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STRANGE RELATIVES OF THE THIRD KIND*

In this paper, we argue that there are more kinds of relative clause constructions between the linguistic heaven and earth than are dreamed of in the classical lore, which distinguishes just restrictive relative clauses and appositives. We start with degree relatives. Degree, or amount, relatives show restrictions in the relativizers they allow, in the determiners that can combine with them, and in their stacking possibilities. To account for these facts, we propose an analysis with two central, and novel, features: First, we argue that the standard notion of degree (a number on a measuring scale) needs to be replaced by a notion of structured degree, which keeps track of the object measured. Second, we argue that at the CP-level of degree relatives an operation of (degree) *maximalization* takes place. We show that the observed facts concerning degree relatives follow from these assumptions. We then broaden the discussion to other relative clause constructions. We propose that the operation of maximalization takes place in relative clauses when the head noun is semantically interpreted CP-internally, while syntactically the CP is part of a DP that also contains CP-external material. Based on this, we argue that degree relatives form part of a linguistically coherent class of relative clause constructions – we call them *maximalizing relatives* – which all show restrictions similar to those observed for degree relatives, and which differ semantically (and often also syntactically) both from restrictive relative clauses and from appositives. We discuss free relatives, internally-headed relatives, and correlatives.

1. Introduction

Much of the traditional and generative literature has assumed two semantic types of relative clause constructions: *restrictives* and *appositives*. Following Partee (1973), it is standardly assumed that restrictive relative clauses denote sets which semantically combine with their head noun through set inter-

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section. Since more than one set can intersect with the same head noun, restrictive relative clauses can stack. As Sells (1985) shows, appositive relative clauses contain an element that stands in a discourse anaphora relation to the NP they modify. Since more than one relative can stand in a discourse anaphora relation to the same NP, appositive relative clauses can stack too.

We are concerned in this paper with relative clauses that for a variety of reasons do not fit either of these molds. The kinds of construction we will be looking at are:

– *degree relatives* (discussed in Carlson 1977b and Heim 1987)
– *realis and irrealis free relatives* (realis: e.g. Jacobson 1988)
– *internally headed relatives* (Basilico 1996)
– *correlatives* (Dayal 1991a, b, 1996).

As we will see, one diagnostic that distinguishes these constructions from both restrictive and appositive relative clauses is that they do not allow stacking (excepting cases with a special semantics, such as corrections, where a second relative clause corrects or amends an earlier one).

What we will argue is that the traditional emphasis on appositives and restrictives gives a rather lopsided picture of the full class of relative clause constructions. We propose that a more satisfactory classification of relative clauses is in terms of *sortal-internal* vs. *sortal-external* relatives. This dichotomy takes as a criterion whether the relative construction's sortal (which is the common noun, or NP, if nominal constructions are DPs) is *semantically* construed as outside or inside the construction's CP. In certain kinds of relative clauses, like correlatives, there can actually be on the surface two tokens of a sortal, one CP-internal and one CP-external. But the situation is essentially the same here: the relevant criterion is which of the two tokens is the one that contributes to the semantics; the other one is, in essence, semantically vacuous.

The classical picture is lopsided because both appositives and restrictives fall inside the class of sortal-external relatives. This makes everything else a "strange relative of the third kind." But it should be clear that this name only indicates the relatively late appearance of non-appositive, non-restrictive relatives on the linguistic horizon. If we are right in claiming that the main semantic dichotomy within relatives is in terms of the sortal-internal/external distinction, then there is nothing strange about the internal ones, nor are they properly of a third kind. Rather, we think of relatives as taking positions in a spectrum of the following sort:

Simplex XPs –	*Appositives* –	*Restrictives* –	*Maximalizers* –	*Simplex CPs*
1	2	3	4	5

Relative clauses form a paradigm in which various intermediate options are filled in between two extremes. On the one extreme (1), there is no relative to make a contribution to the construction whatsoever: these are simplex XPs which lack a relative clause altogether. On the other extreme (5), there is no contribution to the construction besides the relative: in this case the entire construction is a bare CP, completely lacking external material. We will argue that this situation is represented by the irrealis free relatives.

In the center of the paradigm, we find restrictives. These are constructions where the head noun and the relative provide, by and large, an equal contribution to the entire construction, shown by the fact that they combine through intersection, which is a symmetric operation. Appositives are on the left side of the paradigm: the CP-external material makes the main contribution to the construction; since the appositive is related to the CP-external material as a discourse anaphor, its contribution to the construction is indirect and mediated through the discourse level (see Sells 1985 for details).

Between the center and the right extreme (under 3), we find relative clause constructions where the contribution of the CP-external material is reduced to the minimum consistent with the CP's internal makeup. This is where we find the four other constructions that we will discuss. We will argue that part of the semantics of these constructions is a CP-internal *maximalization* operation. Whatever CP-external material is syntactically present is either interpreted CP-internally or by and large predictable from the semantic interpretation of the CP after maximalization.

As indicated at the beginning of this paper, the semantic operations involved in appositives and restrictives easily generalize to *n*-place operations (i.e., it is in principle as easy to connect *n* discourse anaphors to an NP as it is to connect one; similarly, intersecting a noun with *n* relatives is as easy as restricting it with one). This is the reason that these relatives stack. On the right side of the paradigm, what CP-external material there is (semantically) is predicted from the CP-internal semantics. This means that the sortal and cardinality properties are fixed CP-internally. We assume that it is not possible to independently fix these properties more than once for the same construction. Hence the relatives on the right side do not stack.

The structure of this paper is as follows. We will first discuss the syntax and semantics of degree relatives as a paradigm case of maximalizing relatives. After that we will discuss realis and irrealis free relatives, internally headed relatives, and correlatives.

2. Degree Relatives

2.1. *Carlson and Heim*

Degree relatives were discussed in Carlson (1977b) (where they are called ‘amount relatives’) and Heim (1987).

Carlson draws attention to the following facts concerning the interaction between relativization and *there*-insertion contexts. If the relative clause contains a *there*-insertion context and the relativization gap is in the position which is open to the definiteness effect, the relative clause is OK with the relativizer *that* or with the empty relativizer Ø, but not with the relativizer *which*:

(1) a. I took with me the three books that/Ø there were __ on the table.
b.#I took with me the three books which there were __ on the table.

While their accounts are couched in different frameworks, Carlson and Heim give in essence the same explanation for the infelicity of (1b) (we follow Heim’s account):

– The gap of relativization with relativizer *which* is filled by an *individual* variable.
– Individual variables count as *strong* NPs.
– This means that (1b) contains a strong NP in the position which is open to the definiteness effect, hence (1b) is infelicitous.

This account of the infelicity of (1b) is neutral with respect to the proper account of the definiteness effect, but, of course, it relies on the assumption that bound individual variables count as strong. Since we do not want to commit ourselves here on the latter issue, we want to point out that, alternatively, one can give an account of the same facts in terms of the mechanism of variable binding (rather than the nature of the variable), using an analysis of the definiteness effect in the spirit of Milsark (1974):

– The *there*-insertion context contains an operation that has to bind a variable in the position which is open to the definiteness effect. (Following Milsark, this operation will usually be an existential quantifier, but, as is well known, that doesn’t work for downward entailing NPs, so something more is going on there).
– Relativization with relativizer *which* abstracts over the variable in the gap position.
– But then these two operations need to bind the same variable, which means that the higher operation, the abstraction, is vacuous; i.e., the relativizer *which* does not bind a variable. Vacuous abstraction is not allowed; hence, (1b) is infelicitous.

Carlson and Heim explain the felicity of (1a) as follows (we again follow Heim):

- Natural language has a strategy to avoid the problem in (1b), namely, *degree abstraction*: the relativizers *that* and Ø (but not *which*) can bind a degree variable.
- The gap in (1a) contains a null degree expression, *d many books*, in which only the variable *d* is bound by the relativizer.
- The degree variable is not in the position open to the definiteness effect, and the null degree expression *d many books*, which is, counts as a weak NP.
- Thus there is no definiteness problem in (1a): (1a) is felicitous.

Making the same assumptions, the explanation following Milsark is only slightly different:

- The null degree expression *d many books* is an indefinite and provides, like all indefinites, an individual variable to be bound by the *there*-insertion operation. Thus, this operation and the relative clause abstraction bind different variables:
- Hence there is no vacuous abstraction in (1a) and (1a) is feilicitous.

The two explanations can be summarized as follows:

Individual Abstraction: #which there are __ on the table
Semantics – 'Heim': {x: there are [x] on the table}
Explanation of infelicity: variable x is strong
Semantics – 'Milsark': {x: ∃x [ENTITY](x) and ON-THE-TABLE(x)]}
Explanation of infelicity: operation {x: } is vacuous

Degree Abstraction: (books) that there are __ on the table
Semantics – 'Heim': {d: there are [[d many books]] on the table}
Explanation of felicity: d is strong, but [d many books] is weak
Semantics – 'Milsark': {d: ∃x [BOOKS(x) and |x| = d and ON-THE-TABLE(x)]}
Explanation of felicity: no vacuous abstraction
(Note: *d many books* is represented as: BOOKS(x) ∧ |x| = d)

In the current literature on the definiteness effect, some analyses fit better with Heim's approach, others are more in the spirit of Milsark. What we have shown is that the essence of the Carlson/Heim explanation for the facts in (1) – degree abstraction in (1a) vs. individual abstraction in (1b) – is independent of this variation and is compatible with both approaches. We will base our own representations on those of the second approach.

Let us take stock and compare the degree relative in (1a) with the restrictive relative in (1c).

(1) c. I took with me the three books which were on the table.

The restrictive relative is interpreted as a set of individuals, just like the head noun with which it intersects. The relative in degree relatives has a different kind of denotation (a set of degrees), and, as a consequence, it cannot combine with the head noun through intersection (because intersecting a set of individuals with a set of degrees is senseless). The crux of the semantic interpretation of degree relative (2a) is the null degree phrase *d many books* that is located inside the relative:

(2) a. (books) that there were __ on the table
b. (books) that there were (d many books) on the table
c. {d: ∃x[BOOK(x) and |x| = d and ON-THE-TABLE (x)]}

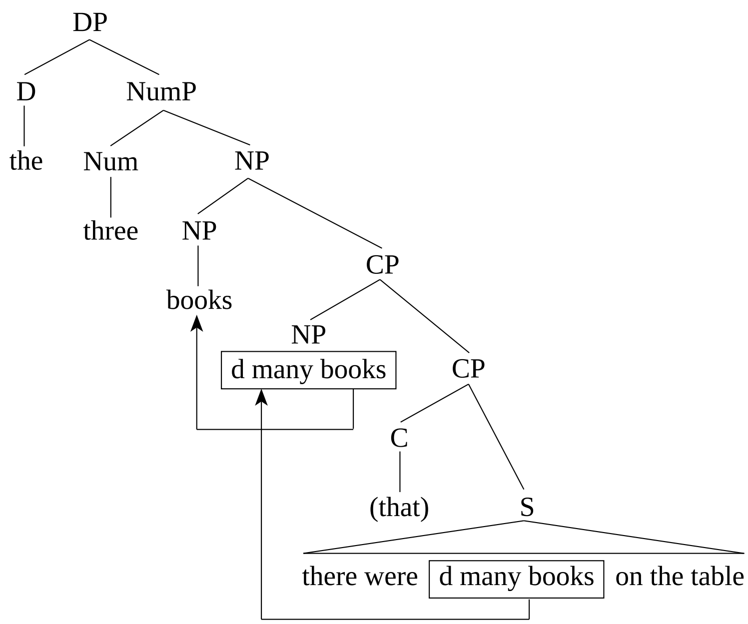
Crucially, we see that the head noun *books* is already interpreted semantically downstairs inside the relative clause. It is this fact that gives the interpretation in (2c), which can be paraphrased as 'the set of all degrees d such that there is a sum of d many books on the table'.

