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Star Operators -- Episode 1: Defense of the Double Star

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1. Introduction

Sentences with two plural NPs sometimes have rather weak truth conditions. (1a) for example can be true in the situation described in (1b).

(1) a. The two women scored the two goals.
b. The two women are Robin and Laura. Robin scored one of the two goals and Laura scored the other one.

Such readings are called cumulative (Sternefeld (1998)) or codistributive (Sauerland (1998), Winter (1997)) readings. I will use the term cumulative. This paper discusses various approaches to capture these readings and argues in favour of the method proposed by Krifka (1989), Sauerland (1998) and Sternefeld (1998), the ** operator.

1.1. Some facts

Let's look at some more examples first. The sentences (2a)-(6a) can have readings (2b)-(6b).

(2) a. Sue and Molly replaced (talked to) Bill and Kevin.
b. Each of Sue and Molly replaced (talked to) one of Bill and Kevin, and each of Bill and Kevin was replaced (talked to) by one of Sue and Molly.

(3) a. The women replaced the men.
b. Each of the women replaced one of the men, and each of the men was replaced by one of the women.

(4) a. The two women replaced the two men.
b. Each of the two women replaced one of the two men, and each of the two men was replaced by one of the two women.

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(5) a. Two girls fed two horses.
b. There is a group of two girls and a group of two horses such that each girl fed one of the horses and each horse was fed by one of the girls.

(6) a. The men talked to each other.
b. Each of the men talked to at least one other man, and each man was talked to by at least one other man.

I take (2)-(6) to be a representative sample of cumulative readings. Here is what I think is the common element in all these data: Intuitively, the two plural NPs in these sentences introduce two groups of individuals. What is at issue here is how the members of these groups have to be related by the relation denoted by the transitive verb. The cumulative reading is characterized by a universal - existential ... universal - existential quantification over the members of those groups. An abstract template is given in (7).[1]

(7) A R B iff
$\forall x \in A: \exists y \in B: xRy \ \& \ \forall y \in B: \exists x \in A: xRy$

The generalization goes back to Langendoen (1978). We observe that cumulative readings are possible with (at least) conjunctions of proper names, definite plural NPs and indefinite plural NPs.[2] I will look for an analysis that is capable of deriving a cumulative reading for all of the data in (2)-(6), that is, all relational plurals with truth conditions like (7). As we will see below, not all previous analyses agree that these data form a natural class.

Relational plural sentences like (2)-(6) also have other semantic readings, collective and distributive readings. We will not be concerned with collective readings here. Those aside, (2a) for example could also be understood as paraphrased in (8):

(8) Each of Sue and Molly talked to each of Bill and Kevin.
(unlikely with *replace*).

This is a doubly distributive reading; notice that such readings are stronger in terms of the quantification over the members of the two groups in the sentence. A schema for doubly distributive readings is given in (9).

(9) A R B iff
$\forall x \in A: \forall y \in B: xRy$

However, let's discuss distributivity on the basis of the simpler example (10a), which can be paraphrased as (10b):

(10) a. The children are sleeping.
b. Each of the children is sleeping.

I will now introduce several proposals that have been made to capture distributive and cumulative readings.

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[1] A and B stand for groups and R for the relation. I talk about groups as if they were sets of individuals, but I will assume that they are of type <e>; see e.g. Schwarzschild (1996) for a discussion of such a plural ontology. I will often use capital letters for group individuals and small letters otherwise, for convenience.

[2] I will not discuss quantified NPs in this paper.

1.2. Distributivity

Various possibilities have been explored in the literature to account for readings like (10b). Bennett (1974) suggests that the NP 'the children' optionally has the meaning in (11):

(11) $\lambda P \forall x[x \in C \rightarrow P(x)]$ 'each of the children'

Scha (1984) (following Bartsch (1973)) introduces a meaning postulate for verbs like *sleep* that are inherently distributive:

(12) sleep(X) iff $\forall y[y \in X \rightarrow$ sleep(y)] (simplified from Scha (1984))

Finally, there is the idea that there is an operator that pluralizes properties. Several implementations of this idea are around (Link (1983), Roberts (1987), Schwarzschild (1996), among others). I will discuss this family of proposals in terms of Link's (1983) * operator defined in (13).

(13) * is that function: D<e,t> -> D<e,t> such that for any f in D<e,t> and any x in D:
[*f](x)=1 iff f(x) =1 or $\exists u,v[(x=u \& v) \& [*f](u) \& [*f](v)]]$

The * operator pluralizes a property; a group is in the pluralized property if either it is in the original property, or it is made up of parts that are.[3] This operator is present at the syntactic input to compositional interpretation (LF). The LF of (10a) will look like (14) on this proposal:

(14) [[the children] [* [1 [t1 are sleeping]]]]

So, abstractly, we seem to have a choice here between blaming the NP for distributivity effects, or blaming the predicate. With regard to the predicate analysis, we have conflicting opinions as to whether this is a lexical phenomenon or a syntactic one.

1.3. Cumulativity

Back to the cumulative readings. While there is to a large extent agreement as to what the truth conditions of cumulative readings are (cf. the paraphrases above), there are once more various suggestions as to how to derive these truth conditions.

1.3.1. Scha - van der Does

Scha (1984), to my knowledge, offers the first formal analysis of cumulative readings. He suggests that the possibility of such readings is a property of the lexical meaning of certain verbs. He introduces a meaning postulate that essentially makes explicit what it means in terms of the members of two groups, that a transitive verb relation holds between the groups. I take the liberty here to change Scha's actual proposal, and everyone else's, to a uniform way of presenting the semantics of these interpretations to facilitate comparison.

