of sentences:

(30) a. If a linguist is wanted, I am none.
b. If a linguist is wanted, I am no one.

Also, none can be used as a [-count] pronoun, unlike no one:

(31) a. You have money and I have none.
b. You have money and I have no one.

The issue of CN- versus NP-modification gains additional interest in the context of categorial grammar. We will see in section 4 that both constituent structures can be derived in a categorial grammar of the type proposed by Lambek (1958, 1961). We will defer further discussion of the matter to that chapter, and freely use the CN-modification analysis here whenever it is opportune, and NP-modification elsewhere.

Summarising, the third analysis, which treats partitive of-phrases as postmodifiers can handle most of the problems that we considered to be evidence against the Keenan & Stavi analysis and the Barwise & Cooper analysis. Evidence from other languages is needed, however, to confirm the hypothesis. The level of modification (CN or NP) still remains to be clarified.

3.2. Dutch partitives.

Dutch nominal structures are quite similar to their English counterparts, but there are a few differences which make a comparison worth while.

First of all, Dutch prepositions do not allow occurrences of inanimate pronominals; instead combinations of locative pronouns and postpositions are used:

(32)	*van het	("of it")	er van ("thereof")
	*met dit	("with this")	hier mee ("therewhith")
	*in dat	("in that")	daar in ("there in")

In the partitive construction we find exactly the same phenomenon:

(33) veel hiervan
much thereof ("much of this")

This is to be expected, if partitive van is just another preposition; if, on the other hand, it has a different category, as was proposed by Barwise & Cooper (1981) for English of, this would be an unexplained fact. Even more problematical is the above example for the Keenan & Stavi structural analysis, since no determiner of the form Det van Det is present.

However, there are other facts of Dutch, which seem to point at a grammatical distinction between partitives van-phrases, and other prepositional phrases, including other uses of van-phrases. Dutch, like some of the Romance languages, such as French, or Italian, has a clitic pronominal which must occur when the noun is missing in certain constructions. This clitic, er (in French: en, in Italian: ne), is the topic of much discussion in Dutch linguistic journals, since its distribution, and the explanation of its distribution, is rather complicated. Consider the following sentences:

(34) a. Ik heb drie boeken, hij heeft er two.
I have three books , he has there two
b. Zij heeft er even veel.
She has there as many ("She has as many

Roughly, we might say, that er appears before an indefinite determiner, when that determiner is not followed by an overt nominal head. However, when the determiner is followed by an adjective, or a partitive van-phrase, er may not occur:

(35) a. De politie vond er twee.
The police found there two
"The police found two"
b. De politie vond twee rode.
The police found two red
"The police found two red ones"
c.*De politie vond er twee rode.
The police found there two red
"The police found two red ones"

(36) a. Zelfs de Paus bekeek er enkele.
Even the Pope watched there several
"Even the Pope saw several"
b. Zelfs de Paus bekeek enkele van de films.
Even the Pope saw several of the films
c.*Zelfs de Paus bekeek er enkele van de films.
Even the Pope saw there several of the films
"Even the Pope saw several of the films"

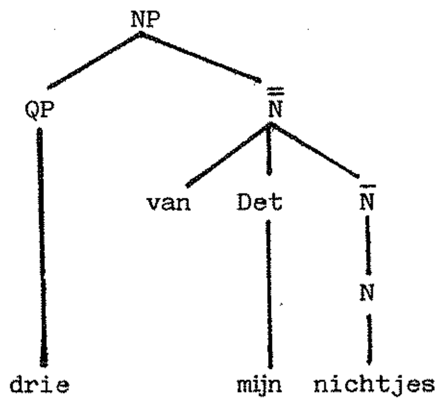
It should be added, that the examples (35c) and (36c) are perfectly grammatical on the locative interpretation of er; the intended interpretation, on which er is interpreted in the same way it is in (35a) and (36a), is excluded.

We might now venture the hypothesis, that er disappears, whenever there is a modifier of the zero noun. This hypothesis turns out to be mistaken, since er must occur obligatorily when there is a non-partitive postmodifier:

(37) a. De gravin heeft drie japons van Dior, en haar dochter
The countess has three dresses of Dior, and her daughter
heeft er twee van Cardin.
has there two of Cardin
b.*De gravin heeft drie japons van Dior, en haar dochter
The countess has three dresses of Dior, and her daughter
heeft twee van Cardin.
has two of Cardin

For some speakers, (37b) is not quite so bad as the star indicates, but even for them, there is a marked distinction between (36c) and (37a). This distinction, noted in Paardekooper (1979: 467), has been invoked as evidence for the assumption that partitive noun phrases have a different structure from ordinary noun phrases with a PP constituent by Klein (1977, 1981). Klein proposes the following structure for the phrase drie van mijn nichtjes ("three of my nieces"):

(38)



This structure is meant to express that the head of the partitive phrase is the overt noun nichtjes, and not a dummy noun. The analysis differs from the one given by Barwise & Cooper in some respects; most pertinently, Klein does not recognise the string mijn nichtjes ('my nieces') as a noun phrase, in fact not as a constituent at all. This appears to be rather strange, and leads to wrong predictions. For example, we would predict that no pronoun may be substituted for this string, since that is possible only if this string is a NP-constituent. However, this is clearly possible, as it is in English: by substituting hen ("them") for mijn nichtjes, we get the partitive noun phrase drie van hen ("three of them"). Furthermore, the structure proposed by Klein does not take care of examples such as veel hiervan, mentioned above.

The Klein structure makes another interesting prediction, to wit, that recursion of partitive phrases is not possible. In other words, it correctly predicts the nonexistence of the following phrases:

(39) *elk van de drie van mijn nichtjes ("each one of the three of my nieces")

*geen van de drie van de vijf van de meisjes ("none of the three of the five of the girls")

There is another, indepently motivated, explanation of the non-existence of such examples as the ones given above, which we will consider in more detail in section 5 below. This explanation is based on the properties of the determiners which may occur before and after partitive *van*. We will see that a limited amount of recursion does indeed occur in examples such as the following:

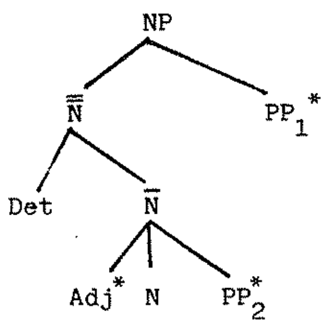
(40) one of the last of the Mohicans
some of the best of our friends

Therefore, we have to reject the Klein structure, since it is incompatible with the existence of such examples.[3] Also note, that there seems to be no way in which the Klein structure is able to deal with English partitive phrase of the type *every one of the students*, *none of us*, etc. Since we would like to assign similar structures to Dutch and English partitives, this will count as an additional argument against the particular structure that is assumed by Klein. One might add, that the type *none of us* is also represented in Dutch, for example in *wie van de drie* "who of the three", where *wie* is a NP, and not a transitive determiner.