What we see, then, is that the kind of degree relative construction illustrated by (1a) is really a different construction from restrictive relatives: degree relatives do not combine with the head noun through intersection; rather, the head noun information plays the role of a *sortal* inside the degree relative.

We will give a compositional semantics for degree relatives based on these insights in the next subsections. For concreteness' sake and simplicity, we choose a syntactic analysis which encodes some of the basic relations at a syntactic level. We stress, though, that the semantics is compatible with a variety of syntactic analyses of the degree relative construction.

Following Bianchi (1995) and Kayne (1994) (and incorporating elements from earlier literature, including Carlson 1977b), we assume the following movement operation: the position of the gap in the relative clause contains a degree phrase *d many books* which is moved to the Spec of CP. From this position the head noun *books* is moved out of the CP to the external head position in the dominating NP. The head noun is phonologically realized; the copies of the degree phrase are phonologically null (indicated as boxed in the tree below):

(3)



In the following subsections we will specify a semantics for degree relatives by giving a compositional interpretation for the above tree.

2.2. *Degrees*

The Carlson/Heim analysis of degree relatives predicts the felicity of the relative in (2a), repeated here, by assuming that (2a) means (2c).

(2) a. (books) that there were __ on the table
b. (books) that there were (d many books) on the table
c. {d: ∃x[BOOK(x) and |x| = d and ON-THE-TABLE(x)]}

For instance, suppose that there are four books on the table: a, b, c and d. Then for any non-empty subset of {a, b, c, d}, the cardinality of that subset is in the denotation of the relative clause. This means that in this case the relative clause (2a) denotes {1, 2, 3, 4}. So the relative clause just denotes a set of numbers (because that is what cardinalities are). How do we go on from here? Carlson makes the following suggestion (taken up by Heim). At this point the degree relative interacts with the rest of the sentence in the same way as *comparatives* do. In essence this means that (4a) and (4b) are given the same interpretation:

(4) a. the books that there were (d many books) on the table
b. as many books as there were on the table

As evidence for this, Heim points out that (5a) permits a reading which requires only identity of quantity, not identity of substance. (5c) and (5d) make the same point with a count noun:

(5) a. It will take us the rest of our lives to drink the champagne that they spilled that evening.
b. It will take us the rest of our lives to drink as much champagne as they spilled that evening.
c. We will never be able to recruit the soldiers that the Chinese paraded last May Day.
d. We will never be able to recruit as many soldiers as the Chinese paraded last May Day.

The relative in (5a) can be either a restrictive or a degree relative. When it is the latter, we get the identity of quantity reading.

As a first comment, we note that if this analysis is to work, it will have to be modified slightly. As mentioned above, in the degree relative in (5a), the head noun *champagne* is interpreted internally and provides a sortal on the degree there. This is shown by the infelicity of (6a) below. In the comparative clause in (5b), *champagne* does not play the role of an internal sortal, as can be seen from the felicity of (6b):

(6) a.# It will take us the rest of our lives to drink the champagne that they spilled beer that evening.
b. It will take us the rest of our lives to drink as much champagne as they spilled beer that evening.

This means that rather than assuming that (4a) has the same interpretation as the comparative (4b) (allowing the sortal inside to be specified differently), Carlson and Heim ought to assume that (4a) is interpreted like the comparative (4c), which has an internal sortal specified:

(4) c. as many books as there were books on the table

This particular problem does not arise on the syntactic analysis of the degree relatives that we proposed: the head noun starts out as a sortal on the degree phrase inside the relative clause and is raised to the external head noun position. This is obviously going to mean that no other sortal can be specified inside the relative clause, and no other head can be in the external head position.

Let us come to the real problem now. The real problem with the Carlson/Heim analysis, as presented above, is that it just can’t be correct. On that analysis, the degree relative denotes a set of degrees – in the count case, a set of numbers. It is obvious that at this level we can define an operation that gives us an identity of amount or number reading, because amounts or numbers are exactly what the denotation of the degree relative contains. But a set of numbers is just that: from a set of numbers you cannot see what these numbers are numbers of. This means that from a set of numbers you can't reconstruct the set of actual sums of individuals that these numbers are the cardinality of. But that then means that the Carlson/Heim analysis predicts that degree relatives can *only* support identity of quantity readings, and in fact cannot possibly support identity of substance readings.

But this is clearly wrong. First, the identity of quantity reading that Heim points out for the examples in (5) is not generally available and usually requires contextual triggers (often modals and generics). For instance, (7) doesn't naturally have this reading:

(7) Yesterday, I spent the whole day drinking the wine that they spilled at the party.

But there doesn't seem to be a reason why the relative in (7) couldn't be a degree relative. Secondly, and more damaging, as we have seen, where the gap of the relative is in the *there*-insertion context as in (8), the relative cannot be a restrictive relative but has only a degree relative analysis:

(8) I took with me every book that there was on the table.

But that would predict that (8) only has an identity of quantity reading, and can't have an identity of substance reading. However, the facts are exactly the opposite: (8) cannot mean that I took with me from the library as many books as there were books on the table in the kitchen; it only means that I took those actual books in the kitchen. That is, (8) only has an identity of substance reading. In analogy to the discussion of (2) above, (8) is true if I took a, b, c, and d. But there is no way that we can assign that interpretation to (8), if the relative clause *books that there were on the table* is interpreted as {1, 2, 3, 4}.

We believe that the Carlson/Heim analysis is correct in most aspects. As we will argue more extensively below, we think there is good reason to think that degree relatives indeed denote sets of degrees. The problem, we think, lies in the notion of degree used. Up to now we have assumed without discussion the classical concept of degree. A classical degree function, like cardinality, is a function that assigns to every plural object a degree – a numerical value on some scale (like its cardinality). Degrees, then, are those numerical values. On this conception, a degree is a value on a measuring scale, and looking at that value alone, one cannot tell what the object is that is being measured. It is this that brings in the problem.

What we need is a *richer* notion of degree: we need a notion of degree that keeps track of what it is a degree of.

A classical degree function maps a plural individual onto a number, its cardinality:

(9) For all plural individuals x: $\text{DEGREE}(x) = |x|$

Our degree function maps a plural individual, relative to a sortal predicate, onto a triple consisting of its cardinality, that sortal predicate (indicating the measure scale), and the plural individual itself:

(10) For all plural individuals x: $\text{DEGREE}_P(x) = \langle |x|, P, x\rangle$

This means that we replace the standard representation (11b) of (11a) with representation (11c), containing a more fine-grained degree:

(11) a. There are three books on the table.
b. $\exists x\, [\text{BOOKS}(x) \text{ and } \text{DEGREE}(x) = 3 \text{ and ON-THE-TABLE}(x)]$
c. $\exists x\, [\text{BOOKS}(x) \text{ and } \text{DEGREE}_{\text{BOOKS}}(x) = \langle 3, \text{BOOKS}, x\rangle$ $\text{and ON-THE-TABLE}(x)]$

The degree $\langle 3, \text{BOOKS}, x\rangle$ thus consists of the measure value – 3 – the measure domain – BOOKS – and the object measured – x. Let us comment briefly on the sortal and the measure domain. We include the sortal in the representation of degrees because it makes sense to do so: degrees are obviously degrees in some measure domain, which is constrained by the sortal. Inclusion is also semantically sensible because, as we argue below, the sortal in the degree is used to construct the identity of quantity reading of the examples in (5) (see the discussion below). For the identity of substance readings, which form the major topic of this paper, we don't need the sortal, and we could just as well let degrees be pairs of the form $\langle x, |x|\rangle$, rather than triples $\langle x, P, |x|\rangle$.

We assume that numerals have the semantics of modifiers. Hence, we get for *three* and *three books*:

(12) a. *three* $\rightarrow \lambda P \lambda x.P(x) \wedge \text{DEGREE}_P(x) = \langle 3, P, x\rangle$
b. *three books* $\rightarrow \lambda x.\text{BOOKS}(x) \wedge \text{DEGREE}_{\text{BOOKS}}(x) = \langle 3, \text{BOOKS}, x\rangle$

Since degrees will only occur in the context of a sortal, we will bluntly use the representation in (11b) as notation for the representation in (11c):

(13) *Definition*: $\lambda P \lambda x.P(x) \wedge \text{DEGREE}(x) = n := \lambda P \lambda x.P(x) \wedge \text{DEGREE}_P(x) = \langle n, P, x\rangle$

With Carlson and Heim, we assume in degree relatives a null degree measure phrase *d many books*, which is represented in exactly the same way as before with a variable over degrees:

(14) λx.BOOKS(x) AND DEGREE(x) = d

The difference lies in the interpretation: variable d no longer ranges over just numbers, but over our degree triples. More precisely, this means that we assume the following interpretation of *d many*:

(15) *d many* $\rightarrow \lambda P \lambda x.P(x) \wedge \text{DEGREE}_P(x) = d$

With Heim and Carlson, we assume that relativization with the *that*-relativizer can bind the degree variable. Also with them, we then make the following two assumptions about the interpretation of the CPs of degree relatives:

1. The gap in the relative clause is interpreted as a null degree expression λx.BOOKS(x) $\wedge$ DEGREE(x) = d, in which individual variable x is bound by (or open to) the operation of the *there*-insertion context, and in which the sortal *books* is interpreted inside the CP.
2. As is typical in relative clauses, at the CP-level *abstraction* takes place, in this case over the degree variable d in the gap. This means that, in building up the meaning of the CP, we get the same representation (2c) as before for (2a) (repeated here).

(2) a. (books) that there were __ on the table
b. (books) that there were (d many books) on the table
c. {d: ∃x[BOOK(x) and DEGREE(x) = d
and ON-THE-TABLE (x)]}

However, given the degree function defined above, we can simplify this representation to a representation that does not have the existential quantifier in it any longer:

(16) {d: ∃x[BOOKS(x) and DEGREE(x) = d
and ON-THE-TABLE (x)]}

Writing the full representation of this gives (17):

(17) $\{\langle |y|, \text{BOOKS}, y\rangle : \exists x[\text{BOOKS}(x) \text{ and } \text{DEGREE}_{\text{BOOKS}}(x) = \langle |y|, \text{BOOKS}, y\rangle \text{ and ON-THE-TABLE}(x)]\}$

By definition of the DEGREE function, $\text{DEGREE}_{\text{BOOKS}}(x) = \langle |y|, \text{BOOKS}, y\rangle$ is only defined if x = y. Thus (17) reduces to (18):

(18) $\{\langle |y|, \text{BOOKS}, y\rangle : \exists x[\text{BOOKS}(x) \text{ and } x = y \text{ and } \text{DEGREE}_{\text{BOOKS}}(x) = \langle |x|, \text{BOOKS}, x\rangle \text{ and ON-THE-TABLE}(x)]\}$

But this means that the existential quantifier plays no role; (18) reduces to (19):

(19) $\{\langle |y|, \text{BOOKS}, y\rangle: \text{BOOKS}(y) \text{ and ON-THE-TABLE}(y)\}$

Thus we derive (20) as the interpretation of (2a):

(20) $\{\langle |x|, \text{BOOKS}, x\rangle: \text{BOOKS}(x) \text{ and ON-THE-TABLE}(x)\}$
('The set of all measure triples, of which the object measured is a sum of books on the table')

That these triples indeed keep track of the objects measured can be seen as follows. Suppose a and b are the books on the table. Then (2a) will be interpreted as (21):

(21) $\{\langle 1, \text{BOOKS}, a\rangle, \langle 1, \text{BOOKS}, b\rangle, \langle 2, \text{BOOKS}, a \sqcup b\rangle\}$
(where $a \sqcup b$ is the plural individual which is the sum of a and b).