The adapted Scha meaning postulate that one would use for the cumulative reading of (15a) is given in (16):

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[3]This operator does not make distribution to singular individuals a semantic reading, because the *ed predicate is still true of the group collectively. Hence the LF in (14) is not actually equivalent to the Scha and Bennett analyses. I will ignore this mismatch here and in the future. It can be overcome by the use of pragmatic restrictors on pluralization operators, Covers in the sense of Schwarzschild (1996).

(15) a. The women replaced the men.
b. Each of the women replaced one of the men, and each of the men was replaced by one of the women.

(16) replace(Y)(X) iff $\forall x \in X: \exists y \in Y:$ replace(y)(x) & $\forall y \in Y: \exists x \in X:$ replace(y)(x)

The logical form of a sentence like (15a) is then as in (17).

(17) a. [[the women] [replaced [the men]]]
b. replace (M)(W)

Cumulation is a lexical matter and invisible in the syntax of logical form.

It should be noted that Scha deals with numeral indefinites like (5a) differently than with definites like (3a). The differences arise because he treats NPs like 'two horses' with the generalized quantifier denotation 'λP.card(λx.horse(x) & P(x))=2'. This makes it impossible to analyse the indefinites case in terms of quantification over group members analogously to the definites case, because there is no group. He uses the term 'cumulative quantification' for the relevant readings with indefinites. I describe here the method he uses for the case of definites. I will adopt a meaning for the indefinites that amounts to 'a two-membered group of horses', λP.$\exists$X[*horse(X) & two(X) & P(X)]. This introduces a group variable and makes it possible to use the same mechanism as for definites in cumulative readings.

Van der Does (1992) proposes to replace the meaning postulate (16) by a general type shifting rule. In the format of presentation I have chosen, such a type shifting rule could look as in (18):[4]

(18) $\lambda R \lambda Y \lambda X. \forall x \in X: \exists y \in Y:$ R(y)(x) & $\forall y \in Y: \exists x \in X:$ R(y)(x)

This makes a cumulative interpretation possible for all transitive verbs. The two proposals agree that cumulation is a pluralization of a relation that simultaneously affects both argument slots.

1.3.2. Krifka - Sauerland - Sternefeld

Krifka (1986), Sternefeld (1998) and Sauerland (1998) agree with Scha and van der Does that cumulative readings come about by simultaneous pluralization of more than one argument slot of a relation. Krifka suggests the ** operator, which is adopted also by Sternefeld and Sauerland:

(19) ** is that function: D<e,<e,t>> -> D<e,<e,t>> such that for any R: [**R](y)(x) =1
iff R(y)(x) or
$\exists$x1x2y1y2[(x=x1&x2) & (y=y1&y2) & **R(y1)(x1) & **R(y2)(x2)]

The reading of (2a) we are interested in can now be derived via an LF as in (20a). This translates to (20b).

(20) a. [[Sue & Molly] [[**replaced] [Bill & Kevin]]]
b. **λyλx[x replaced y] (B&K) (S&M)

[4]Van der Does's actual rule looks quite different, once more because of the generalized quantifier setting chosen.

(20) amounts to a cumulative reading: we collect into a group things that occur in the domain of the *replace* relation. Then we collect into a group those things that occur in the range of the *replace* relation with them. The cumulated relation ***replace* holds between those groups. That means that for everything in the domain group, there must be something in the range group that it stands in the original *replace* relation to, and vice versa. Hence we get the funny '∀∃' quantificational effect.[5]

Like the * operator, the ** operator is present in syntax. Note that one could view a type shift as part of the interpretational mechanism available for syntactic structures. In this case it would be very similar to an invisible operator that is syntacitcally present. Van der Does, however, seems to take it to be a mechanism working on the lexicon. So I think that Scha - van der Does and Krifka - Sauerland - Sternefeld agree that there is polyadic pluralization (Winter's (1997) term: pluralization affecting several arguments simultaneously). They seem to disagree whether this is lexical or syntactic.

1.3.3. Heim, Lasnik & May

We might ask ourselves whether it is possible in the case of cumulative readings to blame quantificational effects not on predicates, but on NPs - like Bennett did for the case of distributive readings. To my knowledge, this suggestion has only been made for reciprocals. Heim, Lasnik & May (1991) discuss in a footnote a possible way to derive interpretation (21c) of (21a) (a weakly reciprocal interpretation), as opposed to (21b) which is the interpretation accounted for by their actual analysis in the main text of the paper (the strongly reciprocal interpretation).

(21) a. The men talked to each other
b. Each man talked to every other man.
c. Each man talked to at least one other man.

The suggestion made is that the reciprocal *each other* could have the meaning (22b) in addition to (22a):

(22) a. $\lambda P \forall x[x \in M \ \& \ x \neq y \rightarrow P(x)]$ 'every other man'
b. $\lambda P \exists x[x \in M \ \& \ x \neq y \ \& \ P(x)]$ 'at least one other man'

According to this proposal, the reciprocal is held responsible for the quantification over the members of the group in question; due to the anaphoric nature of the reciprocal, this is (almost) the same group as the one denoted by the antecedent 'the men' (I am ignoring here the condition of *other*-ness '$x \neq y$'). If one were to generalize this idea to all the data in (2)-(6), this would mean that optionally a plural NP like (23a) could have the meaning given in (23b):

(23) a. the children
b. $\lambda P \exists x[x \in C \ \& \ P(x)]$ 'at least one of the children'

(23) would be similar to the Bennett proposal for distributivity in that a group introducing NP itself is blamed for the quantification over group members. This proposal to account for cumulative readings has not to my knowledge been made by anybody, no doubt because of obviously wrong predictions like (24a) having reading (24b):

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[5]The same comment as in footnote 3 applies concerning the mismatch between Scha et al.'s division of groups into singular members and **, which does not enforce division into singularities. The comment on the remedy is also the same. Compare Beck (1999).