To be sure, rejecting Klein's proposal does not in itself solve the problem of how we are to account for the difference between (36c) and (37a). It has been suggested in the literature, that an empty noun must be "bound", either by *er*, an adjective, or by a partitive PP. Such a stipulation, however, can hardly be called an explanation of the facts. Why these three elements ?

Some authors, e.g. Blom (1976), Zwarts (1976), have suggested that *er* cooccurs with an empty $\bar{N}$-position. They assume an $\bar{X}$-structure for nominal structures of the following form:

(41)



In this diagram, the Kleene stars indicate that any number of positions is available. For our purposes, the particulars of this structure are not relevant. It would, for example, be equally satisfactory to have the PP_1 position under the $\bar{\bar{N}}$ node. We only need the following aspects of the structure: (1) adjectives and some PPs are dominated by $\bar{N}$; (2) some PPs are not dominated by $\bar{N}$. Let us call the former PPs *lower PPs* and the latter ones *upper PPs*. The upper PPs, then, may cooccur with an empty $\bar{N}$ position, and hence with *er*. Lower PPs, as well as adjectives, on the other hand, cannot cooccur with an empty $\bar{N}$, since their presence would make the $\bar{N}$ non-empty. Consequently, lower PPs and adjectives do not coocur with *er*. Assuming that partitive PPs are lower PPs, everything follows, such as the contrast between (36c) and (37a).

If you are working in the field of $\bar{X}$-syntax, this might seem a rather neat solution to the problems at hand, especially if you are able to find[4] independent evidence for the categorisation of PPs as lower or higher PPs. From a semantic point of view, this particular solution does not have the same appeal, since it distinguishes levels of modifiers which do not appear to be different semantically. For instance, *houten paard* ("wooden horse") has the same meaning as *paard van hout* ("horse of wood"). Yet the approach sketched above presupposes that *houten paard* is an $\bar{N}$, whereas *paard van hout* is not a $\bar{N}$, given that *van hout* is a higher PP, since it may cooccur with *er* in *Ik heb er twee van hout* ("I have (there) two of wood"). Of course, this argument is by no means conclusive, since one may distinguish syntactically, what is undistinguishable semantically. As I do not have a solution of my own to offer here, I will leave the explanation of the *er* facts for future research. In the mean time, I take it that they do not invalidate the structural analysis proposed above.

4. Categorial aspects of partitives.

4.1. Lambek's calculus.

In Lambek's approach to categorial grammar (cf. Lambek 1958, 1961), such notions as 'phrase structure' or 'function-argument structure' do not carry much weight. The following rule of inference, which is part of his calculus, makes it clear that one may freely pick out and exchange functors and arguments:

(42) Functor-argument choice.

$$\frac{xy \longrightarrow z}{x \longrightarrow z/y \text{ or } y \longrightarrow x\backslash z}$$

In words: if the string of symbols *xy* is reducible to *z*, then either *x* or *y* (the disjunction is exclusive) can be the functor, taking the other element as its argument. (If the notation is not clear: the arrow denotes the reducibility relation, slashed categories denote functor categories. *z/y* is the category of functor expressions taking an *y*-element to their right in order to form a *z*-expression; $x\backslash z$ is the category of functor expressions taking an *x*-argument to their left side in order to form a *z*-expression.)

Another important feature of the Lambek calculus is the possibility of functor-composition. The following rules can be proved in the calculus:

(43) a. $(x/y)(y/z) \longrightarrow (x/z)$ [right-composition]

b. $(x\backslash y)(y\backslash z) \longrightarrow (x\backslash z)$ [left-composition]

It is not necessary for our present purposes to give a full account of the Lambek calculus here. The following rules, when added to the usual rules of cancellation (44a,b below), will suffice.

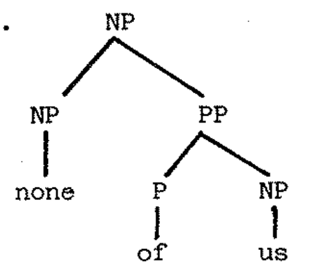
(44) a. $(x/y)\ y \longrightarrow x$ [right-application]

b. $y\ (y\backslash x) \longrightarrow x$ [left-application]

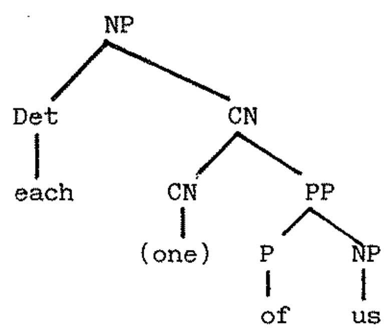
4.2. Deriving partitive phrase structures.

Let us now consider the structural analysis of partitive noun phrases. Recall the discussion of partitive structures in section 3.1. where it was mentioned that both of the following structures are wanted for partitive noun phrases (and, more generally, for any NP containing postmodifiers):

(45) a.



b.

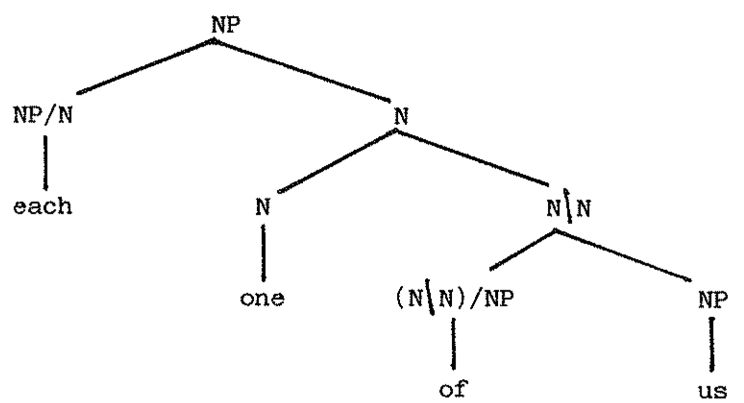


These two structures can be obtained without special stipulation in Lambek's categorial grammar calculus. More precisely, if the lexical assignment is such that the structure drawn in (45b) is admitted, then the alternative structure in (45a) is also admitted. To see this, consider the following category assignment:

(46) a. each, some, my, ... ⟶ NP/N
b. one, Δ, ... ⟶ N
c. of ⟶ (N\N)/NP
d. us, them, ... ⟶ NP