It should be clear that out of this set of triples we can extract both the numerical information (quantity) and the individual information (substance). Before we discuss that, we first have to discuss one more crucial operation which takes place in building up the meaning of the CP of degree relatives.

2.3. *Maximalization*

Carlson discusses another set of facts concerning degree relatives. He points out that degree relatives can only occur with certain determiners: basically, only universal determiners (*every*, free-choice *any*, *all*), definites (*the*, *those*, . . .), and partitives built from definites are felicitous:

(22) a. I took with me every book/any books/the books/the three books/three of the books that there was/were __ on the table.
b.#I took with me three books/few books/many books/some books/most books/no books that there were __ on the table.

These facts are particularly interesting since they seem to hold crosslinguistically. While Carlson's English facts in (1) have no correspondence in languages that do not have the distinction between relativizers *that* and *which*, the facts in (22) can easily be tested crosslinguistically. And these facts seem to be the same in Dutch and Hebrew at least. The facts in (22) do not fall out of the analysis so far. Up to now, the degree relative denoted a set (of degrees), and there was no a priori reason why we couldn't quantify over the members of that set with the same range of quantifiers as in the case of a set of individuals (the interpretation of a normal noun). While there is no such a priori reason, the restrictions in (22) suggest that this is not the way the linguistic system works.

The crux of our analysis will be that in degree relatives, at the CP level, an operation of *maximalization* takes place. Maximalization operations have been proposed to be at work in the semantics of a variety of constructions, like plural anaphora (Evans 1980; Kadmon 1987), questions (Groenendijk and Stokhof 1982), free relatives (Jacobson 1988) and comparatives (von Stechow 1984). Excellent discussion can be found in Rullmann (1995). We will discuss free relatives in a later section. It is instructive to look briefly at comparatives, since they also involve degree phrases.

Hoeksema (1983) gave analysis (23b) of (23a):

(23) a. John is taller than any girl is.
b. For every degree d such that some girl is d tall: the degree to which John is tall is more than d.

Thus, on Hoeksema's analysis, we quantify universally over degrees in comparatives like (23). von Stechow (1984) showed that this analysis does not carry over to comparatives like (24): (24a) does not mean (24b), but rather (24c):

(24) a. John is five inches taller than any girl is.
b. For every degree d such that some girl is d tall: the degree to which John is tall is 5 inches more than d.
c. The degree to which John is tall is 5 inches more than the *maximal degree* to which some girl is tall.

Note that there is nothing semantically incoherent about meaning (24b), with simple universal quantification over degrees: it would just presuppose that all girls in the comparison set have the same height. But our semantic system does not make that reading available. This means that the set of degrees to which some girl is tall is not available for quantification in the comparative: an operation of maximalization takes place, picking the maximal degree in that set, and only then is the result available to be used in the semantics of the comparative (yielding (24c)).

What we want to claim is that exactly the same goes on in degree relatives: the set of degrees denoted by the degree relative is only available for interaction with other semantic operations after an operation of degree maximalization has applied to it. Thus, in degree relatives, at the CP level, an operation of maximalization takes place.

Maximalization, as an operation on a set of degree triples, maximalizes pointwise: it selects out of a set the unique triple all of whose coordinates are maximal. We define:

(25) Let CP be a set of degrees of the form $\langle|y|, P, y\rangle$,
max (CP), the maximal element in CP, is defined by:

$$\max(CP) = \langle|\sqcup\{y: \langle|y|, P, y\rangle \in CP\}|, P, \sqcup\{y: \langle|y|, P, y\rangle \in CP\}\rangle$$

We will call the numerical value of max(CP) 'max'.

With this we define the operation of maximalization, MAX:

(26) $$MAX(CP) = \begin{cases} \{\max(CP)\} \text{ if } \max(CP) \in CP \\ \text{undefined otherwise} \end{cases}$$

Maximalization restricts the set of degrees to the singleton set containing the maximal degree (if there is one). Thus, the full interpretation of the CP in (2a), repeated here as (27a), is (27b):

(27) a. (books) that there were __ on the table
b. $MAX(\{\langle|x|, BOOKS, x\rangle: BOOKS(x) \text{ and } ON\text{-}THE\text{-}TABLE(x)\})$

Since there is exactly one maximal sum of books on the table, max(CP) is defined and (27b) is equivalent to (28): (using O for ON-THE-TABLE):

(28) $$\{\langle|\sqcup\{x \in BOOK: O(x)\}|, BOOKS, \sqcup\{x \in BOOK: O(x)\}\rangle\}$$

This is the singleton set containing the cardinality of the sum of the books on the table, the sortal predicate BOOKS, and the sum of the books on the table. In case a, b, c, and d are the books on the table, the relative clause (27a) denotes: $\{\langle 4, BOOKS, a\sqcup b\sqcup c\sqcup d\rangle\}$.

The operation of maximalization works just like the σ-operator which interprets the definite article in theories of plurality following Link (1983), but here defined at the CP level. This means that uniqueness (i.e., the fact that the output is a singleton) is built into the analysis. Since this aspect of maximalization plays the central role in our analysis, it may be useful to digress on this briefly.

We assume that maximalization operates pointwise, i.e., maximalizes all coordinates. A natural alternative would be a maximalization operation which only maximalizes the numerical value, NUMMAX:

(24) $$NUMMAX(CP) = \{\langle|y|, P, y\rangle \in CP: \text{for every } \langle|z|, P, z\rangle \in CP: \text{if } |y| \le |z| \text{ then } |y| = |z|\}$$

NUMMAX restricts the set of degrees to those triples whose first element, the numerical value, is maximal. In most cases, NUMMAX and MAX give the same output, but not always: NUMMAX allows non-singleton sets as output. Central cases to look at here are certain readings of relatives containing modals. Carlson (1977b) discusses examples like (30a, b):

(30) a. I took with me the books that I could fit in my bag.
b. I took with me every book that I could fit in my bag.

Carlson argues that examples like (30a, b) are ambiguous. Besides a reading where what I took is books that I could individually fit in my bag, they have a reading where what I took is books that I could fit *together* in my bag. Carlson paraphrases this reading as a degree reading:

(31) I took with me as many books as I could fit in my bag.

We don't think that (30a, b) and (31) are equivalent (as little as we think that (4a) and (4b) are equivalent), but the paraphrase in (31) does capture the plurality spirit right.

Crucially, when we think about the relatives in (30a, b), then, because of the modal involved, it is very easy to think of situations where there wouldn't be a unique maximal element satisfying the CP condition. For instance, suppose we have a situation s where there are four books, a, b, c, d, all of the same size, and exactly two fit in my bag. Let us ignore the individual reading (i.e., we are talking about one event of transporting books in my bag). Given s, the denotation of the CPs in (30a, b) before maximalization is:

(32) $\text{CP} = \{\langle 1, \text{B}, \text{a}\rangle, \langle 1, \text{B}, \text{b}\rangle, \langle 1, \text{B}, \text{c}\rangle, \langle 1, \text{B}, \text{d}\rangle, \langle 2, \text{B}, \text{a}\sqcup\text{b}\rangle, \langle 2, \text{B}, \text{a}\sqcup\text{c}\rangle, \langle 2, \text{B}, \text{a}\sqcup\text{d}\rangle, \langle 2, \text{B}, \text{b}\sqcup\text{c}\rangle, \langle 2, \text{B}, \text{b}\sqcup\text{d}\rangle, \langle 2, \text{B}, \text{c}\sqcup\text{d}\rangle\}$

In this case, maximalization with NUMMAX and with MAX give different results. Maximalization with NUMMAX gives the result:

(33) $\text{NUMMAX(CP)} = \{\langle 2, \text{B}, \text{a}\sqcup\text{b}\rangle, \langle 2, \text{B}, \text{a}\sqcup\text{c}\rangle, \langle 2, \text{B}, \text{a}\sqcup\text{d}\rangle, \langle 2, \text{B}, \text{b}\sqcup\text{c}\rangle, \langle 2, \text{B}, \text{b}\sqcup\text{d}\rangle, \langle 2, \text{B}, \text{c}\sqcup\text{d}\rangle\}$

Maximalization with MAX is undefined. Our judgment is that in situation s, (30a) and (30b) are either undefined (on the relevant reading) or are reinterpreted as relating to one of these maximal sets, which is picked out as unique in some other way in the context. Now, this is not a surprise for (30a): even if NUMMAX is the correct maximalization operation, the definite article in (30a) will require uniqueness. It is (30b) which is the crucial example here. Universals usually do not impose uniqueness requirements on their NP. If NUMMAX is the maximalization operation, then the prediction is that, unlike (30a), (30b) ought to support a universal reading of some sort in situation s. But (30a) and (30b) do not differ in this respect:

both are undefined in s, or both are defined when we let the context provide a unique maximal subset. Thus, in degree relatives, universals show uniqueness effects similar to definites. We think that this is strong support for the operation MAX as defined here.

2.4. *CP-external Material: The Head Noun*

We have dealt now with the CP-internal structure of the degree relatives. Let us next look at the CP-external material. Let us first discuss the NP projection. As explained, our analysis follows Carlson and Heim, in analyzing (2a) as (2b):

(2) a. books that there were __ on the table
 b. books that there were (d many books) on the table

More precisely, we assume that the degree phrase *d many books* starts out inside the IP of the relative clause and moves to the Spec of CP: from there, the NP *books* gets raised to the head position in the dominating NP:

(34) books (d many books) that there were (d many books) on the table

As far as the semantics is concerned, we assume that this means that at the level of NP, the head noun *books* is already interpreted semantically inside the relative clause.

As for surface structure, we (obviously) assume that the copies of the degree phrases are phonologically null (i.e. deleted). There is an interesting difference with comparatives here. We do not assume a movement analysis for the sortal inside comparatives, and hence we assume that the sortal in comparatives is base generated.

Chomsky (1977) proposes a deletion analysis for English comparatives, noting that deletion does not apply in certain situations, like the one in (35a), which involves contrast. Another situation where deletion does not automatically apply is found in French and Dutch comparatives, where redundant material may be overtly realized as a clitic pronoun, as shown in (35b, c).

(35) a. I did not say that Bill has as many horses as Mary has COWS, I only said he has as many horses as she has HORSES.

b.	Jean	a	autant de	chevaux	que	Marie	en	a.
c.	Jan	heeft	net zo veel	paarden	als	Marie	er	heeft.
	John	has	as many	horses	as	Mary	CL	has

In contrast, as we have seen in (6a), and as is also seen in (36a–c), English, French and Dutch degree relatives do not allow overt material, not even under comparable circumstances:

(36) a. I never said that Bill has as great a number of horses as Mary has COWS, I only said he has the exact number of horses {that there were in HER stable/#that there were COWS in her stable}.

b.	Jean	a	précisement	le nombre de	chevaux	que
c.	Jan	heeft	precies	het aantal	paarden	dat
	John	has	exactly	the number of	horses	that

Marie	(*en)	a.
Marie	(*er)	heeft.
Mary	CL	has.