(24) a. The children weigh 50 lbs.
b. One of the children weighs 50 lbs.

One would have to tie the availability of the existential meaning for the NP to the presence of a distributive (that is, universal) NP. It is not clear how this ought to be done.

Notice that on this hypothetical proposal, in contrast to the ideas presented above, the predicate meaning remains untouched. The NP is responsible for reducing a claim about a group to a claim about its members.

1.3.4. Winter

Winter (1997) makes a proposal that is similar to this unattested one in this respect. He suggests that cumulative readings involve dependencies between NPs, hence, are in a way not plurality phenomena at all. His analysis of (25a) is presented in (25b):

(25) a. The women replaced the men.
b. $\forall x[x \in W \rightarrow x$ replaced $f(x)]$

f: x -> the man/men associated with x

The second definite NP contains a hidden anaphoric variable that makes it dependent on the first NP. The first NP is distributed over. The dependency yields a pseudo-cumulative effect: the sentence may be true if each woman replaces only one man.

Winter argues that we independently know that definite NPs exhibit such dependency effects. An example is (26):

(26) a. Every soldier hit the target.
b. $\forall x[x \in S \rightarrow x$ hit $f(x)]$

f: x -> the target associated with x

A dependent NP analysis is thus expected for (25) and yields pseudo-cumulative effects at no extra cost. Note, though, that the plural on the second NP might be meaningless.

Winter's analysis attempts to cover only cases like (3), and could not be extended to all data in (2)-(6). For example, in the data with proper names like in (2) 'Bill and Kevin' there is no room for a hidden anaphoric element. When we have a numeral, as in data like (4) 'the two men', the numeral would have to be explained away to get the result that each woman replaced one man (similar to the fact that the dependent NP is plural in (3)); (27) with the numeral is not the intended reading.

(27) a. The two women replaced the two men.
b. $\forall x[x \in 2W \rightarrow x$ replaced $f(x)]$

f: x -> the two men associated with x

Winter actually exploits empirical differences between plain definites vs. names and numerals to argue for his analaysis. One interesting difference is that dependent definites are possible across islands, whereas similar data with indefinites, say, don't have a (pseudo-) cumulative reading.

(28) a. The companies will go bankrupt if the computers are not powerful enough.
b. 600 companies will go bankrupt if 5000 computer are not powerful enough.

While (28a) has a weak reading in terms of quantification over the companies and the computers (each company will go bankrupt if *their* computers are not powerful enough), (28b) could not be paraphrased by anything like (29):

(29) There is a group of 600 companies and a group of 5000 computers such that for each of the companies x there is a computer y: x will fo bankrupt if y is not powerful enough; and for each of the computers y there is a company x such that x will go bankrupt if y is not powerful enough.

Winter concludes that cumulative quantification (the indefinites cases) should not receive the same analysis as codistributivity (the definites). In distinguishing them he follows Scha. With respect to conjunction of proper names, his position seems to be that a cumulative reading is possible only in *respectively* type contexts. He suggests that this might be an independent property of conjunction. Winter concludes that there is no polyadic pluralization.

I am fully convinced by his arguments that dependent definites can yield pseudo-cumulative readings. I'm not convinced of his conclusion that there is no polyadic pluralization, and will argue against this aspect of his paper below. But I will also in general avoid data with plain definites in order to avoid the dependent NP effects, which on my view interfere with genuine cumulativity effects.

1.4. Plot

With the exception of Winter's analysis, all proposals agree that cumulativity should be analyzed in terms of quantification over the members of the groups denoted by the two NPs involved. We can distinguish two kinds of approaches to pluralization, and cumulation in particular: ones that blame the NPs for how to reduce a statement about groups to a claim about the members of those groups, and ones that blame the verbs, or predicates. Within the predicate analyses, we can distinguish lexical from non-lexical approaches. In the next sections, I present several sets of data that argue for the non-lexical predicate analysis, that is, for the star operators. Section 2 argues in favour of syntactic operators on predicates over lexical pluralization of predicates. We will see that non-lexical predicates pluralize, and that QR can create those predicates. Section 3 examines the NP proposals (the extended Heim, Lasnik & May idea as well as Winter), and again argues that the star operators are preferable. Section 4 is a discussion of the theory of pluralization that we end up with and of the perspective on the relation between plural morphology and semantic pluralization it leads to.

2. Pluralization is syntactic

2.1. Distributivity - the * operator

Let's take seriously the idea that quite generally, pluralization is lexical, that is, something that happens to argument slots of lexical items. This idea underlies the theories that make use of meaning postulates. It implies that for a given two-place relation, there are four ways to pluralize it ignoring cumulation (van der Does (1992)). In (30) they are presented as shifting operators.

(30) a. CC: λR.R
b. CD: λR.λY.λX.∀y∈Y:R(y)(X)
c. DC: λR.λY.λX.∀x∈X:R(Y)(x)
d. DD: λR.λY.λX.∀x∈X:∀y∈Y:R(y)(x)

C stands for collective and D for distributive. A CD reading is one that leaves the subject argument slot unaffected and distributes over the members of the group that fills the object argument slot. A sentence like (31a) receives the analysis given in (31b) on the CD reading:

(31) a. Joe talked to the women players.
b. CD(talked to) ([[the women players]]) (Joe)

The position that pluralization is a lexical phenomenon contrasts with the idea that pluralization is brought about by phonologically empty operators that are present at some syntactic level. Evidence that distributive operators are present in the syntax could come from data that show that non-lexical predicates are distributed. A typical derived predicate is a relative clause. Below are some relevant data. On the readings formalized below the sentences, pluralization is not lexical.