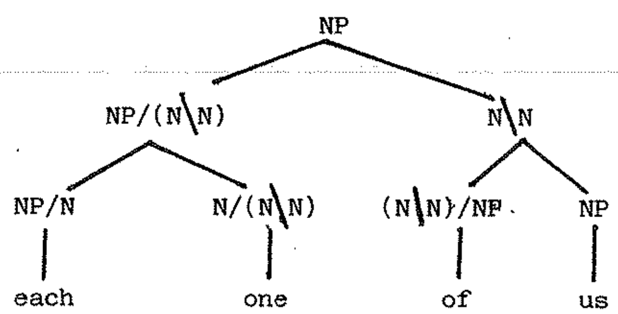
By using none but the application rules (44a,b), a reduction diagram isomorphic to the tree structure (45b) can be obtained:

(47)



By using the rule of functor-argument choice (42), as well as the rules of composition (43a,b), it is possible to admit the alternative reduction diagram below, which is compatible with tree structure (45a):

(48)



For the category of one, (42) has been used, for the combination of each and one, (43a) has to be invoked. Let me illustrate how we may arrive at the category of one. By (46), we have: one $\longrightarrow$ N. By left-application (rule 44b), we furthermore have: N N\N $\longrightarrow$ N. From this we derive, by applying (42), the following: N $\longrightarrow$ N/(N\N). Therefore, one $\longrightarrow$ N/(N\N).

The type lifting we find in Lambek's calculus must be mirrored in the semantics, if the tight fit between syntactic categories and semantic types, characteristic of Montague grammar, is to be maintained. For some discussion, and a proposal, see van Benthem (MS).

In (48), the string each one reduces to NP/(N\N). If only cancellation rules are used, this string will receive its 'basic' category, NP. By analogy, a basic NP such as none will get the category NP/(N\N) as well. This latter assignment does not follow, as a matter of fact, from the Lambek system itself (for a quick proof of this assertion, use the decision procedure in Lambek (1958)). So we just have to stipulate the additional category in the lexicon.

In the previous examples, I have been careful not to use any nouns other than the dummy element Δ and one. The categorial analysis presented above, however, would also admit examples in which partitive of is preceded by a common noun. In this respect, the categorial analysis differs from the ones offered by Barwise & Cooper (1981), Keenan & Stavi (to appear), Klein (1981), and others.

At first sight, the rival theories appear to make the right predictions. The examples below are all flawed:

(49) a. ?one boy of those boys
b. ?each man of these men
c. ?six dogs of your dogs

It is not clear, however, that these examples are really ungrammatical (as distinct from unacceptable). They are redundant, and therefore rather clumsy. But it is possible to find examples which are much better. Dean (1966), cited in Stockwell, Schachter & Partee (1973: 120), gives the following example:

(50) two cooks of those we hired last summer

Here the redundancy, and hence the unacceptability, of the earlier examples in (49) is absent.

Another example is:

(51) only two girls of the ten girls you recommended

I take it, that the categorial analysis is in fact correct, and that a pragmatic constraint must be invoked to rule out the unacceptable examples in (49).

5. Upstairs determiners.

In this section, we will consider the second of the four main questions about partitives formulated in section 2:

(II) Which determiners may appear in front of partitive *of* ?

Determiners which can appear in front of partitive noun phrases will henceforth be termed 'upstairs determiners'. For a precise answer to question (II), we need both necessary and sufficient conditions for upstairs determiners. It appears, however, that necessary conditions are easier to state than sufficient conditions.

In the previous section, we have seen that, characteristically, upstairs determiners are accompanied by a dummy noun. We expect, therefore, that genuine transitive determiners do not appear immediately in front of partitive *of*, since they do not cooccur with dummy nouns. The following hypothesis is a straightforward consequence of the above analysis:

(52) *Conjecture*: all possible upstairs determiners are either intransitive, or pseudotransitive.

According to this conjecture, no genuine transitive determiner should appear in front of partitive *of*. This appears to be borne out by the facts. The examples below include all of the transitive determiners listed in table 1 (cf. section 1, above):

(53) a. *every of my foes
b. *no of the gunmen
c. *a of our masters
d. *the of these men
e. *her of the poems
f. *its of the pages
g. *my of the faults
h. *your of the gold
i. *our of the blame
j. *their of the joy

As expected, the ungrammaticality disappears, once we insert *one*, instead of the zero noun (provided the determiner may cooccur with *one*): *every one of my foes*, for example, is fine.

In Dutch, the situation is quite similar (except for the circumstance that Dutch does not have a pronoun comparable with *one*). Transitive determiners such as *'n*, *de*, *mijn*, *wiens* and *diens* do not occur as upstairs determiners in partitive constructions:

(54) a. *'n van ons
   a of us
b. *de van hen
   the of them
c. *mijn van het goud
   my of the gold
d. *wiens van de ossen
   whose of the oxen
e. *diens van de kinderen
   that one's of the children

Conjecture (52) is confirmed, as far as English and Dutch are concerned. Unfortunately, it is not possible to strengthen it to a complete characterisation of upstairs determiners in partitive constructions, since we are not allowed to assume that all intransitive or pseudotransitive determiners make good upstairs determiners. On the contrary. A quick survey of table 1 will provide a great many counterexamples. For example, *none of us* is correct, but *nobody of us* is not. Most conspicuous, perhaps, are the demonstratives, which, although they are clearly pseudotransitive, do not appear as upstairs determiners, as the following examples show:

(55) a.*that of the gold
b.*this of our mice
c.*those of the men

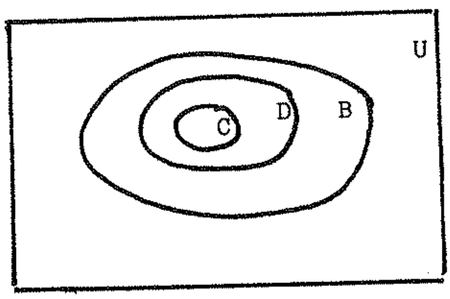
However, it should be noted, that there is a use of demonstratives in which they introduce relative clauses, which is not deictic, as usual, and this use is compatible with the upstairs position:

(56) a. those of us, who knew logic
b. those of you, who are cold and hungry

We find exactly the same phenomenon in Dutch, which suggests that it is not a peculiarity of English demonstratives, but reflects a deeper property of demonstratives in general. And, indeed, I want to argue that it is the strong deictic character of demonstrative determiners, which makes them unsuitable for use in upstairs position. When this deictic character is absent, as it is in (56 a,b) above, the restriction disappears.

Deictic determiners depend on a contextually given set[5]. This set can be specified in various ways, either ostensively, by pointing, or otherwise, such as previous mention in the discourse. Quite simply, an expression such as <u>these boys</u> can be said to denote the property set of a contextually given subset of the set of boys.