These facts can be regarded as providing some additional support for a movement analysis of the sortal in degree relatives. The identical sortals are base generated in the comparative construction in (35a). While a deletion rule tends to apply to such structures, it is, as shown, not obligatory. As for the degree relatives in (36a–c): in the languages in question, *not deleting* identical material is not an option for movement chains in general. On a movement analysis we thus would not expect redundant material to be realized.

While we assume that the head noun is semantically interpreted CP-internally, we follow the standard view in phrase structure theory that the featural content of a maximal projection (here the NP) is determined by its head. For degree relatives, we take this to mean that the *unmarked* situation is that the NP will denote the *kind* of entity that its head denotes. This means that in the unmarked case, the NP in (2a) denotes a set of books, i.e. a set of sums of individuals.

This means then that, in the unmarked case, at the NP level the degree relative is turned from a set of degrees into a set of individuals. The operation SUBSTANCE which does this takes a set of degree triples and gives you the set of third elements of these triples, the substances:

(37) $\text{SUBSTANCE(CP)} = \{x: \langle |x|, P, x\rangle \in \text{CP}\}$

At the CP-level, we derived (28), repeated here, for CP (2a):

(2) a. (books) that there were __ on the table

(28) $\{\langle |\sqcup\{x \in \text{BOOK}: O(x)\}|, \text{BOOKS}, \sqcup\{x \in \text{BOOK}: O(x)\}\rangle\}$

At the NP level, the sortal *books* is already interpreted, SUBSTANCE applies as a default operation, and gives (38) as the interpretation for the NP (2a′):

(2) a′. books that there were __ on the table

(38) $\{\sqcup\{x \in \text{BOOK:O}(x)\}\}$, where $|\sqcup\{x \in \text{BOOK:O}(x)\}| = \text{max}$

This is the singleton set consisting of the sum of the books on the table (whose cardinality is identified inside the CP as max).

We do not know what exactly the contextual conditions are that allow (and sometimes even prefer) the special interpretation strategy which produces the identity-of-quantity interpretations, as in (5a,c) repeated here as (39a,b), or in sentence (39c).

(39) a. It will take us the rest of our lives to drink the champagne that they spilled that evening.
b. We will never be able to recruit the soldiers that the Chinese paraded last May Day.
c. At passover I drink the four glasses of wine that everybody drinks.

A cursory glance at such examples suggests that the presence of a modal, generic, or habitual may facilitate these interpretations. But the proper study of these readings falls outside the scope of this paper. When licensed, the interpretation of these examples can be derived as follows. For the degree interpretation of (39b), the CP in (40a) is interpreted as (40b):

(40) a. the soldiers the Chinese paraded
b. $\{\langle|\sqcup\{x \in \text{SOL:PAR}(x)\}|, \text{SOL}, \sqcup\{x \in \text{SOL:PAR}(x)\}\rangle\}$

In this case, at the NP level a degree phrase meaning is constructed from the degree value and the sortal in the triple, as in (41a) – in essence, the meaning of the degree phrase (41b):

(41) a. $\{d: \exists n\exists x[d = \langle n, \text{SOL}, x\rangle \text{ and } n \geq |\sqcup\{x \in \text{SOL:PAR}(x)|]\}$
b. as many soldiers as the Chinese paraded soldiers
('The set of degrees of soldiers whose number is at least as great as the number of soldiers that the Chinese paraded')

From this stage on, the meaning of (39b) will be constructed in the same way as that of the comparative (we will never be able to recruit as many soldiers as the Chinese paraded last May Day; cf. (5d) in sec. 2.6), deriving a meaning equivalent to: 'We are not able to recruit a degree of soldiers which is in (41a)'.

Note that, as mentioned earlier, this is a case where we use the fact that we have made the sortal part of the degree: if, on this reading, (40a) has a meaning along the lines of (41b), we need to have the meaning of the sortal *soldiers* available at the external NP level, which is possible if the sortal is one of the elements in the degree triple.

2.5. *Deriving Carlson's Determiner Restrictions*

We now come to NumP and DP. We assume a modifier analysis of number phrases (see e.g. Bartsch 1973, Partee 1987, Bittner 1994, Bowers 1991). This means that, in the normal case, the numerical restricts the NP interpretation:

– the NP *books* is interpreted as the set of all sums of books;
– the NumP *three books* is interpreted as the set of all sums of books which have three members:

(42) a. three books
b. $\{x \in \text{BOOKS}: |x| = 3\}$

As we have seen, degree relatives can occur with numerals, as in (43):

(43) the three books there were __ on the table

But as we have also seen, due to maximalization, the number is already fixed within the CP as max. This means that, unlike in the normal case, if Num is specified in the degree relative construction, it *cannot restrict* the NP interpretation, because the NP interpretation is already restricted to max inside the CP. The only thing, then, that Num can do in degree relatives is *specify what max* is, i.e. make max explicit.

Thus, the operation that takes place at the NumP of a degree relative is as follows:

(44) $$\text{NUM(NP)} = \begin{cases} \text{NP if Num} = \text{max} \\ \text{undefined otherwise} \end{cases}$$

Thus we get (45b) as the interpretation of the NumP (45a):

(45) a. $[_{\text{NumP}}$ three books that there were __ on the table]
b. $\{\sqcup\{x \in \text{BOOK: O}(x)\}\}$ if $|\sqcup\{x \in \text{BOOK:O}(x)\}| = 3$;
undefined otherwise

Again we see that the material in NumP, though external to the CP, does not have a semantic interpretation independent of the CP meaning: it makes the CP-internal number specification induced by maximalization explicit.

Let us now come to the DP. DPs turn NumP meanings (or NP meanings if there is no NumP) – which are sets – into generalized quantifier meanings. Following Bittner (1994) (which can be seen to make explicit a suggestion in Partee 1987), we assume that when the D-position is empty, NumPs are turned into existential DPs through Partee (1987)'s operation of Existential Lift:

(46) Existential Lift: $\alpha \rightarrow \lambda P.\exists x[\alpha(x) \wedge P(x)]$

(For an account of the problematic cases of downward entailing NPs, see Landman, to appear.) This means that from the NumP meaning (42b), repeated below, we derive the standard existential DP meaning (42c) for (42a):

(42) a. three books
b. $\{x \in \text{BOOKS}: |x| = 3\}$
c. $\lambda P.\exists x[\text{BOOKS}(x) \text{ and } |x| = 3 \text{ and } P(x)]$

When we apply the same operation to the NumP in (47a), we get (47b) as the interpretation:

(47) a. [$_{DP}$ three books that there were __ on the table]
b. $\lambda P.\exists x[x \in \{\sqcup\{y \in \text{BOOK:O}(y)\}\} \wedge P(x)$
if $|\sqcup\{x \in \text{BOOK:O}(x)\}| = 3$; undefined otherwise

But (47) simplifies to (48):

(48) $\lambda P.P(\sqcup\{x \in \text{BOOK:O}(x)\})$ if $|\sqcup\{x \in \text{BOOK:O}(x)\}| = 3$;
undefined otherwise

This is the set of properties that the sum of all books on the table has if max = 3; it is undefined otherwise. This is, of course, not an existential meaning at all; it is nothing but the meaning of the definite *the three books*. Thus, there is no existential generalized quantifier which is the meaning of any DP based on the maximalized CP; rather, maximalization inside the CP allows only a definite meaning for DPs based on that CP. We assume that this is the foremost reason why, as Carlson observed, existential determiners do not felicitously combine with degree relatives. In languages like English, the combination of an empty determiner with Existential Lift can be seen as a strategy for creating semantically existential determiners, while semantically definite and quantificational determiners are created through non-empty determiners. Maximalization creates a CP (and hence an NP or NumP) which doesn't allow the formation of existential DPs. We assume, then, that the two operations clash and the result is infelicitous. Technically, we can incorporate this clash by assuming a kind of plurality requirement on Existential Lift:

(49) Plurality: The application of Existential Lift to α presupposes α to be not a singleton set.

If we assume that *no* is a complex consisting of a negation scoped over an empty determiner interpreted through Existential Lift (in other words, we analyze *no* on the model of *not a*), then the above account predicts that degree relatives are generally incompatible with all weak determiners.

What remains, then, is to discuss the cases where the determiner is specified. The primary case here is *most*, but also included would be strong readings of numericals, if they exist. Carlson's observation was that universals and definites are acceptable, but *most* is not. As is usual in generalized quantifier theory, there are many ways in which one can single out the right set of quantifiers. We will make a suggestion here which seems to fit closely with the perspective on maximalization we present.

In degree relatives max is specified inside the CP. DP quantifiers turn the NumP or NP set into a generalized quantifier. We have assumed that the semantics of the degree relative construction is in essence determined inside the CP. We take this as constraining the possibilities of combining the CP with DP quantifiers, the constraint being that the CP can only combine with determiners that *preserve* the internal CP information – and in particular, max – into the generalized quantifier meaning.

The intuition is as follows. Quantificational statements make available a set of affirmative instances, which one can think of as the set that the quantification is about. It is this set that is naturally picked out by discourse anaphora – what Kadmon (1987) calls the 'maximal set determined by the antecedent of the anaphora', MAX_A:

(50) a. Every book on the table was blue. They were heavy.
b. The books on the table were blue. They were heavy.
c. Most books on the table were blue. They were heavy.
d. Three books on the table were blue. They were heavy.
e. the set of blue books on the table

In all these cases, as Evans (1980) observed, the natural interpretation of the discourse anaphora is the set in (50e), the set of blue books on the table. The difference between cases (50a) and (50b) on the one hand and (50c) and (50d) on the other is that, in a normal context, in (50a) and (50b) the cardinality of MAX_A is the same as that of the set of books on the table, while in cases (50c) and (50d) MAX_A is typically a *subset* of the set of books on the table, and hence it has cardinality smaller than the latter set. In the case of degree relatives, the DP is based on an NP which is a singleton set {s}, where s is a sum of individuals such that |s| = max. This set {s} functions as a domain of quantification and hence makes available for quantification the set AT(s) (= {a ∈ AT:a ⊑ s}). Of course, |AT(s)| = max. We interpret the constraint that max has to be preserved into the quantification as a constraint on the set that the quantification is about: MAX_A is constrained to have cardinality max. In other words, we don't allow the quantification to do numerical restriction twice, because that loses track of max.

We assume the following definition and constraint:

(51) a. *Definition*: Given a quantificational DP D(NP) based on a degree relative NP, max is preserved into the quantification iff for every predicate P: in normal contexts for D(NP, P), $|MAX_A| = max$.

b. *Constraint*: An NP based on a degree relative can only be combined with determiners that preserve max into the quantification.

The idea is, then, that the size of MAX_A can be set only once. In normal quantification it is set by numericals or determiners. In degree relatives it is set CP-internally to max. Hence degree relative NPs only allow determiners that do not reset the size of MAX_A. Such determiners are, of course, just the definites and universals:

(52) *Consequence*: The only determiners that preserve max into the quantification are the universals like *every* and definites like *the*. Hence, these are the only determiners that can head a DP with a degree relative.

In this way we account for Carlson's observations concerning the determiner restrictions on degree relatives.