(32) a. the states that I climbed a mountain in (are NJ and RI/outnumber the states in which I gave a talk.)
b. max(λx.*state(x) & *λy[I climbed a mountain in y](x))
c. max(*λx.state(x) & I climbed a mountain in x)

The subject NP in (32a) denotes the largest group of entities each of which is a state, and each of which I climbed a mountain in. The two alternative formalizations I suggest both involve pluralization of non-lexical properties. The most local pluralization possible, I think, is (32b). Nothing smaller would work because essentially, a mountain cannot be in a plurality of places. The following data all make the same point:

(33) a. the states that I want to climb a mountain in (are Alaska, California and Colorado.)
a'. max(λx.*state(x) & *λy[I want to climb a mountain in y](x))

b. the men that a woman wanted to talk to
b'. max(λx.*man(x) & *λy[a woman wanted to talk to y](x))

c. the chess players that are likely to win the competition
c'. max(λx.*chess player(x) & *λy[y is likely to win the competition](x))

d. the women that Bill thinks could win
d'. max(λx.*woman(x) & *λy[Bill thinks that y could win](x))

e. the women that Sue tried to give a book to
e'. max(λx.*woman(x) & *λy[Sue tried to give a book to y](x))

The analysis in terms of the * operator is straightforward. Let's accept for a fact, then, that non-lexical properties pluralize. The properties that pluralize may be created by movement. If you are a believer in abstract syntax, this implies that readings like CD above can be described using the * operator in combination with QR:

(34) a. Joe talked to the women players.
b. [[the women players] [*[1[Joe talked to t1]]]]

This position is found already in Roberts (1987), who provides the following example:

(35) a. John gave a pumpkin pie to two girls.
b. [[two girls] [*[1 [John gave a pumpkin pie to t1]]]]

In fact, you are led to expect that any constituent that QR can create can pluralize. The idea is made use of in recent research (e.g. Sternefeld (1998), Winter (1998)). It is argued for most explicitly in Sauerland (1998). I will review some of his arguments and add some new ones.

(36a) on reading (36b) is an example in which CD as it stands would be insufficient, due to the presence of the singular indefinite subject.[6] The * operator plus QR approach assigns the LF in (36c) to the sentence where distribution takes scope over 'a student'.

(36) a. A student did these experiments.
b. each of these experiments was done by a possibly different student.
c. [[these experiments] [*[1[a student did t1]]]]

Let's explore some consequences of the QR idea.

If QR creates the constituent that the plural operator attaches to, we expect the familiar constraints on QR to show up. (37) and (38) demonstrate clause boundedness (the # indicates that the a.-sentence does not have the interpretation representend by the b.-LF).

(37) a. # A student said that these experiments were set up badly.
b. [these experiments] [*[2 [a student said that t2 was set up badly]]]

(38) a. # I met a guy who likes these sentences.
b. * [these sentences] [*[2 [I met a guy who likes t2]]]

On the other hand, we expect (39) to be ok.

(39) a. A student might want to live in these apartments.
b. [[these apartments] [*[1 [a student might want to live in t1]]]

And there should be a contrast in (40).

(40) a. A lawyer has pronounced these proposals to be against the law.
b. # A lawyer has pronounced that these proposals are against the law.

Fiengo and Higginbotham's (1981) Specificity Condition leads us to expect the following specificity effect:

(41) a. I saw a review of these papers.
b. [[these papers] [*[1 [I saw a review of t1]]]]

(42) a. # I saw Jill's review of these papers.
b. * [[these papers] [*[1 [I saw [Jill's review of t1]]]]]

If QR can create the argument for the * operator, what about syntactically complex arguments for the ** operator?

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[6] A type shifted version of CD could of course deal with (36a):
(i) $\lambda R \lambda Y \lambda Q. \forall y \in Y: Q(\lambda x R(y)(x))$

2.2. Cumulation - the ** operator

First, a word on the data I use in the following discussion of cumulativity. I avoid plain definites, in accordance with Winter's observation that dependent NPs might interfere with cumulativity effects. I use instead numeral indefinites and conjoined proper names, sometimes with *respectively* to facilitate the cumulative reading. In this, I follow Schwarzschild (1996) in assuming that *respectively* indicates two-place pluralization (just like *each* indicates one-place pluralization). *Respectively* introduces a restriction on polyadic pluralization: sensitivity to order of mentioning. I will ignore this additional effect in my formalizations.[7] (43) and (44) give an example for what my data and analyses will look like:

(43) a. Jim and Frank married two dentists.
b. Jim and Frank married Sue and Amy, respectively.

(44) a. $\exists Y$[*dentist(Y) & two(Y) & <J&F,Y> $\in$ **marry]
b. <J&F, S&A> $\in$ **marry

Let's first establish that non-lexical relations cumulate. The following example is similar to ones discussed by Winter (1997) and Sauerland (1998) to make this point:

(45) Two girls gave two boys a flower.

On the relevant reading the ** operator needs to take scope over the singular indefinite 'a flower'. The relation that cumulates, (47), is not lexical. See Sauerland (1998) for a discussion of the syntax of such complex relations (i.e. the syntax of LFs like (46)).

(46) [[two girls] [two boys] [**[2 [1 [t1 gave t2 a flower]]]]]

(47) **$\lambda y \lambda x \exists z$[flower(z) & give(x,y,z)]

Another example for a cumulating non-lexical relation:

(48) a. Jim and Frank want to marry two dentists.
b. Jim and Frank want to marry Sue and Amy, respectively.