Now, partitive expressions are a special case, because they contain a noun phrase (the argument of partitive <u>of</u>), which explicitly mentions a set already introduced, or presupposed, in the discourse. Consider a noun phrase such as <u>these of the boys</u>. The expression <u>the boys</u> denotes a pre-established set of boys (or their property set, in the generalised quantifier perspective). <u>These of the boys</u>, then, would denote the property set of a contextually given subset of the set of boys under discussion. But for that purpose, one could equally well use the expression <u>these boys</u> without further ado. In a picture:



U, the universe
B, the set of boys
D, the interpretation of <u>the boys</u>
C, the contextually given set

Figure 2: the interpretation of <u>these of the boys</u>.

It is clear, that if one wants to talk about C, there is no need to mention D in the discourse, and this might well explain why the longer form <u>these of the boys</u> is not used.

If this explanation is correct, then we have another example of a pragmatic constraint against redundant partitive constructions, similar in many respects to the one we invoked for the examples in (49) above.

A similar explanation can be invoked for the nonoccurrence of personal pronouns in the partitive construction:

(57) a. *he of the barkeepers
     b. *she of those damsels
     c. *it of these messages
     d. *they of the soldiers
     e. *we of the scientists

Personal pronouns are context dependent, that is, indexical elements comparable with demonstratives. Consequently, the same reasoning applies to them.[6]

Summarising, we have found that transitive and indexical determiners are excluded from the upstairs position. Together, these two restrictions give a fairly precise characterisation of the upstairs determiners.

6. Downstairs determiners.

6.1. The Partitive Constraint.

In the previous section, I have already mentioned a property of partitives which seems to be essential and for which Jackendoff (1977) has offered the term *Partitive Constraint*. This constraint says that in an *of-NP* construction, the NP must be definite, or, in Jackendoff's terms, have a demonstrative or genitive determiner (apparently, *the* is also considered a demonstrative).

This constraint rules out many possible candidates for the downstairs position in partitive constructions (that is, of course, the position immediately following *of*), such as numerals, indefinite quantifiers such as *a*, *few*, *many*, *a few*, universal quantifiers such as *all*, *every*, *each*, *any*. It permits, on the other hand, *one of the boys at the bar*, *none of the four men*, *many of his friends*, *one or two of his many mistakes*, *several of her admirers*, etc.

Barwise and Cooper (1981) give a formal definition of the notion 'definite noun phrase' within the definitional frame-work of generalised quantifier theory. Their definition[7] (1981: 183-4) is equivalent to the following one:

(58) Definition: a noun phrase X is definite iff for every model M for which ⟦X⟧ is defined, ⟦X⟧ is a proper principal filter.

To understand this definition, one should know that a filter is a collection of sets (in fact, a subset of POW(U), the power set of the universe of discourse), that is closed under intersections and supersets. A proper filter is neither empty nor equal to POW(U). Principal filters are defined as collections of supersets of a given set. For example, $\{X \subseteq U \mid A \subseteq X\}$ is the principal filter generated by A. On finite models, all filters are principal.

Universal quantifiers, such as every man, are interpreted as the principal filter generated by the denotation of their noun, in this case by the set of men. When there are no men in the model, the filter is nonproper, so universal quantifiers are not definite, according to the above definition.

Noun phrases such as the men are likewise interpreted as the principal filter generated by the noun denotation, but when the noun denotation is empty, the denotation is not defined. This captures the existential commitment that is felt in the use of these expressions. A consequence of this definition is, of course, that the men is definite.

De Jong & Verkuyl (1984) argue that universal quantifiers should be interpreted as proper filters as well, since they feel that their use is odd when the common noun denotes the empty set. In addition to that they argue that universal quantifiers are acceptable as downstairs determiners. The example they give is:

(59) De helft van alle kinderen is ziek
The half of all children is ill

It is not clear, however, that this argument is convincing, given that in most cases universal quantifiers are not acceptable as downstairs determiners:

(60) a.*twee van alle boeken
two of all books
b.*geen van alle boeken[8]
none of all books
c.*een paar van alle boeken
a few of all books

So it appears that (60) represents the rule, and (59) represents an exception to the rule. However, the facts are more complicated than that, because there are other partitives which pattern like the one in (59). These include partitives introduced by superlatives:

(61) a. het mooiste van alles
the most beautiful of all
b. de beste van alle leerlingen
the best of all pupils
c. de meest gevaarlijke van alle stunts
the most dangerous of all stunts

Notice that superlative partitives are like any other partitive in that they do not allow indefinite determiners such as some (Dutch sommige, enkele): *the best of some hit records, *de laatste van enkele feestgangers ("the last one of some partygoers").[9]

In the light of such examples, we have to accept that there are two types of partitives, type A, exemplified by the partitives in (60) above, which does not have universal downstairs determiners, and type B, exemplified by the cases in (59) and (61) above, which admits universal downstairs determiners. The classification is dependent on the upstairs determiners. The upstairs determiners of type B are all definite in Dutch (all of the above examples, at least, have an occurrence of the nonneuter definite article de, or an occurrence of the neuter definite article het). Perhaps this is the reason why the downstairs determiners of partitives of type B need not be definite as well. This explanation, if it is one, would contradict De Jong & Verkuyl's argument that universal quantifiers have existential presuppositions, and, ipso facto, are definite quantifiers.

Tentatively, I propose the following formulation of the Partitive Constraint:

(62) Partitive Constraint[10,11]

In partitive noun phrases, the downstairs determiner must be definite if the upstairs determiner is not; otherwise the downstairs determiner must be either definite or universal.

6.2. Pseudo-partitives.

In Selkirk (1977), several arguments are put forward to substantiate the claim that partitive-like constructions involving measure nouns of the type exemplified in (63) below are distinct from the very similar examples in (64):

(63) a. a number of people
b. three pounds of meat
c. a bushel of apples
d. loads of money

(64) a. a number of her friends
b. three pounds of that meat
c. a bushel of those apples
d. loads of them

According to the Partitive Constraint discussed in the previous section, the examples in (63) cannot be real partitives, since they clearly violate the constraint. The examples in (64), on the other hand, comply with the Partitive Constraint.

Given the similarities between the two sets of examples, it would seem rather ad hoc to stipulate that the cases in (64) are real partitives, and that the cases in (63) are just partitive-like constructions. However, Selkirk shows that there are syntactic tests which discriminate between the two sets.

First of all, extraposition of the of-phrase is possible in the case of real partitives, but not in the case of pseudo-partitives:

(65) a. A lot had been eaten over the left-over turkey.
b. *A lot had been eaten of left-over turkey.