We assume the standard meaning for the definite article *the* as the sum operator:

(53) *the*: $\lambda Q \lambda P.P(\sigma(Q))$
where $[\![\sigma P]\!] = \sqcup[\![P]\!]$ if $\sqcup[\![\sigma P]\!] \in [\![P]\!]$, undefined otherwise

With this we derive from the NumP meaning (54b) the DP meaning (54d) for the DP (54c):

(54) a. $[_{\text{Nump}}$ three books there were __ on the table]

b. $\{\sqcup\{x \in \text{BOOK:O}(x)\}\}$ where $|\sqcup\{x \in \text{BOOK:O}(x)\}| = 3$
$[\lambda Q\lambda P.P(\sigma(Q))\ (\{\sqcup\{x \in \text{BOOK:O}(x)\}\}) =$
$\lambda P.P(\sigma(\{\sqcup\{x \in \text{BOOK:O}(x)\}\})) = \lambda P.P(\sqcup\{x \in \text{BOOK:O}(x)\})]$

c. $[_{\text{DP}}$ the three books there were __ on the table]

d. $\lambda P.P(\sqcup\{x \in \text{BOOK:O}(x)\})$ where $|\sqcup\{x \in \text{BOOK:O}(x)\}| = 3$
'the set of properties of the sum of books on the table (a sum of three books)'

Since the degree relative denotes a singleton, the standard meaning of *every* when applied to a degree relative is not particularly sensible. We assume that *every* has another meaning as a *distributor*, a meaning in which it makes available from the singleton set {s}, the set of atomic parts of s, AT(s) (which is AT(⊔{s})):

(55) *every*: $\lambda Q \lambda P.\forall a \in \mathrm{ATOM}(\sqcup Q): P(a)$

With this we form from the NP meaning in (56b) the DP meaning (56d) for (56c):

(56) a. $[_{NP}$ book there was __ on the table]

b. $\{\sqcup\{x \in \mathrm{BOOK}{:}O(x)\}\}$

$[\lambda Q \lambda P.\forall a \in \mathrm{AT}(\sqcup Q): P(x)\ (\{\sqcup\{x \in \mathrm{BOOK}{:}O(x)\}\}) =$

$\lambda P.\forall a \in \mathrm{AT}(\sqcup\{\sqcup\{x \in \mathrm{BOOK}{:}O(x)\}\}): P(x) =$

$\lambda P.\forall a \in \mathrm{AT}(\sqcup\{x \in \mathrm{BOOK}{:}O(x)\}): P(x) =$

$\lambda P\ \forall a \in \{x \in \mathrm{BOOK}{:}\ O(x)\}: P(a)]$

c. $[_{DP}$ every book there was __ on the table]

d. $\lambda P.\forall a \in \{x \in \mathrm{BOOK}{:}O(x)\}: P(a)$

'the set of all properties that every book on the table has'

We see then that on the analysis given here, the determiner restrictions that Carlson observed for degree relatives follow by and large from maximalization.

2.6. *A More General Perspective*

While we have motivated maximalization by pointing out similarities with comparatives, there is reason to think that the presence of the operation of maximalization in degree relatives is not a consequence of the CP denoting a set of degrees per se, but rather that maximalization is the semantic operation which mediates the relation between what is syntactically CP-internal and what is syntactically CP-external. We will discuss in later sections some cases which argue that maximalization is present in relative clauses whenever the head noun is interpreted CP-internally and there is CP-external material syntactically present. This means in particular that we can also find maximalization in constructions where there is no evidence that the construction goes through a degree interpretation. In such constructions we have maximalization directly on a set of sums of individuals.

While in the previous subsection we have explained the restrictions on the external material through maximalization, the fact that we get maximalization whenever the internal interpretation combines with externally present material suggests that we might want to turn things upside down. In this subsection we want to make some brief speculations about this.

What we observe is that in the relative clauses at hand – we call them 'maximalizing relatives' – the material which is syntactically CP-external is semantically interpreted CP-internally, or can be derived completely from the CP-internal interpretation. Let us assume that, for reasons we don't understand, there is actually a constraint in the grammar to this effect:

(57) *Constraint*: If the head is semantically CP-internal, no semantically independent CP-external material is allowed.

Maximalization can then be seen as an operation which is operative in allowing syntactically CP-external material to occur, while satisfying this constraint: we can have a head NP, a numerical, and a definite determiner CP-externally, because these can be recovered from the CP meaning due to maximalization; according to the account in this paper, restrictions on what can occur CP-externally follow from what can be recovered after maximalization. On this perspective, then, degree relatives are maximalizing relatives, and involve maximalization, because they are semantically head-internal relatives.

2.7. *Some Loose Ends*

2.7.1. *Stacking*

As Carlson observed, and as we mentioned before, degree relatives, unlike restricted relatives, do not stack, cf. (58):

(58) a.#The one sailor that there was on the boat that there had been on the island died in the explosion.
b. The one sailor who was on the boat who had been on the island died in the explosion.

As indicated in the introduction, stacking is to be expected for restricted relatives, since it just represents the case of two relative clause sets intersecting with the head noun set. In the case of a degree relative like (58a), the head noun *sailor* is interpreted inside the relative clause *that there was __ on the boat*. For all crucial semantic purposes, *sailor* is not external to the relative clause. We assume that this means that the head noun of the degree relative cannot have this internal interpretation relation to more than one relative clause. Furthermore, since maximalization creates a singleton set, intersection of two such relatives makes no semantic sense (it is either identity or empty). Altogether these seem to be rather good reasons to expect that degree relatives do not stack.

2.7.2. *Carlson's Singular*

Carlson mentions one piece of data which is unexplained so far in our account: according to Carlson, (59a) is infelicitous.

(59) a.# The sailor that there was __ on the island drowned.
b. The one/single/only sailor that there was __ on the island drowned.

Carlson explains the infelicity of (59a) by assuming that the underlying representation of the CP in (59a) contains an ill-formed expression like #*there was that much/many sailor on the island*. This explanation is problematic, since it seems to rule out felicitous cases like (59b) as well. We suggest that the deviance of (59a) is due to the fact that, out of the blue, we think of *the sailor* as a definite description similar to proper names, and not as an expression involving a degree expression, i.e. the set of sailors of cardinality one. (59b) is fine because it provides an explicit cardinality expression. Also, in a context stressing the cardinality, (59a) becomes fine, as in (60):

(60) They told me that there would be lots of sailors on the island, but I couldn't find any. And then they told me that the sailor that there HAD BEEN on the island had drowned a week ago.

2.7.3. *Constructions Similar to Degree Relatives*

There are a variety of constructions which are similar in certain ways to the degree relatives studied here, but whose discussion falls outside the scope of the present paper. We mention two cases here. In the first place, Heim (1987) (following Carlson 1977a) discusses abstraction over kind variables. We have discussed abstraction over degree variables as a way to avoid the definiteness effect problem in degree relatives. Abstraction over kind variables is another way of avoiding these problems. While we will not go into the details of the semantics of reference to kinds, the facts seem to be basically the same as for degree relatives. Kind interpretations are found in examples like (61):

(61) a. You no longer see the telephones that/#which there were in my grandmother's time.
b. Every tram that there was in my grandmother's time has been replaced by a new model.
c.# Some trams/#most trams/#three trams that there were in my grandmother's time have been replaced by a new model.

While we also have substance readings for these kind readings, it is not clear that in this case SUBSTANCE is the default rather than one of the options. In cases like (61) kind readings seem very prominent. We do easily get a substance reading in (62):

(62) We no longer have the pictures that there were on the wall when my grandmother still lived here.

We have discussed cases where the degree function is a standard nominal degree function. We find degree readings of degree relatives in predicative constructions as well, as in (63):

(63) a. John is almost the doctor that /#who/#which his father was.
b. The children are almost/twice/not quite the/#four musicians that their parents were.
c.# Mary is twice the doctor that her father was that not even her grandfather was.

These cases seem very close to the degree relative cases that we discuss in this paper, though we will not try our hand at the semantic analysis of such predicates.

2.7.4. *Antecedent-Contained Deletion*

Carlson (1977b) points out that antecedent-contained deletion constructions seem to show the same distributional facts as the degree relatives:

(64) a. Marv put everything #which/that/Ø he could __ in his pocket.
b. Marv put everything/(all) the things/#three things/#most things he could __ in his pocket.

We argue in Grosu and Landman (1996) that the connection between these contrasts and the restrictive/maximalization distinction is more complex than Carlson assumed, and we also propose a solution that generalizes to data without antecedent-contained deletion. We don't have space here to go into that discussion, so we refer the interested reader to that paper.

2.8. *Events and Degree Relatives*

Rothstein (1995) argues that examples like (65), containing a relative clause headed by *time*, involve quantification over events:

(65) Every time the bell rang, I opened the door.

Rothstein points out the following facts concerning these relative clause constructions:

(66) a.# Every time which the bell rang, I opened the door.
b. Every time that/Ø the bell rang, I opened the door.

(67) a.# Three times/many times/most times/no times that the bell rang, I opened the door.
b. Every time/the three times/some of the times the bell rang, I opened the door.

Rothstein does not give an explanation for these facts, which in the context of the present paper are of course stunningly like Carlson's facts concerning degree relatives.

Rothstein treats *time the bell rang* as a normal restrictive relative clause. Rothstein's analysis can be sketched step-wise as follows:

(68) a. $[_S$ the bell rang]: $\{e \in$ RING: THEME(e) = THE BELL$\}$
b. $[_{CP}$ the bell rang]: $\{e \in$ RING: THEME(e) = THE BELL$\}$
c. $[_{NP}$ time]: E (the domain of events)
d. Relative clause formation is intersection: $[_{NP}$ time the bell rang]: $E \cap \{e \in$ RING: THEME(e) = THE BELL$\}$
e. $[_{NP}$ time the bell rang]: $\{e \in$ RING: THEME(e) = THE BELL$\}$

Crucially, at each of these stages we have a set of events, just as in the case of a normal restrictive relative we have a set of individuals. On Rothstein's analysis there is as little reason to expect the facts in (66) and (67) as there is to expect restrictive relative clauses to show the restrictions of degree relatives (which they don't).

However, the perspective changes dramatically if we apply the ideas of the Davidsonian theory more strictly and literally. Consider the derivation of a normal relative clause in the neo-Davidsonian theory:

(69) a. [__ walked]: $\{e \in$ WALK: AGENT(e) = x$\}$
b. Existential closure: $[_s$ __ walked]: $\exists e \in$ WALK: AGENT(e) = x
c. Abstraction over x: $[_{CP}$ that __ walked]: $\{x: \exists e \in$ WALK: AGENT(e) = x$\}$
d. Restrictive relative combines through intersection: $[_{NP}$ boy that __ walked]: $\{x \in$ BOY: $\exists e \in$ WALK: AGENT(e) = x$\}$

Crucially, what we see here is that existential closure over the event argument takes place first, and only after that, at the CP level, do we abstract over the individual variable x, yielding the abstract in (69c). When we look at Rothstein's analysis of the event relatives in (68), we observe that she skips the stage of existential closure. But there is no reason to assume that existential closure, which takes place at the sentence level in normal relatives, doesn't take place at the sentence level in the relatives that Rothstein discusses. If existential closure takes place here, we build up:

(70) $[_s$ The bell rang$]$: $\exists e \in$ RING:THEME(e) = THE BELL

Now, following Rothstein's arguments – which we accept – the relative is an event relative. This means that the abstraction that takes place at the CP level is abstraction over an event variable:

(71) $[_{CP}$ the bell rang$]$: $\{e$: $\exists e \in$ RING: THEME(e) = THE BELL$\}$

But now the analysis is in trouble. Since the existential quantifier binds the event variable, the abstraction over variable e is vacuous, and (71) is infelicitous. Thus we face the same problem of vacuous quantification as with the degree relative (1b) of section 2.1. Normal relativization is impossible. This leaves the degree strategy, with an empty degree phrase *d many times*, as an alternative. But the degree strategy goes through maximalization. From there on Rothstein's facts in (66) and (67) are explained in the same way as the similar facts for degree relatives:

(72) a. $[_S$ the bell rang (e many times)$]$
$\exists e \in$ RING: THEME(e) = THE BELL $\wedge$ $\text{DEGREE}_E(e) = e'$
where degrees are triples of the form $\langle |e|, E, e\rangle$ for sum of events e, and $|e|$ the number of atomic subevents of e

b. Abstraction:
$[_{CP}$ that the bell rang (e many times)$]$
$\langle |e|, E, e\rangle$: $e \in$ RING $\wedge$ THEME(e) = THE BELL$\}$

c. Maximalization:
$[_{CP}$ that the bell rang (e many times)$]$
$\{\langle |\sqcup\{e \in$ RING: THEME(e) = THE BELL$\}|$, E,
$\sqcup\{e \in$ RING: THEME(e) = THE BELL$\}\rangle\}$

d. Substance:
$[_{NP}$ time that the bell rang$]$
$\sqcup\{e \in$ RING: THEME(e) = THE BELL$\}$

e. With the distributive *every*:
$[_{DP}$ every time the bell rang$]$
$\lambda P.\forall e \in \{e$ RING: THEME(e) = THE BELL$\}$: P(e)

At the level of the DP, we now assign the same interpretation as Rothstein does; hence from here on, things can work the same as in her analysis.