(49) a. [[Jim and Frank] [[Sue and Amy] [** [2 [1 [t1 want to marry t2]]]]]]
b. **$\lambda y \lambda x$[x wants to marry y]

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[7]Following Schwarzschild, one can assume a hidden restrictor argument for the operator that handles polyadic pluralization. Let's assume that this is a salient relation between individuals, what Schwarzschild calls a paired cover or PCov. The value assigned to PCov in the case of *respectively* could look as in (i):
(i) {<x,y>: x and y were mentioned as the nth member of a conjunction}
I will not make this information part of my formulas because we have not taken the time to discuss restrictors on plural operators, and they are irrelevant to the point at hand. The way to incorporate it would be to conjoin the information in (i) with the cumulated relation, as demonstrated below for example (43b) in the text.
(ii) <J&F, S&A> $\in$ **$\lambda y \lambda x$[<x,y> $\in$ PCov & marry(y)(x)]
(iii) <J&F, S&A> $\in$ **$\lambda y \lambda x$[x and y were mentioned as the nth member of a conjunction & marry(y)(x)]

The LF characterizes a reading in which Jim wants to marry Sue and Frank Amy - they don't have the same desire. The ** operator takes scope over *want*, cf. (49b). Its argument relation relates the matrix subject and the embedded object. In order for us to be able to cumulate between these two argument slots, the object has to be outside the scope of the ** operator. That is, in order for us to derive a cumulative reading, the two plural NPs in question must be co-arguments of the same cumulated relation, and 'take the same scope' in the sense that nothing else may intervene between them. This implies that 'two dentists' can only receive a de re reading if we understand the sentence cumulatively. Moreover, Jim and Frank's respective desires involve concrete individuals.[8] This is intuitively correct.

Sauerland (1998) argues that QR can derive the argument for the ** operator. One argument in favour of that is that the domain of cumulation is restricted by the familiar constraints on QR. Finite complement clauses are generally scope islands:

(50) a. # Max and Peter said that Bill married two dentists.
b. * Max and Peter said that Bill married Ann and Amy, respectively.
c. **λyλx[x said that Bill married y]

And so are relative clauses:

(51) a. # Sue and Amy talked to a man who likes two European countries.
b. * Sue and Amy talked to a man who likes Northampton and Danbury, respectively.
c. **λyλx[x talked to a man who likes y]

The following contrast is analogous to a pair of data noticed by Sauerland:

(52) a. The lawyers have pronounced these proposals to be against the law.
b. # The lawyers have pronounced that these proposals are against the law.

Inverse linking type data are ok:

(53) a. Sue and Amy saw a premiere of Oklahoma! and Cats respectively.
b. Sue and Amy saw a premiere of two new operas this week.
c. **λyλx[x saw a premiere of y]

Once more, according to Fiengo and Higginbotham (1981) we expect a contrast between (54a) and (54b):

(54) a. Sue and Amy discussed a review of two new books.
b. # Sue and Amy discussed Jill's review of two new books.

These data show that the possibility of cumulation tracks scope islands. Let's finally look at some more specific contraints on QR to confirm this - English double-object constructions and the German middle field.

In (55) the universal NP cannot take scope over the negative quantifier:

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[8] Sauerland (1998) makes this point using the example in (i):
(i) John and Bill expected a boy and a girl to win.
I used a different kind of example because I am not sure about the semantics of the NP 'a boy and a girl' that the relevant reading would require.

(55) weil ich niemandem jeden neuen Mitarbeiter vorgestellt habe.
becaues I nobody every new employee introduced have
'... because I didn't introduce every new employee to anybody.'

In general, linear order of quantifiers largely determines relative scope in the German middle field. This effect shows up in cumulation. (56) has a cumulative reading formalized in (57). (58) has no cumulative reading.

(56) weil drei Manager drei neue Mitarbeiter niemandem vorgestellt haben.
because three managers three new employees nobody introduced have
'...because three managers didn't introduce three new employees to anybody.'

(57) a. $\exists X[*\text{manager}(X) \& \text{three}(X) \& \exists Y[*\text{employee}(Y) \& \text{three}(Y) \&$
$<X,Y> \in **\lambda y \lambda x[x \text{ introduced } y \text{ to nobody}]]]$
b. [[drei Manager] [1 [[drei Mitarbeiter] [2 [t1
[t2 [**[3 [4 [t4 t3 niemandem vorgestellt haben]]]]]]]]]

(58) weil drei Manager niemandem drei neue Mitarbeiter vorgestellt haben.
because three managers nobody three new employees introduced have
'...because three managers didn't introduce three new employees to anybody.'

If scope rigidity is captured by excluding an LF for (55) in which the universally quantified NP takes scope over the negative quantifier, the same constraint will prevent (58) from having the reading and LF in (57).

English double-object constructions also treat cumulation in a way parallel to QR. (59) shows that the second object cannot take scope over the first. The observation essentially goes back to Barss and Lasnik (1982).

(59) I gave a boy every cookie.
* every cookie >> a boy

Similarly, while cumulation in (60) can take scope over the indefinite second object, cumulation between the subject and the second object cannot take scope in (61) over an indefinite first object.

(60) a. Two girls gave two boys a cookie
b. $**\lambda y \lambda x[x \text{ gave } y \text{ a cookie}]$

(61) a. # Two girls gave a boy two cookies
b. $**\lambda z \lambda x[x \text{ gave a boy } z]$

(61) only has a cumulative reading in which the same boy is involved. The LF in (62) is impossible:

(62) * [[two girls] [two cookies] [**[2[1[t1 gave a boy t2]]]]]

(63b) vs (63a,c) show the same effect:

(63) a. Two employees showed two reports to a friend.
b. # Two employees showed a friend two reports.
c. Two employees showed a report to two friends.

In the structures with a prepositional object (63a) and (63c), there is a cumulative reading in which cumulation takes scope over the singular indefinite. The corresponding double-object structure does not have such a reading.