(66) a. How many pounds did you buy of those apples ?
b. *How many pounds did you buy of apples ?

(These examples, including the stars, are Selkirk's.)

Another test mentioned by Selkirk is also linked up with the extraposition of prepositional phrases, though not of the of-phrase this time. Consider the following examples:

(67) a. A variety of answers have been rediscovered to this classical mechanical problem.

b. *A variety of the answers have been rediscovered to this classical mechanical problem.

(68) a. A bunch of objections soon arised against this kind of tactics.

b. *A bunch of the traditional objections soon arised against this kind of tactics.

Selkirk gives an explanation of the above difference in terms of Chomsky's Subjacency condition. The structures that Selkirk assumes are:

(69) <u>Pseudopartitives</u>:

[$_{NP}$ [a number (of)] people]

<u>Real partitives</u>

[$_{NP}$ a [$_{N}$ number [$_{PP}$ (of) [$_{NP}$ her friends]]]]

If we assume that the Subjacency Condition applies to rules of extraposition, we will find that the PP <u>against this kind of tactics</u> can only be moved out of the pseudopartitive construction:

(70) a. [$_{NP}$ [a bunch of] [$_{N}$ objections [$_{PP}$ against this kind of practice]]]

b. [$_{NP}$ a [bunch [$_{PP}$ of [$_{NP}$ the traditional objections [$_{PP}$ against ..]]]]

In the structure given in (70a), the PP has to cross only one bounding node, the NP node of the whole construction, whereas the same PP has to cross two NP nodes in (70b), which is ruled out by the Subjacency Condition. However, the value of this particular explanation is not quite clear, since the assumption that Subjacency applies to rules of extraposition has been severely criticised in the literature (cf. note 3). Whatever the correct explanation may be, the facts presented by Selkirk at least indicate a difference between real and pseudopartitives.

Another test discussed by Selkirk is also relevant for Dutch. Compare the following examples:

(71) a. I met a larger number of high school students than I did (?of) college students.

b. I met a larger number of the high school students than I did of the college students.

c.*I met a larger number of the high school students than I did the college students.

We see here that in constructions which have been submitted to Comparative Ellipsis, the of may be dropped in the case of pseudo-partitives, though not in the case of real partitives. While in normal, nonreduced English sentences the of must be retained[12], this is not the case in Dutch. The Dutch partitive preposition van is obligatorily absent in the pseudo-partitive construction, whereas it is always present in the real partitive construction:

(72) Dutch pseudo-partitives.

a. een pond suiker ("a pound of sugar")
b. een kilo bessen ("a kilogram of berries")
c. een fles sherry ("a bottle of sherry")
d. een bos bloemen ("a bunch of flowers")
e. een kopje water ("a cup of water")

(73) Dutch partitives.

a. een pond van de beste suiker ("a pound of the best sugar")
b. een fles van zijn eigen wijn ("a bottle of his own wine")
c. een paar van die specerijen ("a few of those spices")
d. een aantal van de fijnste uren ("a number of the finest hours")
e. zeven emmers van dit water ("seven buckets of this water")

Pseudo-partitives which retain van are ungrammatical: *een pond van suiker, *een fles van sherry. Partitives which do not contain van are equally ungrammatical: *een pond de beste suiker, *een fles zijn eigen wijn.

Consequently, the difference between pseudo-partitives and real partitives is very obvious in Dutch, since it is reflected directly in the syntax, whereas the distinction must be inferred more indirectly in English from the behaviour with respect to extraposition and Comparative Ellipsis.

I will treat expressions such as een aantal ("a number"), een kilo ("a kilogram"), etc., which contain a determiner and a measure noun, as complex determiners.[13]

As a consequence of this assumption, pseudo-partitives are seen as ordinary noun phrases, having the overall structure Det N and the cases in (73) as ordinary partitive noun phrases, having the overall structure Det of NP. There is no violation of the Partitive Constraint.

7. The interpretation of partitive noun phrases.

7.1. Trouble with "both".

Our reformulation of Jackendoff's Partitive Constraint in section 6.1. is not sufficient for an adequate characterisation of the possible arguments of partitive of. The most obvious problem to be dealt with now is the nonoccurrence of both as a downstairs determiner. According to Barwise & Cooper, both and the two are equivalent determiners, yet one of the two men is a fine partitive, while *one of both men is ungrammatical.

The solution to this problem turns out to be rather straightforward, once the differences between the two and both are recognised, and leads to a deeper understanding of the semantic interpretation of partitive noun phrases. The explanation given here is essentially that of Ladusaw (1982), although it was arrived at independently.

It is wellknown that both is interpreted strictly distributively, whereas the two is interpreted most naturally as a collective quantifier (cf. for instance Edmondson (1978)). To see this, compare the following sentences:

(74) a. Both men could lift the stone.
b. The two men could lift the stone.

Sentence (74a) tells us something about the individual powers of the men under consideration, whereas (74b), on its prefered reading, tells us something about their combined strength. Differences like this cannot be captured in the Barwise & Cooper system without modification, since that system does not distinguish plural predicates (which can be used collectively) from singular predicates. For the interpretation of collective predicates, one will have to adopt a somewhat richer view of generalised quantifiers (cf. Hoeksema (1983) for a proposal, and Scha (1981) for some related ideas).

Before looking into the semantic definitions of plural quantifiers, we must consider the Dutch counterpart of both, beide, which, unlike both, can be used without any problem as a downstairs determiner. Partitive noun phrases such as een van beide paarden "one of both horses", geen van beide ruimtevaarders "none of both astronauts" are perfectly grammatical.

Like both, beide is interpreted distributively. However, it seems that beide has a less prominent collective reading as well. To see this, one has to consider sentences where a distributive reading is ruled out:

(75) a. Het verschil tussen beide voorstellen is groot.
The difference between both proposals is large
b. Tussen beide steden ligt een meer.
Between both cities lies a lake

For similar examples in German, cf. Reis & Vater (1979: 373):

(76) 72 Prozent der Katholiken und 59 Prozent der Protestanten
72 percent of-the catholics and 59 percent of-the protestants
sind für eine Vereinigung beider Kirchen.
are for a union of-both churches

So, perhaps, this might explain why beide is a possible downstairs determiner in Dutch partitives. The matter is somewhat equivocal, it must be acknowledged, because it is very hard in many circumstances, to perceive a collective interpretation for beide. For instance, most people only recognise a distributive reading for Beide mannen tilden de steen op ("Both men lifted the stone"), but, for some mysterious reason, one also finds sentences such as: Eindelijk werden beide mannen het eens ("At last, the two men reached agreement"), where beide mannen obviously must be interpreted collectively.