We think that the parallel between the event-relative data in (66)–(67) and Carlson's degree-relative data concerning the interaction between relativization and *there*-insertion contexts is of major theoretical interest, in that it reveals deep semantic parallels between the nominal domain (as exposed in *there*-insertion contexts) and the verbal domain (the event argument).

In the first place, in as much as the event argument of the Davidsonian theory and the operation of existential closure are independently motivated, the Davidsonian approach to the verbal domain and the parallel shown here provide rather strong evidence in favor of a Milsark-inspired approach to the definiteness effect in *there*-insertion contexts. That is, assuming the Davidsonian theory, the present analysis provides support for the existence of a variable binding operation in *there*-insertion contexts.

Secondly, and vice versa, the parallelism seems to provide one of the strongest arguments we have seen in favor of the event argument of the Davidsonian theory and an event variable binding operation in main clauses.

Finally, the parallel between what happens in *there*-insertion contexts and at the sentence level leads to other questions as well, which we can only briefly and tentatively explore here. If there is such a strong parallel, one might wonder whether we shouldn't expect to find definiteness effects at the sentence level as well. We will argue here that that is in fact exactly what we find.

In the *there*-insertion context, only indefinites are felicitous in the position that is open to the definiteness effect (with the well-known exceptions) and this position is a scope island. As is well known, the latter means only that the very expression which occupies the definiteness position cannot take scope outside this context: its sub-expressions may well scope out.

Of course, a natural way to think of this in the operator approach to the definiteness effect is that the definiteness NP must be interpreted as a set expression restricting the quantificational operator in the *there*-insertion context.

Let us think now about what would correspond to this at the sentence level. Clearly, there isn't a *position* that might be open to the definiteness effect, presumably because the sentence level operator binding the event argument is not realized in the surface syntax. Nevertheless, there are expressions which restrict this operator in the same way as NPs in the definiteness position restrict the operator in the *there*-insertion context. These are precisely adverbials like *three times*, as in (73):

(73) I visited Paris three times this year.

Now, we know from Rothstein's discussion that such adverbials with *time* can easily scope out of the sentence and get an interpretation where they quantify over events which are not the events quantified over through existential closure in the matrix. For instance, Rothstein's (65) expresses that for every event of bell ringing, there is an event of door opening: the adverbial quantifies over bell ringings, the matrix existential quantifier over door openings. Thus, we do not *have* to think of these adverbials as being in "the position that is open to the definiteness effect"; they always allow scoped interpretations. The essence of the scoped interpretation of these adverbials is that they quantify over events independently of the quantification over events through the event operator in the matrix (that's the point of scoping them). If we want to find the analogue of the definiteness effect, we should concentrate on cases where the *time*-adverbial does not get interpreted as an independent quantifier over events, but where it restricts the matrix event operator. (73) shows such an interpretation. (73) may have a variety of readings, including readings where *times* does not range over events, and event readings where *three times* takes scope over the matrix (meaning, say, that there were three events of a particular contextual nature involving an event of my visiting Paris). But crucially, (73) also has a reading where *three times* restricts just the matrix existential quantifier over events, and where (73) means (74):

(74) There were three events of me visiting Paris this year.

If there is anything at the sentence level that acts like the NPs in the position of the definiteness effect, it is these adverbials on this particular interpretation. The crucial question to ask, then, is: Which event adverbials allow an interpretation as restricting the matrix event quantification, rather than introducing scopally their own event quantification? Look at (75):

(75) a. I was in Paris three times.
(There were three events of me being in Paris.)
b. I was in Paris many times.
(There were many events of me being in Paris.)
c. Not a single time did I kiss Mary.
(There wasn't an event of me kissing Mary.)
d.#I was in Paris every time.
e.#I was in Paris the time.
f.# I was in Paris most times.

The # in (75d–f) does not mean that these examples are infelicitous but that (75d), for instance, does not have a reading quantifying universally over events of my being in Paris. Rather, it has a reading universally quantifying over other events and linking those to events of me being in Paris. Similarly, (75e, f) lack a reading where the adverbial directly restricts the event quantification in the matrix.

We think that the data in (75) are a direct correlate of the definiteness effect in *there*-insertion contexts, and that these data confirm the deep parallels between what goes on at the nominal level (i.e., in a nominal quantifier like the operation in the *there*-insertion context) and at the verbal level (the event quantifier and the way adverbials restrict it). It seems that a unified analysis is called for (see Landman 1997).

3. Free Relatives

In this section we want to discuss maximalization in free relatives. We start by contrasting two types of free relative constructions: realis and irrealis free relatives.

Realis free relatives, as in (76) and the Rumanian (77), have the distribution of DPs but lack an overt DP head; the head is a CP-internal wh-expression in the Spec of CP.

(76) a. What I gave to John was a shining dagger.
b. What few students came to the concert (#what even fewer students were left after the intermission) left before the encores began.

(77)

Cine	te-a	atacat	ieri	e	însurat	cu
who	you-has	attacked	yesterday	is	married	with

sora	mea.
sister-the	my

'Who attacked you yesterday is married to my sister.'

While we talk here about the head of the wh-expression as an internal head in free relatives, such heads have been analyzed as being external heads by Bresnan and Grimshaw (1978) and Larson (1987). Bresnan and Grimshaw's argumentation was criticized in Groos and van Riemsdijk (1981), Hirschbuhler and Rivero (1981, 1983), Harbert (1983, 1992), Suñer (1984), Jacobson (1988), and Grosu (1989, 1994); a critique of Larson's argumentation can be found in Grosu (1996). These authors offer a variety of arguments in favor of the head-internal hypothesis. Two arguments for the head-internal hypothesis are illustrated in (76b): first, unlike restrictive relatives and appositives, the wh-phrase in free relatives (which is arguably in Spec of CP) can contain an explicit sortal (*students*); secondly, like degree relatives, and unlike restrictives and appositives, free relatives do not stack. We discuss the arguments from maximalization below (and we refer the interested readers to the works cited above for additional evidence).

Irrealis free relatives look on the surface like realis free relatives, except that they exhibit an irrealis verb form. Irrealis free relatives are not found in the major Germanic languages (with the possible exception of Yiddish);

they are, however, found in Romance, Slavic, and Semitic languages. We illustrate with (78) from Rumanian.

(78) a. Am [cu cine [discuta, să discut]
I-have with whom to discuss, SUBJ I discuss

filozofie]
philosophy

I have [someone] with whom to discuss philosophy.'

b. Nu mai avem [*ce locuri noi* să vizităm]
not more have-we what places new SUBJ visit

'There are no longer any new places for us to visit.'

(78) shows that irrealis free relatives as well are internally headed, in that they can have the sortal inside the wh-phrase; also, irrealis free relatives do not stack, unlike restrictives and appositives (demonstration omitted for reasons of space).

The main syntactic claim we want to defend in this section is that realis free relatives are full DPs: that is, while the head is syntactically and semantically CP-internal, there is (phonologically null) CP-external material present (Grosu 1994 argues that the CP-external element is *pro*). We will substantiate this by arguing that, unlike realis free relatives, irrealis free relatives are bare CPs, with no CP-external structure whatsoever, and that most of the differences between the two types of structure follow from this, together with the assumption that realis free relatives are not bare CPs. Interrogratives are, of course, prime examples of structures which are considered to be bare CPs. What we argue is that irrealis free relatives, but not realis free relatives, are syntactically like interrogatives.

We have four arguments for this, but for reasons of space beyond our control we can only discuss one in detail. We'll first mention the other three:

1. Realis free relatives with CP-internal head obey certain matching effects which are found neither for interrogatives nor for irrealis free relatives (Hirschbuhler and Rivero 1983; see Grosu 1994 for discussion).
2. Realis free relatives cannot have in their Spec of CP a phrase that includes a DP which dominates, but is not a projection of, the wh-word. No such restriction is found in irrealis free relatives or interrogatives (see Grosu 1989 for discussion). Grosu (1994) argues that both these effects in realis free relatives are traceable to the existence of a CP-external *pro* head, which is absent in irrealis free relatives or interrogatives.
3. Irrealis free relatives, like interrogatives, but unlike realis free rela-

tives (or, of course, restrictives), allow multiple wh-phrases. The multiple realis free relative in (79a) is out (and so is its Rumanian counterpart), whereas the Rumanian irrealis free relative in (79b) is fine (similar examples are found in Russian):

(79) a.* [Who danced with whom last night] will get married next week.

b. Nu mai avem [*pe cine cu cine* împerechia]
not more have-1p1 ACC who with who to-match

'We no longer have any pairs to match' [said by an unsuccessful matchmaker].

But maybe the most direct argument, and the one we want to focus on here, is the following: extraction out of realis free relatives, like extraction out of restrictive relatives or appositives, is crashingly bad; extraction out of interrogatives is, depending on the language, mildly bad (English) to fine (Rumanian, Hebrew). Again, irrealis free relatives pattern with interrogatives. Our examples are from Rumanian (the facts are similar in Hebrew): (80a), a realis free relative, is completely out; (80b) is a headed irrealis, which is also bad; the irrealis free relative in (80c) is just as fine as the interrogative in (80d):

(80) a. * Despre ce ai pe [cine vorbeşte cu
about what you-have ACC wh is speaking with

Maria] în clasa ta?
Maria in the-class your

'What do you have who is talking with Maria about __ in your class?'

b.*? Despre ce (nu) ai pe cineva [cu
about what (not) you-have ACC someone with

care să vorbeşti __]
who SUBJ talk

'What do(n't) you have someone with whom to talk about __?

c. Despre ce (nu) ai [cu cine să vorbeşti __]
about what (not) you-have with who SUBJ talk

'What do(n't) you have with whom to talk about __?'

d. Despre ce nu ştii [cu cine să vorbesti __]
about what not you-know with whom SUBJ talk

'What don't you know with whom to talk about __?'

If we assume that realis free relatives contain a full DP structure with (following Grosu 1994) a *pro* head, it will follow straightforwardly from most theories of extraction that the extraction in (80a) is impossible. If, at the same time, we assume that irrealis free relatives are bare CPs like interrogatives, it follows correctly that they should show by and large the same extraction facts as interrogatives.