The restriction on scope leads us to conclude that the two LFs in (64) are, for some reason, ungrammtical. The same restriction will prevent the LF in (62).

(64) a. * [Obj2 [Subj [give Obj1 t2]]]
b. * [Subj [Obj2 [give Obj1 t2]]]

We expect a corresponding effect for distributivity. (65a) should have a distributive reading with narrow scope of 'a student', while (65b) should not allow such a reading.

(65) a. Bill showed these papers to a student.
b. Bill showed a student these papers.

I conclude that the QR approach to cumulation can straightforwardly predict when cumulation is possible. Let's compare this to what a lexical approach could say about these data.

First, let me note that it is not clear to me what a lexical theory could say about the *want* - type data in (46). I think that these really require us to form a complex relation 'want to marry'.

Secondly, let's look at the effects we observed with three-place relations. If we view the possibility of cumulation between two argument slots as a lexical property of the relation involved, then for three-place relations, we would have to define a shift that cumulates between two argument slots and leaves the third unaffected. This is what Link's shifts in (26) above did with distribution in two-place relations. Extending a type shift that achieves cumulation between two argument slots to a three-place relation could look like (66) (this one affects the second object and the subject).

(66) a. $\lambda R \lambda Z \lambda y \lambda X. \forall x \in X: \exists z \in Z: R(z)(y)(x)$ & $\forall z \in Z: \exists x \in X: R(z)(y)(x)$
b. $\lambda R \lambda Q \lambda Y \lambda X. \forall x \in X: \exists z \in Z: Q(\lambda z. R(z)(y)(x))$ &
$\forall z \in Z: \exists x \in X: Q(\lambda z. R(z)(y)(x))$

In (66b) the first object takes narrow scope, in (66a) it takes wide scope. (66b) would be necessary to derive the reading described for (63c). But we could use it in (63b) also, which is undesirable.

The interesting aspect of the data discussed in this section is that the (im)possibility of cumulation depends on the syntactic environment of the relation to be cumulated (here: an NP - NP structure vs. an NP - PP structure). Another example to make this point is (67) (=(58)) vs. (68). In (67) it is the negative quantifier that prevents cumulation. A proper name in the same place causes no problems. A lexical shift would be unable to see this.

(67) weil drei Manager niemandem drei neue Mitarbeiter vorgestellt haben
because three managers nobody three new employees introduced have
'...because three managers didn't introduce three new employees to anybody.'

(68) weil drei Manager dem Otto drei neue Mitarbeiter vorgestellt haben
because three managers the Otto three new employees introduced have
'...because three managers introduced three new employees to Otto.'

I conclude that we can have a cumulative reading between two positions only if syntax can create a constituent that denotes a relation between these two positions.

2.3. A Note on (Pseudo-) Gapping & Moltmann

Moltmann (1992a) observes a parallel between the *respectively* construction and Gapping. In the following pairs, what is related by *respectively* in the a.-sentence is Gapped in the b.-sentence.

(69) a. Max and Peter want to marry Sue and Amy, respectively.
b. Max wants to marry Sue and Peter Amy.
(want to marry)

(70) a. * Max and Bill said that Peter married Ann and Amy, respectively.
b. # Max said that Peter married Ann and Bill Amy.
(said that Peter married)

(71) a. Max and Peter intend to buy wine and bread respectively.
b. Max intends to buy bread and Peter wine
(intend to buy)

(72) a. John and Bill believe that they have met Mary and Sue respectively.
b. John believes that he has met Sue and Bill Mary.
(believes that he has met)

Moltmann looks for an explanation for this parallel in terms of coordination. On our approach, *respectively* is a special case of cumulation. If Gapping was a test for constituency, we would expect the parallel: Gapping would independently show that the constiuent we require for cumulation can exist (or, more specifically, that the kind of movement we are looking at can create it), since it can be affected by deletion. Let's look at Pseudogapping instead of Gapping, since it seems clearer that Pseudogapping is a test for constituency (see e.g. Nijt (1979), Lasnik (1995), Johnson (1999) and references therein). The following data are relevant in comparison to (69a), (70a), (51) and (60a) vs. (61a):

(73) Max wants to marry Sue, but Peter doesn't Amy.
(want to marry)

(74) # Max said that Peter married Ann, but Bill didn't Amy.
(say that Peter married)

(75) * Max talked to a man who likes Northampton and Bill did Danbury.
(talk to a man who likes)

(76) a. While John didn't give Bill a lot of money, he did Susan.
(give a lot of money)
b. * While John didn't give Bill a lot of money, he did a lot of chocolate pears.
(give Bill)
[from Johnson (1996)]

Let's look at the parallel between cumulation and Pseudogapping in the double-object case. The constituent that cumulates is the same one that ellides in Pseudogapping. Pseudogapping shows that there is no constituent that includes the first object but not the second. Cumulation shows us the same thing. Quite generally, Pseudogapping confirms that the relation denoting constiuent we need to build as the argument of the ** operator

must exist: we can watch it disappear. Moltmann's original parallel between Gapping and *respectively* is expected to the extent that what is Gapped is a constituent like the ellided one in Pseudogapping (and that we take *respectively* to be indicative of cumulation, hence constituency in the way described).

There is one case I'm aware of where cumulation and Gapping on the one hand and Pseudogapping on the other come apart:[9] coreferential subjects in finite complement clauses. Pseudogapping seems impossible, while Gapping and cumulation are fine.

(77) * John believes that he has met Sue and Bill does Mary.
(believe that he has met)

(78) The two women said that they would buy the two cars.
(said that they would buy)

(79) John and Bill believe that they have met Mary and Sue respectively.
(believe that they have met)

I have no explanation for this.