7.2. Structured domains.

For the interpretation of partitives, it appears to be necessary to have structured domains of discourse, for which a relation of inclusion (a "part-of" relation) is defined.

Some of the logical properties of this relation are uncontroversial and can be stated without argument:

(77) Definition.

Let $(U, \sqsubseteq)$ be a structured domain of discourse. We require that the following conditions hold:

(A) $\forall x \in U: x \sqsubseteq x$

(B) $\forall x,y \in U: (x \sqsubseteq y \;\&\; y \sqsubseteq x) \rightarrow x = y$

(C) $\forall x,y,z \in U: (x \sqsubseteq y \;\&\; y \sqsubseteq z) \rightarrow x \sqsubseteq z$

In other words, the part-of relation is reflexive, transitive and antisymmetric. Together, these requirements define a partial order.

Furthermore, we need to make sure that we can freely talk about the union (or sum) of two entities, and their overlap (or intersection):

(78) Definition.

$x \sqcup y = z$ iff $x \sqsubseteq z \;\&\; y \sqsubseteq z \;\&\; \forall w: (x \sqsubseteq w \;\&\; y \sqsubseteq w) \rightarrow z \sqsubseteq w$

(79) Definition.

$x \sqcap y = z$ iff $z \sqsubseteq x \;\&\; z \sqsubseteq y \;\&\; \forall w: (w \sqsubseteq x \;\&\; w \sqsubseteq y) \rightarrow w \sqsubseteq z$

(80) Definition.

Let $(U, \sqsubseteq)$ be as in (77). Then the following conditions should hold in addition to (A-C):

(D) $\forall x,y \in U \; \exists z \in U: \; x \sqcup y = z$

(E) $\forall x,y \in U \; \exists z \in U: \; x \sqcap y = z$

Definitions (78) and (79) guarantee the unicity of unions and intersections, and (80 D,E) their existence for any pair of elements.

We also postulate a special least element of U, $\emptyset$:

(81) Definition.

(F) $\emptyset \in U \;\&\; \forall x \in U: \emptyset \sqsubseteq x$

Some simple corollaries of definition (81) are the following:

(82) a. $x \sqcup \emptyset = x$

b. $x \sqcap \emptyset = \emptyset$

It is not clear, that it is necessary to postulate a greatest element of U.

One might wonder whether the part-of relation should be discrete, or continuous. It seems that the answer depends on the class of expressions one is considering. For the purposes of mass term semantics, a continuous relation seems to be called for, if one assumes, along with, e.g. Bunt (1981), Link (1983), ter Meulen (1981), that physical properties of the world, such as the supposed granular structure of matter, are irrelevant for the interpretation of mass terms.

On the other hand, if only count terms are considered, a discrete part-of relation, comparable in all respects to the subset relation of set theory, would be preferable.

In Bunt's (1981) ensemble theory, a generalisation of axiomatic set theory is proposed, which covers both discrete sets and mereological entities. I will not use this particular theory here, since I do not believe that the less obvious axioms of axiomatic set theory (Bunt gives a generalisation of ZF set theory) are relevant for semantic purposes, and furthermore it would appear to be simpler to have a direct reflex of the count-mass distinction in the model. I might add, that Bunt's ensemble theory not only admits discrete and continuous ensembles, but also entities of a mixed kind: these include ensembles with both discrete and continuous parts, discrete collections of continuous ensembles, and the like. At the present moment, I envisage no use for such entities in the formal semantics of partitives.

Let us postulate two disjoint universes of discourse U and $\bar{U}$, where U is the universe of discrete individuals and $\bar{U}$ the universe of continuous individuals. In other words, we stipulate:

(83) Definition.

(G) ~~$\forall x \in U \exists y \in U [y \sqsubset x \; \& \sim \exists z \in U [y \sqsubset z \sqsubset x]]$~~ or $x \sqsubset z \sqsubset y$ or $x \sqsubset y$

(G') $\forall x,y \in \bar{U} [y \; [\sqsubset] \; x \rightarrow \exists [z] \in \bar{U} \; [y \sqsubset z \sqsubset x]]$

In this definition, it is stated that the part-of relation is discrete on U and smooth on $\bar{U}$. The symbol '$\sqsubset$' denotes the strict part-of relation defined in the usual manner in (84) below:

G: $\forall xy \in U: ((x \sqsubset y) \text{ or } (y \sqsubset x)) \rightarrow (\sim \exists z \in U: y \sqsubset z \sqsubset x \text{ or } x \sqsubset z \sqsubset y)$

(84) Definition.

$x \sqsubset y$ iff $x \sqsubseteq y$ and $x \neq y$

The two universes, U and $\bar{U}$ are not unrelated, to be sure. Following Link (1983), I will adopt a primitive materialisation relation '$\triangleright$', connecting individuals and the stuff they are made out of. This relation is useful for partitives such as the one in:

(85) Most of the party was rather boring.

(This example also shows, that we should not take the locution 'stuff' too literally here; in many cases, of course, mass terms refer to abstract, or immaterial, entities.)

As regards the materialisation relation, we only require that it be a function. In other words, we require that there be a definite and unique quantity of gold constituting my ring, and a definite and unique amount of time, constituting today, etc.

7.3. A fragment.

In the final section of this paper, I will present a short fragment of English and its modeltheoretic interpretation according to the principles discussed above.

First of all, the syntax of partitive noun phrases will be presented in the format of categorial grammar.

(86) Definition.

Let the primitive categories of our system be $NP_@$ and $N_@$, where @ = m, s, p Whenever A and B are categories, so are A/B and A\B. For every category C, BE_C is the set of its basic expressions. We now specify:

(i) BE_{N_s} = {man, woman, horse, ship, day, sound, Δ,... }

(ii) BE_{N_m} = {sand, gold, time, patience, water, ice, Δ,..}

(iii) BE_{N_p} = {men, women, horses, people, ships, days, Δ,..}

(iv) BE_{NP_s} = {he, she, it, none, everybody, nobody, ... }

(v) BE_{NP_m} = {it, none, .. }

(vi) BE_{NP_p} = {they, we, ...}

(vii) BE_{NP_s/N_s} = {the, a, some, every, each, no, this, that, ..}

(viii) BE_{NP_m/N_m} = {some, little, much, no, the, this, my, .. }

(ix) BE_{NP_p/N_p} = {the, these, those, all, some, most, many, ..}

(x) $BE_{NP_@/(N_@\backslash N_@)}$ = {none, ..}

(xi) $BE_{(N_@\backslash N_@)/NP_\$}$ = {of}

Definition (86) is not yet fully explicit. Ideally, those determiners which can cooccur with a dummy noun should be marked separately. Let us therefore assume that Δ is a $N_@$ with the feature d, and pseudo-transitive determiners, such as all or some, may optionally have the category $NP_@/N_{@,d}$. This information has not been included in (86), to keep the definition simple.