A second difference between irrealis free relatives and realis free relatives points in the same direction. Realis free relatives have the same distribution as normal DPs. Irrealis free relatives have a limited distribution: they do not occur as subjects and are natural in (though not completely restricted to) contexts of indefiniteness, i.e. contexts which show definiteness effects (*there be*, relational *have*, etc.); these are precisely contexts in which realis free relatives are not allowed. We will argue shortly that realis free relatives obligatorily involve maximalization, and hence are definites; this explains why they do not occur in contexts of indefiniteness. We assume that irrealis free relatives are bare CPs and do not occur in DP positions. If we make the plausible assumption that the subject position is a DP position, we can explain why irrealis free relatives cannot occur there. Landman (1997) assumes that the position that is open to the definiteness effect is a position whose interpretation is set denoting – meaning, an NP or a CP, but crucially not a DP (see also Higginbotham 1987). Whereas indefinites in argument position are DPs with an empty determiner that triggers Existential Lift, in contexts of indefiniteness Existential Lift is not triggered as part of the NP meaning (which is just a set), but comes in as part of the construction. Landman (1997) contains an explicit proposal to this effect. If we follow this, we predict correctly that irrealis free relatives can occur in contexts of indefiniteness, and we predict correctly that irrealis free relatives always have an existential interpretation (which comes in not as part of their meaning, but as part of the constructions they occur in).

Concerning realis free relatives, we now come back to our speculations about maximalization in section 2.6. Clearly, in realis free relatives the sortal head is semantically CP-internal. We have just argued that, unlike the case of irrealis free relatives, there is reason to assume that in realis free relatives there is material external to the CP. Thus we have a situation here where the head is semantically CP-internal, but there is syntactically CP-external material (the phonologically empty *pro*). Following the constraint in section 2.6, this is only possible if the semantics of the external material is completely determined by the meaning of the CP. And this is only guaranteed if maximalization takes place. Thus it follows from our suggestions in section 2.6 and the suggested syntax for realis free relatives that maximalization is obligatory in realis free relatives. This seems to be true in all the languages that we have looked at. We rely on the suggestions in section 2.6 rather than on the earlier remarks concerning the parallels with other degree constructions, because maximalization is part of the semantics of realis free relatives, whether or not the abstraction is individual or degree abstraction. This is shown in (81) and (82):

(81) a. Who is waiting for me at the corner seems to be my cousin John.
b.#Who there is under your bed seems to be my cousin John.

(82) a. What (few) rowdies there are at this meeting may cause more trouble than you reckon with.
b. What little light there is in this painting is quite diffuse.

These data are similar to the facts we saw in the degree relatives. In (81), *who* binds an individual variable; as (81) shows, it can't do this if the variable is in a *there*-insertion context. In (82), *what* can be interpreted as a degree variable; consequently, both (82a) and (82b) are acceptable. This is strong evidence, then, that abstraction in (81a) is over individuals and not degrees. Nevertheless, this doesn't make such relatives similar to restrictive relatives, because relatives of both the (81) and (82) types have the same determiner restrictions as degree relatives. We don't see explicit determiners here, of course, but it is a longstanding observation in the literature that free relatives have either a definite or a universal interpretation (see, e.g., Jacobson 1988). Assuming maximalization to be responsible for these interpretational restrictions, it follows indeed that in realis free relatives we can have maximalization both of degrees and of individuals.

We now turn to consideration of the null CP-external material, which we take to be *pro*. Let us first look at the quantificational status of realis free relatives. Larson (1987), following classical views, assumes that free relatives without *ever* are definites, whereas free relatives with *ever* are universals. This division of readings is suggested by (83):

(83) a. What you gave Mary was an expensive object (*definite*)
b. Whatever you give Mary is expensive. (*universal*)

In many respects, *whatever*-phrases and phrases headed by free-choice *any* behave similarly, semantically:

(84) a. I will buy any manuscript you find.
b. I will buy whatever manuscript you find.

Since there is no doubt that the phrases with free-choice *any* are externally headed, this might suggest that at least the free relatives with *whatever* are externally headed as well.

However, on closer inspection there are a number of differences between the *any*-phrases and the free relatives, differences that in fact support the analysis of the free relatives as internally headed.

In the first place, the contrast in (85) provides a syntactic argument for an internally-headed analysis:

(85) a.#John likes *anything* it is __ that Mary gives him.
b. John likes *whatever* it is __ that Mary gives him.

Grosu (1996) traces this contrast to the fact that the italicized phrase in (85b) – but not the one in (85a) – reaches its surface position through reordering from the gap in cleft-focus position. Secondly, the semantic bifurcation suggested in (83) was criticized by Jacobson (1988). She shows that both kinds of free relatives have definite and universal interpretations. It is easy to find free relatives without *ever* that have a universal interpretation, as in (86a); the felicity of the discourse anaphora in (86b) shows that the free relative with *ever* is a definite here and not a universal:

(86) a. Don't do today what you can postpone till tomorrow.
b. Whoever parked this car here should be found immediately. He parked it illegally.

Thus the semantic differences between free relatives with and without *ever* are due to other factors (like generic tense, etc.).

A related difference is shown in (87)–(88). Look at (87):

(87) a. We will veto three-quarters of *every proposal you make*.
b. We will veto three-quarters of *the proposals you make*.

(87) is unambiguous: it only has a (slightly funny) reading where the quantificational DP takes wide scope: 'Take a proposal: three-quarters of it will be vetoed'. (87b) is ambiguous: it also has the wide scope universal reading, but in addition it has a narrow scope plural reading: 'Of the proposals, three-quarters won't make it'. In (88) we see that this test distinguishes *any*-phrases and *whatever*-phrases along the same lines:

(88) a. We will veto three-quarters of *any proposals you make*.
b. We will veto three-quarters of *whatever proposals you make*.

(88a) is unambiguous: the *any*-phrase is quantificational and has to take wide scope. (88b) is ambiguous: it allows the wide scope universal reading, but, like (87b), it also allows a narrow scope definite interpretation.

Another difference between free-choice *any* and *whatever* is that the first, like universals, can be modified by *almost* and *absolutely*, while the second, like definites, cannot:

(89) a. almost/absolutely any proposals
almost/absolutely every proposal

b. #almost/absolutely whatever proposals
#almost/absolutely the proposals

The facts discussed up to now show that one should be cautious in trying to model the syntax and semantics of *whatever*-phrases on free-choice *any*. While the above facts are not direct evidence for the CP-internal analysis, they follow from it in a straightforward way.

Most interesting for our analysis are the facts in (90):

(90) a. #Yesterday at two, I kissed any girls there were at the party.
b. Yesterday at two, I kissed whatever girls there were at the party.

Free-choice *any* is not felicitous in (90a). This follows from the analysis of *any* in Kadmon and Landman (1994). Kadmon and Landman assume that free-choice *any* in, say, (90a) is a polarity item which is licensed by an implicit generic operator. The context in (90a) does not allow a generic operator, hence (90a) is infelicitous. What we see in (90b) is that in the very same context, *whatever* is fine. The CP-internal analysis of *whatever boys* in (90b) has a natural explanation for this. We make the natural assumption that *ever* in *whatever boys* is a polarity item, which has to be in the scope of a licensing operator. Clearly, in (90b) this cannot be a generic operator, since there is none. However, it is well known that polarity items are licensed inside relative clauses of universal or plural definite DPs. Of course, we have argued that it is the maximalization operation which contributes in essence the universal or definite meaning (see the related discussion in Rullmann 1995).

All this makes it very plausible to assume that the reason that *whatever boys* in (90b) is fine, is that *ever* in (90b) is licensed by the maximalization operator. We have argued that the determiner restrictions motivate the assumption that the maximalization operator is a CP-internal operator. Since polarity items must be in the scope of their licensing operator at surface structure, it follows that *whatever boys* is CP-internal.

We assume that the free relative has a DP structure, and we make the assumption that, if there is a DP, the semantic operations which we associated with the NP, NumP, and DP, respectively, in section 2 take place, whether or not the intermediate projections are syntactically realized. In particular, (91) below is arguably a degree realis free relative; yet, as with the corresponding degree relative, the DP interpretation concerns ‘identity of substance’, rather than ‘identity of quantity’.

(91) I took away whatever books there were on the table.

The semantics of the realis free relatives (that is, those aspects that are relevant for our purposes here) follows the semantics given for degree relatives in a straightforward way. Degree maximalization in realis free relatives directly follows our analysis of degree relatives given above. Jacobson (1988, 1995) proposes an operation of individual maximalization at the CP-level (turning a set of singular and plural individuals into the singleton set containing the maximal plural individual among them). Although she does not assume a full DP structure, it is unproblematic to incorporate her maximalization operation into our structures, which do have a null DP structure above CP.

From here on, the story of realis free relatives is the same as that of degree relatives: maximalization predicts the facts concerning the interaction with *there*-insertion contexts in (81) and (82) above in the same way as it does for degree relatives. While there are no explicit determiners in realis free relatives, the two interpretation possibilities allowed by maximalization are as a definite or as a distributor on a definite (universal); indefinite interpretations, or interpretations that do not preserve max in the quantification, are not allowed. Finally, maximalization disallows stacking, for the same reasons as it does in the case of degree relatives.

4. Internally-Headed Relatives

Let us make a brief remark here on internally-headed relatives. Internally-headed relatives are like realis free relatives in that they exhibit an overt CP-external head noun. They differ from realis free relatives in that they show no evidence of movement of the internal head to the Spec of CP (if there is overt movement, it has a local character). Since internally-headed relatives have the distribution of DPs, we assume that they too have an external D: this D is overtly realized in Lakhota and Mojave; it is null in Quechua, Japanese, and Navajo (cf. Basilico 1996 and references therein).

We want to point out in this section that all this does not necessarily mean that all internally-headed relatives are maximalizing relatives. Given our suggestions in section 2.6, whether they are maximalizing relatives depends on whether the head noun is semantically interpreted CP-internally or externally. The situation is the inverse of that of degree relatives and restrictive relatives in English: there the head noun is syntactically CP-external, but can be semantically external (restrictive) or internal (maximalizing). For internally-headed relatives the head noun is syntactically CP-internal, but again, in principle it could be semantically internal (maximalizing) or external (restrictive). It turns out that among internally-headed relative clauses both options are realized. With respect to the languages mentioned, whether internally-headed relatives are restrictive or maximalizing appears to correlate with whether the D is overt or covert. We do not know whether this correlation is significant.

Williamson (1987) provides extensive evidence that the internal head of a Lakhota relative is not interpreted in its surface position, but rather in the position indicated by the scope marker *cha* (see (92) below) or, when the latter is not present, just below the external D. Correspondingly, Lakhota internally-headed relatives have the intersective semantics of restrictive relatives, allow indefinite determiners (cf. Williamson 1987), and allow stacking (cf. Cole and Hermon 1994). On the other hand, in Quechua and Japanese, the determiner is not overly realized, and internally-headed relatives seem to be similar to realis free relatives: they allow only definite (or universal) interpretations, and they disallow stacking (cf. Basilico 1996).

These points are illustrated in the data in (92) and (93):

(92) Lakhota (adapted from Williamson (1987) (SM: scope marker)

a.

[[Thaspą	wąži	tąyą	yužaža	pi]	cha]	wachį
apple	a-IRR	well	wash	PL	SM	I-want

‘I want an apple (nonspecific) that is well washed.’

b.

[[[[wowapi	wa	Deloria	owa]	cha]	blawa]	{ki, cha}	. . .
book	a	Deloria	wrote	SM	I-read	the SM	

‘{The, a} book that Deloria wrote that I have read . . . .’