We have seen in this section that non-lexical predicates can be pluralized, in particular cumulated. Which ones, is dictated be restrictions on movement, especially QR. A corresponding constituent can be detected in Pseudogapping.

3. NPs versus Predicates

3.1. Scope correlations

Let's come back to a prediction of the ** operator approach that we discovered in section 2.2.: that the two NPs between which a cumulated relation holds 'take the same scope'. A relevant example was (80), which only has completely de re cumulative readings:

(80) a. Jim and Frank want to marry two dentists.
b. Jim and Frank want to marry Sue and Amy, respectively.

(81) a. [[Jim and Frank] [[Sue and Amy] [** [2 [1 [t1 want to marry t2]]]]]]
b. **λyλx[x wants to marry y]

This is not what the NP approaches lead us to expect. If 'Sue and Amy' could mean 'one of Sue and Amy', as on the whacky NP proposal, (80) could have a cumulative reading where each of Jim and Frank has a desire to marry one of Sue and Amy, not necessarily a particular one. Similarly, 'two dentists' should be able to take narrow scope relative to *want*. Even if one could somehow make this proposal intelligent enough to avoid the obvious problems, the scope correlation we observe in (80) is completely unexpected. So, it seems extremely unlikely that NPs should be blamed for any quantificational effect in cumulation. If this is true of cumulation, this indicates that pluralization should generally be viewed as a property of predicates, not NPs.

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[9]That is, one case in which cumulation sides with Gapping. There are cases in which Gapping and cumulation come apart, as in (i), where Gapping is fine but cumulation isn't:
(i) I gave Sue crayons and he toys.
(gave Sue)
Generally it seems that more things can Gap than cumulate (or Pseudogap). This makes me think that Moltmann's parallel was somewhat accidental, and that Pseudogapping really is the more relevant parallel.

What if we accept the point for cumulation and restrict the proposal to reciprocals (as was the intention of Heim, Lasnik and May in the first place)? This makes the prediction that (82a) can mean (82b).

(82) a. They want to invite each other.
b. Each of them has the desire to invite one of the others.

Sternefeld (1998), following suggestions in Langendoen (1978), suggests to derive weakly reciprocal readings using the ** operator. Very roughly he would suggest an LF for (82a) that looks like (83).

(83) [[they] [[each other] [**[2[1[t1 want to invite t2]]]]]

Let's assume that *each other* denotes the same group as the antecedent *they*. See Sternefeld for details about the interpretation of the reciprocal. The resulting interpretation can be described as in (84).

(84) For each x∈ [[they]] there is another one of [[they]] who x wants to invite (and for everyone there is someone who wants to invite her/him).

The difference is once more that (84) describes a de re desire whereas (82b) describes a desire that there be someone to be invited. My intuitions favour (84), which further supports Sternefeld in extending the use of the ** operator to weak reciprocity.

Let's figure out what the dependent NP proposal would say about such data. Winter could assign to the similar sentence (85a) the reading represented in (85b):

(85) a. Jim and Frank want to beat the champions.
b. ∀x[x∈ J&F -> x wants to beat f(x)]
f: x -> the champion associated with x

So this could mean for example that both Jim and Frank have a desire to beat the champion in their weight class, whoever that is. This seems right, and I think there a contrast here between the indefintes and the definites, and also between (85) and (86) with a numeral definite:

(86) Jim and Frank want to beat the two champions.
de re only

This comfirms Winter's claim that pseudo-cumulative effects with definites can have other sources than polyadic pluralization, as well as our decision to not use plain definites as a test for cumulation.

3.2. Dependent NPs are not sufficient

We have noted above that a dependent NP approach cannot cover all the NP types that can be involved in cumulative readings. In contrast to Winter, I am looking for a uniform analysis of all cumulative readings under (2)-(6). On my view, that would make his proposal insufficient as an account of cumulativity. Note that besides the obvious semantic parallel in all the data I take to exemplify cumulativity, we have found another argument for giving them the same semantic analysis: their uniform behaviour. In the data discussed above, conjunctions of proper names always sided with indefinites for when a cumulative reading was available (the only confounding factor was the availability of an

additional dependent reading for definites). On Winters view, these are not instances of one and the same semantic mechanism. Cumulative effects with proper names are, according to him, only possible in *respectively* - like contexts in which coordination is crucial, and in the case of indefinites, we are looking at cumulative quantification, something else again.

I now want to bring up another phenomenon that shows that dependent NPs are not sufficent to capture cumulative readings: pluralization within NP. The data discussed here pose a problem for Winter's suggestion that there is no polyadic pluralization, and are not easily covered by his analysis in terms of dependent NPs. This is a case even with plain definite NPs in which cumulation provides us with a straightforward analysis while Winter's dependency approach does not. Consider (87):

(87) a. Reinier compared the daughters of the defense players.
b. Reinier compared the daughters of Greg and Norm.

Imagine the defense players are Greg and Norm. Greg has one daughter, Karen, and Norm has one daughter, Sarah. The NP 'the daughters of the defense players' refers to the group Karen & Sarah. The ** approach derives this meaning for the NP as follows:[10]

(88) max(λx[**daughter(Greg&Norm)(x)])

(88) denotes the largest group x such that each member of x is a daughter of Greg or a daughter of Norm (and x contains all the daughters that Greg and Norm have). This is the desired group.

A given cumulative treatment translates to Winter's dependency approach by distributing over one argument of the cumulated relation and making the other argument dependent on the first one. For our case, that would yield (89):

(89) max(λx[∀x'∈ x -> daughter(f(x'))(x'))

The best value for f I could think of is given in (90). This is not very appealing, for one thing because we seem to use the 'daughter' information twice.