In (86, xi), the symbol $ is a variable ranging over the features s, m and p (singular, mass, plural), just as the symbol @. However, when $ = s, @ = m, and when $ = m, @ = m. When $ = p, @ may be p,m or s. Thus we have some of him (was already decaying), but not *many of him, or*one of him; we have most of the gold, much of the gold, but not*every one of the gold, or *many of the gold; we have little of them (was left), as well as few of them (had left), and one of them.

The above syntactic definitions still allow too many partitives. However, the semantics proposed below will not assign meanings to some of the expressions that are wellformed according to the syntactic definitions. Hence we have an instantiation of semantic filtering here. More specifically: the Partitive Constraint will be incorporated in the interpretation of partitive of.

Partitive of is interpreted as a partial function from the set of quantifiers to the set of noun modifications. We will assume that it is defined for ultrafilters only.

(87) Definition.

A quantifier Q is an ultrafilter iff there is an $x \in U(\bar{U})$, such that: $P(x) \Longleftrightarrow Q(P)$. (I.e.: Q is the property set of x, or the ultrafilter generated by x.)

In accordance with the principles of categorial grammar, the semantic interpretation of the expressions reflects their categorisation:

(88) Definition.

Fix a set Dom(C) for each basic category C as its domain of interpretation. For the derived categories, set:

$Dom(X/Y) = Dom(Y\backslash X) = Dom(X)^{Dom(Y)}$.

For the basic categories, we have the following domains of interpretation in mind: $Dom(N_m) = POW(\bar{U})$, $dom(N_s) = \mathcal{P}(U_{at})$, $Dom(N_p) = POW(U - U_{at})$, $Dom(NP_@) = POW(Dom(N_@))$.

U_{at} is defined as the set of atoms in U. Atoms are those elements of U that have no proper part but $\emptyset$ in U.

(89) Definition.

$Atom(x) =_{df} \forall y: y \sqsubset x \rightarrow y = \emptyset$

Remark: $\bar{U}$ does not have any atoms, by axiom (83, G′).

Let us now take a look at our models.

(90) Definition.

A model for partitives is a 4-tuple $(U, \bar{U}, \rhd, V)$, such that:

(i) U and $\bar{U}$ are as in section 7.2. above;

(ii) $\rhd$ is a map from U into $\bar{U}$;

(iii) V is an assignment of values in Dom(C) to each member of BE_C, where C is any category.

(91) Definition.

An interpretation with respect to a model M is a function $[\![\ ]\!]_M$, which, for any category C, assigns members of Dom(C) to members of WE_C, such that:

(i) $[\![x]\!]_M = V(x)$, for $x \in BE_C$;

(ii) if $x \in WE_{A/B}$ and $y \in WE_B$, then $[\![xy]\!]_M = [\![x]\!]_M([\![y]\!]_M)$;

(iii) if $x \in WE_A$ and $y \in WE_{A\backslash B}$, then $[\![xy]\!]_M = [\![y]\!]_M([\![x]\!]_M)$.

Here is a partial specification of the basic assignment function V:

(92) Definition.

$V(\underline{some}_m) = f: Dom(N_m) \longmapsto Dom(NP_m): f(x) = \{y \in Dom(N_m) \mid x \cap y \neq \emptyset\}$

$V(\underline{the}_s) = f{:}Dom(N_s) \mapsto Dom(NP_s){:}\ f(x) = \{y \subseteq Dom(N_s) \mid x \subseteq y\}$ if x is a singleton set, undefined otherwise.

$V(\underline{the}_m) = f{:}Dom(N_m) \mapsto Dom(NP_m){:}\ f(x) = \{y \subseteq Dom(N_m) \mid \bigsqcup x \in y\}$ if $x \neq \emptyset$, undefined otherwise

$V(\underline{the}_p) = f{:}Dom(N_p) \mapsto Dom(NP_p){:}\ f(x) = \{y \subseteq Dom(N_p) \mid \bigsqcup x \in y\}$ if $x \neq \emptyset$, undefined otherwise

$V(\underline{both}) = f{:}Dom(N_p) \mapsto dom(NP_p){:}\ f(x) = \{y \subseteq Dom(N_p) \mid \forall z\ [(Atom(x)\ \&\ z \in x) \rightarrow z \in y)]\}$ if there are exactly 2 atomic members of x, undefined otherwise

$V(\underline{all}) = f{:}Dom(N_p) \mapsto Dom(NP_p){:}\ f(x) = \{y \subseteq Dom(N_p) \mid x \subseteq y\}$

In the above definitions, unions of arbitrary subsets of U and $\bar{U}$ have been introduced. The union of a subset of U is of course the smallest member of U such that every member of the subset in question is part of it.

A few comments: (1) for every argument p, V($\underline{the}_@$)(p) is an ultrafilter; (2) for no argument q, V(both)(q) is an ultrafilter. These claims follow directly from the definition of ultrafilters in (87) above.

Before going on to the definition of V(of), we must take note of the following notational conventions:

(93) Definition.

$\underline{of}_{a,b} = \underline{of}_{(N_a \backslash N_a)/NP_b}$

(94) Definition.

Gen(x) is the generator of the ultrafilter x. If x is not an ultrafilter, Gen(x) is not defined. For any property P, P(Gen(Q)) iff Q(P).

Now we are ready to consider the following definition of V(of) for every admissible value combination of @ and $ (cf. the discussion below (86)).

(95) Definition.

$V(\underline{of}_{s,p}) = f{:}Dom(NP_p) \mapsto Dom(N_s)^{Dom(N_s)}{:}\ f(Q)(p) = p \cap \{x \mid x \subseteq Gen(Q)\}$

$V(\underline{of}_{p,p}) = f{:}Dom(NP_p) \mapsto Dom(N_p)^{Dom(N_p)}{:}\ f(Q)(p) = p \cap \{x \mid x \subseteq Gen(Q)\}$

$V(\underline{of}_{m,p}) = f{:}Dom(NP_p) \mapsto Dom(N_m)^{Dom(N_m)}{:}\ f(Q)(p) = p \cap \{x \mid x \subseteq \triangleright Gen(Q)\}$

$V(\underline{of}_{m,s}) = f{:}Dom(NP_s) \mapsto Dom(N_m)^{Dom(N_m)}{:}\ f(Q)(p) = p \cap \{x \mid x \subseteq \triangleright Gen(Q)\}$

$V(\underline{of}_{m,m}) = f{:}Dom(NP_m) \mapsto Dom(N_m)^{Dom(N_m)}{:}\ f(Q)(p) = p \cap \{x \mid x \subseteq Gen(Q)\}$

It is a somewhat unfortunate consequence of our decision to make use of two separate domains of discourse U and $\bar{U}$, that the definitions in (95) cannot be collapsed in one general definition of the form: $V(\underline{of}_{@,\$}) = f: Dom(NP_{\$}) \longmapsto Dom(N_{@})^{Dom(N_{@})}: f(Q)(p) = p \cap \{x | x \subseteq Gen(Q)\}$. This suggests, that a different choice of models might lead to a more economical formulation of the interpretation of partitive *of*. There are various ways in which one could go about this, and there are many ideas in the literature on mass terms, which might be relevant here, such as the proposals for a theory of aspect and individuation in ter Meulen (1983, 1984). It would take us too far, however, to examine the various possibilities in due detail, and so I have to relegate this matter to some other occasion.