(93) Quechua (Dayal 1991b; G. Hermon p.c.)

a.

[Nuna	ishkay	bestya-ta	ranti-shqa-n]	alli
man	two	horse-ACC	buy-PERF-3	good

bestya-m	ka-rqo-n
horse-VAL	be-PAST-3

‘The two horses that the man bought were good horses.’
(*Not*: ‘Two horses that the man bought were good horses.’

b.*

Juzi	[nuka	warmi-ta	kuya-shkas]	kulki-ta
Jose	I	woman-ACC	love-RC/NOM	money-ACC

kara-shka-ka]	sumaj-mi	ka-rka
give-RC/NOM-TOM	beautiful-VAL	be-PAST-3

‘The woman that I love that Jose gave money to was very beautiful.’

5. Correlatives

Hindi correlatives are discussed in Dayal (1991a,b, 1995, 1996) and McCawley (1994). Hindi correlatives are CPs which use (overt) j-phrases (the Hindi counterpart of relative wh-phrases), have internal heads, and are related to CP-external material, specifically a resuming element called the *correlate*. What gives correlatives their name is that typically the CP does not form a constituent with the correlate: rather, the CP occurs adjoined to an IP that contains the correlate. The fact that correlatives may be discontinuous is arguably responsible for certain options that are not found with headed constructions; in particularly, correlatives may exhibit multiple wh-phrases and multiple resumers. Some of these facts are illustrated in (94) (note that the CP is adjoined to IP in (94a) and to the correlate in (94b)):

(94) a. [jo laRke khaRe hai], {*pro*, ve, dono, sab,
WH boys standing are those both all
#do, #kuch, #adhiktam} lambe haiN
two few most tall are
'Which boys are standing, {they, both, all, #two, #few, #most} are/is tall.

b. laRke-ko [[jo laRkiyaaN paRh rahii haiN] {ve,
boys-DAT WH girls read PROG are those
dono, sab, #do, #kuch, #adhikam} laRkiyaN] pasand
both all two few most girls like
haiN
are
'{Those, both, all, #two, #few, #most} girls that are reading like the boys.'

Note that in both examples in (94), the sortal *boys*, resp. *girls* is CP-internal. This is one feature distinguishing correlatives from restrictive relatives, which do not have this option. Secondly, the j-phrases of correlatives, but not those of restrictive relatives, may combine with the morpheme *bhii* to yield effects comparable to those of wh-phrases with *ever* in English (see Dayal 1991a, b, 1995, 1996). Note further that (94a) shows that the correlate may be null, and (94b) shows that the correlate may contain the sortal as well. Most interesting for our purposes are the restrictions on the determiners of the correlates. As (94) shows, we find the same restrictions that we found for degree relatives: only universal and definite determiners are allowed. Since for degree relatives we derived these restrictions from maximalization, this is support for classifying correlatives under 'maximalizing relatives' as well. A third property of correlatives, which supports that classification, is that correlatives do not stack, as shown in (95):

(95)

jo	laRkii	khaRii	hai	{#jo	ravii	kii	dost	hai},
WH	girl	standing	is	WH	Ravi	GEN	friend	is

vo	(laRkii)	bahut	lambii	hai
DEM	girl	very	tall	is

'What girl is standing (#who is Ravi's friend), {she/that girl} is very tall.'

Finally, (96) shows multiple j-phrases and/or multiple correlates:

(96) a.

jis	laRkii-ne		jis	laRke-ko		dekhaa,	us-ne
WH	girl	ERG	WH	boy	DAT	saw	her-ERG

us-ko	pasand kiyaa
him-*Acc*	liked

'Which girl saw which boy, she liked him.'

b.

jo	dono	vahaaN	khaRe	haiN,	vah	laRkaa	us	laRkii
WH	two	there	stand	are	that	boy	that	girl

par	fidaa	hai
on	infatuated	is

'Which two are standing there, the boy is in love with the girl.'

c.

jo	laRkii	jis	laRke	se	baatciit	kar	rahii	thii,
WH	girl	WH	boy	with	chat	do	stayed	was

ve	ek saath	sinemaa	gaye	hayN
they	together	movies	went	are

'Which girl was talking to which boy, they went to the movies together.'

(96a) (from Dayal 1991b) is a case where j-phrases and correlates are in a one-one correspondence. Dayal argues that (96a) has a bijective reading (meaning roughly, 'Every girl that saw a boy liked him, and every girl saw exactly one boy'). The borderline case of this would be the case which involves a unique girl and boy. (96b) and (96c) (from McCawley 1994) show the possibility of one-many and many-one relations, respectively. Dayal (p. c.) notes that the bijective reading is absent in (96b) and (96c), and that (96b) is somewhat marginal.

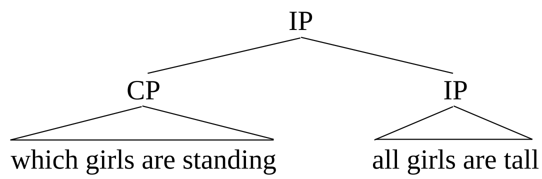
Dayal (1991b, 1995, 1996) provides a semantics for correlatives which, apart from some relatively minor details, fits straightforwardly with our approach to maximalizing relatives.

Consider an example like (97) (which is an English gloss following the examples in (94)):

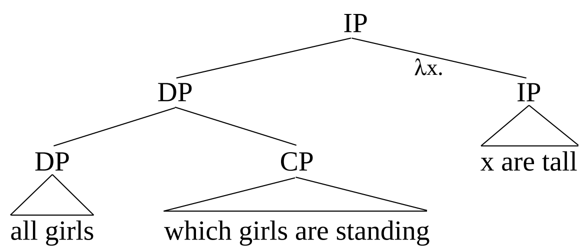
(97) Which girls are standing, all girls are tall.

The correlate *all girls* is the CP-external material. We will assume that, just as in the case of degree relatives, this material either is interpreted CP-internally or is CP-determined. This means minimally that the correlate is not interpreted in situ, but instead plays the same role in building up a generalized quantifier out of the CP as the CP-external material does in degree relatives or realis free relatives. In other words, while syntactically we have the structure in (98), semantically we have a structure like (99):

(98)



(99)



The interpretation is as follows: *girls* is interpreted inside the CP. After abstraction, the relative is: $\{x \in \text{GIRLS}: \text{STANDING}(x)\}$. Maximalization is the operation in (100a), or equivalently, Dayal's (100b):

(100) a. $\text{MAX(CP)} = \{x \in \text{CP}: \forall y \in \text{CP}: x \sqsubseteq y \rightarrow x = y\}$,
b. $\text{MAX(CP)} = \{x \in \text{CP}: x = \sqcup\text{CP}\}$

Maximalization gives us (101) as the CP meaning:

(101) $\{\sqcup\{x \in \text{GIRLS}: \text{STANDING}(x)\}\}$.

From this we derive the usual definite DP-interpretation:

(102) $\sqcup\{x \in \text{GIRLS}: \text{STANDING}(x)\}$

In our example, *all* is a distributor on this meaning, giving the generalized quantifier in (103):

(103) $\lambda P.\forall x \in \text{ATOM}(\sqcup(x \in \text{GIRLS: STANDING}(x)\})\text{: P}(x).$

This generalized quantifier combines in the normal way, through application, with the IP with the meaning λx.x ARE TALL. We derive (104) as the meaning of (99):

(104) $\forall x \in \text{GIRL: STANDING}(x) \rightarrow \text{TALL}(x)$

The main difference to Dayal's analysis is that we do not assume the correlate itself to be a variable, interpreted in situ: there *is* a variable bound by abstraction in the position of the correlate, but the meaning of the correlate itself contributes to the building of the generalized quantifier outside the IP. This is a small difference, but an important one, because it accounts for cases that are problematic for Dayal, in particular, cases where the correlate is a universal, like *sab* ('all') or *dono* ('both'). Dayal (1991b) suggests a solution for these cases based on the assumption that these items represent exactly the set of floating quantifiers. That suggestion will not work for the parallel English data in (22) (section 2.3), however, since *any* and *every* are not floating quantifiers.

Concerning the binary case in (96a), Dayal assumes that the CP builds up a binary generalized quantifier. This means that the CP denotes a relation, rather than a set. In this relation the arguments are maximalized with respect to each other. This means that after relational maximalization, the CP denotes (roughly) (105):

(105) $\{\sqcup\{\langle x, y\rangle\text{: } x = \sqcup\{u \in \text{GIRL:BOY}(x) \wedge \text{SAW}(u, x)\} \wedge$
$y = \sqcup\{z \in \text{BOY:GIRL}(y) \wedge \text{SAW}(y, z)\}\}\}$

With Dayal, we assume that in the case of (96a) the singularity of the correlates imposes singularity restrictions inside the CP:

(106) $\{\sqcup\{\langle x, y\rangle\text{: } x = \sqcup\{u \in \text{GIRL:BOY}(x) \wedge \text{SAW}(u, x)\} \wedge$
$y = \sqcup\{z \in \text{BOY:GIRL}(y) \wedge \text{SAW}(y, z)\} \wedge$
$|x| = 1 \wedge |y| = 1\}\}$

At the next stage, this CP together with the correlates is turned into a definite and from there into a distributive binary generalized quantifier $\lambda R, \forall r \in \text{ATOM}(\sqcup(62b))\text{:R}(r)$, which combines with the IP, $\lambda\langle x, y\rangle$. LIKED(x, y), giving (after simplification) Dayal's interpretation (107) for (96a):

(107) $\forall x \forall y[\text{if } x = \sqcup\{u \in \text{GIRL:BOY}(x) \wedge \text{SAW}(u, x)\} \wedge |x| = 1 \wedge$
$y = \sqcup\{z \in \text{BOY:GIRL}(y) \wedge \text{SAW}(y, z)\} \wedge |y| = 1$
$\text{then LIKED}(x, y)$

In the case of (96c), there is only one correlate, and it is plural. We assume the following here: the meaning of the CP is built up along the lines of (105), but does not include singularity restrictions as in (106), since the correlate is plural; hence we do not get a binary reading here.

However, the fact that there is only one correlate means that the IP does not denote a relation, but a (plural) property:

(108) $\lambda x.\text{WENT TO THE MOVIES}(x)$.

This means that, while the CP is relational, the generalized quantifier that has to be built up is not binary. This is achieved by summing the argument-value pairs in the relation. What gets built up in this case is the unary generalized quantifier in (109):

(109) $\lambda P.\forall r \in \text{ATOM}(\sqcup(\text{CP}))\text{: } P([r]_1 \sqcup [r]_2)$
where $[\langle x, y\rangle]_1 = x$ and $[\langle x, y\rangle]_2 = y$

This will derive meaning (110) for (96c):

(110) $$\forall x \forall y[\text{if } x = \sqcup\{u \in \text{GIRL:BOY}(x) \wedge \text{TALK}(u, x)\} \wedge y = \sqcup\{z \in \text{BOY:GIRL}(y) \wedge \text{TALK}(y, z)\} \text{ then WENT TO THE MOVIES } (x \sqcup y)]$$

In sum, in correlatives the sortal head is semantically interpreted CP-internally. The resumer (or resumers in some of the multiple cases), though discontinuous from the CP, is (are) treated on a par with CP-external (but DP-internal) material in degree relatives. Constraint (57) of section 2.6 then triggers maximalization. Maximalization, in its turn, explains (along the lines of section 2.5) the correlates being restricted to definites and universals, and other effects like non-stacking.

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