The semantics of partitive *of* has been formulated in such a manner, that ⟦of NP⟧ is not defined in case ⟦NP⟧ is not an ultrafilter. This definition, in conjunction with the definition of V(*both*) in (92), causes *of both women* and similar expressions with the same determiner to be uninterpretable on every model. In consequence of that, it could be argued, all such expressions are ruled out as ungrammatical. Other expressions, such as *some women*, are likewise never interpreted as ultrafilters. An exception has to be made for universal quantifiers, such as *all women*, which denote ultrafilters when there is only one group of two women in the domain of discourse. We may furthermore assume that universal quantifiers (more precisely, only the ones introduced by *all*, not the singular ones introduced by *every*, *each* or *any*) have a collective interpretation in addition to the ordinary distributive reading for which the definition of V(*all*) in (92) above has been provided. Scha (1981: 491) argues that this reading is needed for sentences such as (96):

(96) All boys gather.

For this reading, we postulate the following definition:

(97) Definition.

$$V(\underline{all}_c) = f: Dom(N_p) \longmapsto Dom(NP_p): f(p) = \{q | \sqcup p \in q\}$$

This denotation is an ultrafilter except when p is the empty set.

In general, the determiner *the* is prefered for collective interpretation, which may account for the oddness of *all* as a downstairs determiner. However, the examples discussed in section 6.1. suggest that *all* is not always impossible in that position.

Notes.

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1. Cf. van Benthem (1983, 1984), Zwarts (1983), Westerståhl (1982).
2. For an account of French partitives, cf. Milner (1978), Hulk (1983).
3. Klein gives several interesting arguments for his proposal, which I have not discussed in the main text, since none of them appears to admit of close examination. For example, Klein argues that his structure predicts the extraposition behaviour of PPs in partitive constructions if Chomsky's Subjacency condition is assumed. However, the validity of this condition for extraposition rules is extremely dubious (cf. Koster 1978: 48-57). Klein also argues that his structure makes the right predictions for the behaviour of Gapping, given Neijt's (1979) theory of Gapping. Unfortunately, Klein's explanation is based on a misunderstanding of the definition of the notion 'major constituent' (he assumes major constituents are just maximal projections).
4. Zwarts (1976) mentions the distribution of pronominals as independent evidence. For some discussion, cf. Jullens (1983).
5. For a more substantial discussion of context dependent quantification, cf. Westerståhl (1984).
6. One might note here, that the preposed partitives discussed in 3.1. above in connection with the examples (27) and (28) behave differently:

   (i) Of those ladies, she was the most elegant.
   (ii) Of the soldiers, they were particularly valorous.
   (iii) Of our enemies, those were harmless.

   So we have additional evidence, that preposed partitives are a separate category altogether.
7. Barwise & Cooper's definition is phrased in terms of determiners. The present definition is more general in that it deals with pronouns as well.
8. For some reason, <u>geen van alle</u> can be used as a "floating quantifier":

   (i) Zij waren geen van allen verzekerd.
   They were none of all insured
   "None of them was insured"

9. There are some differences between Dutch and English here. In English, one has superlative partitives of the following type:

(i) the greatest of scholars
the most cruel of men
the fairest of womankind

These seem to be typical for a somewhat elevated style of English, and do not have counterparts in Dutch. They appear to violate the partitive constraint, but this violation is only apparent. The bare plurals scholars, men, and the singular collective term womankind, are not used in an indefinite fashion; there is no change in meaning when all is prefixed to them.

In addition, there are some real problematical cases that occur in both languages:

(ii) Hij is de oudste van negen kinderen
He is the oldest of nine children

Such examples seem to be idiomatic. Sentence (ii) is typically used to state of someone, that he has eight brothers and sisters, and that he is older than any of them. It certainly cannot be used to express that there is a set of nine children (perhaps arbitrarily chosen), such that the one we are discussing is older than the other members of the set. For example, suppose I have 11 children. In that case I could hardly state of my third child, that he is the oldest of nine children. Yet the fact remains, that the indefinite determiner nine can be used here.

Also note, that partitives of this type seem to prefer predicate nominal position:

(iii) ?The oldest of nine children died last night.

10. There are some counterexamples to the Partitive Constraint which suggest that some further elaboration is needed. Ladusaw (1982: 240) mentions the following cases:

(i) that book could belong to one of three people
(ii) this is one of a number of counterexamples to the Partitive Constraint
(iii) John was one of several students who arrived late

Ladusaw remarks, that the examples in (i-iii) are appropriately used only when the user has a particular group of individuals in mind. Perhaps an analysis of specificity along the lines of Fodor & Sag (1982) is needed here.

11. A problem for the present version of the Partitive Constraint is the behaviour of de rest ('the rest'). This expression can introduce a partitive: de rest van de meisjes ('the rest of the girls'). Furthermore, it contains the definite article de ('the'). However, it appears that it does not license universal downstairs determiners:

    (i) *De rest van alle kandidaten bleef volhouden.
    The rest of all candidates kept trying

12. Selkirk notes a couple of exceptions to this claim. For example, a dozen drops of, as well as a pound etc., the latter, according to Selkirk, especially in recipes, eg. A pound cake is one pound butter, one pound sugar, one pound eggs and one pound flour.

13. Greenberg (1975) assumes the same structure for numeral-classifier combinations. This is no surprise, given the fact that historically, classifiers often derive from measure nouns (e.g. in Mandarin Chinese, cf. Li & Thompson 1981).

14. In Hoeksema (1983), a somewhat different domain is proposed for plural noun phrases. For our present purposes, the definition given here is satisfactory, but for a complete account of plurality, including conjoined noun phrases, the definition in the earlier paper is to be prefered.

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