(90) f: x -> x's father, who is a defense player

Intuitively, 'the defense players' establishes a referent independently (cf. also (87b)), so this seems misguided. How about the other way around - making 'the defense players' the NP to establish a dependency? The obvious problem with this is that there are no two syntactically independent NPs here; 'the defense players' is a proper part of the second NP. One could try to move 'the defense players' out of the containing NP:

(91) [[the defense players] [1 [the daughters of t1]]]

Note that its impossible to move the smaller NP further, because the big NP needs to denote the required plurality when it encounters *compare*.

(91) does not yield the desired interpretation straightforwardly. The special interpretation rule in (92a) would derive the required semantics:

[10]I presuppose here that one can be the daughter of at most one male individual, and that we need to pluralize the *daughter* relation in order to make it compatible with the plural object argument.

(92) a. $[[[X<e> Y<e,e>]]] = \bigcup_{x \in X} : Y(x)$

b. $\bigcup_{x \in [[\text{the defense players}]]} : f(x)$
f: x -> x's daughter(s)

It is not very satisfactory to assume a special interpretation rule. Besides this undesirable effect, note that the functional aspect of the analysis now becomes redundant. We may as well do this:

(93) $\bigcup_{x \in [[\text{the defense players}]]} : \max(\lambda z.\text{daughter}(x)(z))$

Also, on this analysis the number marking on the head noun is unnecessary to derive a plurality. By contrast, on the ** analysis plural marking corresponds to the presence of the ** operator. Number marking seems to matter, however - the NPs in (94a) and (94b) do not refer to the same individual, even though Greg and Norm only have one daughter each.

(94) a. the daughters of Greg and Norm
b. # the daughter of Greg and Norm

Similarly, (95a) refers to a group while (95b) refers to one person:

(95) a. the members of the two expeditions
b. the member of the two expeditions

A singular head noun seems incompatible with the NP denoting a plurality. We will come back to this in the next section. To summarize the main point of this subsection: there is cumulative pluralization within NP. This does not lend itself to an analysis in terms of dependent NPs. More relevant data:

(96) a. the mountains in France and Spain
b. max(λx.*mountain(x) & **in(F&S)(x))

(97) a. the worldcup games in NY and NJ
b. max(λx.*worldcup_game(x) & **in(NY&NJ)(x))

(98) a. Zwei Toechter von zwei Kolleginnen waren zu besuch.
two daughters of two colleagues(fem.) visited
b. $\exists X \exists Y$[two(X) & two(Y) & *colleague(Y) & **daughter(Y)(X) & *visited(X)]

4. Star Operators and Morphology

Let us go along with my arguments that the star operators are the best analysis of pluralization, and with it the analyses in terms of stars that I suggested for the data discussed above. What are the consequences in terms of our theory of pluralization? That is: what do we need to assume about the relation between plural marking and semantic pluralization to make things work this way?

4.1. Predicates and Verbal Morphology

The theory of pluralization we are lead to is one in which pluralization operators are dissociated from plural morphology on the verb and inserted freely at LF. I repeat in (99a) (53b) from above; in the LF for the sentence on the relevant reading, the ** operator attaches to a constituent that comes into existence only at LF.

(99) a. Sue and Amy saw a premiere of two new operas this week.
b. [[Sue and Amy] [[two new operas] [**[2 [1 [t1 saw a premiere of t2]]]]]]

This implies that plural marking on verbal categories does not translate directly into a plural operator. What is pluralized (cumulated) in (99b) is not the verb itself (the same observation applies e.g. to the *want*-case in (48)). In cases like (100) and (101), obviously no verbal plural morphology is required for pluralization (as indicated) to take place.

(100) a. Sue introduced a linguist to these men.
b. [[these men] [*[1[Sue introduced a linguist to t1]]]]

(101) a. Sue gave two apples to two boys.
b. [[two apples] [[two boys] [**[2[1[Sue gave t1 to t2]]]]]]

Hence, we must be able to insert a plural operator independently of plural marking on the verb. The answer to the reverse question: is there always a plural operator when we do have plural morphology on a verb?, depends on one's opinion about collective readings. In data like (102), it is unnecessary to pluralize the predicate, but harmless to do so (since the original predicate is always contained in the pluralized predicate).

(102) a. The girls are gathering in the hall.
b. The girls outnumber the boys.

Sternefeld (1998) proposes that insertion of plural operators is completely free (although of course readings may be unavailable on conceptual grounds). Let's follow him in this. This would mean that verbal plural morphology, or lack thereof, is meaningless. Syntactic restrictions on pluralization come about by what can be constituents at LF.

4.2. Groups and Nominal Morphology

In this section I want to explore the following hypothesis:

(103) An NP headed by a count noun denotes a plurality iff the head noun is morphologically plural.[11]

This contrasts with what we said above about the pluralization of verbal categories. While number marking is meaningful on nominal categories, it is only a reflex of syntactic agreement on verbal categories. This is a position already found in Roberts (1987); it

[11]Let's assume that the formulation excludes conjunctions. The hypothesis is suggested here for the ordinary cases of non-generic definite and indefinite NPs I'm looking at in this paper. It raises questions about bare plurals and nouns like *committee*, which I have not pursued yet. Also, I still exclude quantified NPs from the discussion. So clearly, (103) is very preliminary as yet.
It should also be noted that data discussed in Roberts (1987) and Heim, Lasnik and May (1991), which won't concern us here, indicate that number marking on pronouns should not be covered by the hypthesis.

contrasts with the idea that number concord is a semantic phenomenon (e.g. Hoeksema (1983)).

The hypothesis as it stands is an empirical generalization about NPs, not a principle of grammar that tells us when and where to insert plural operators. The grammatical principle for non-nominal categories I proposed (following Sternefeld) is 'freely insert stars'; for NPs it could be: 'the plural morpheme translates to the star operator of the appropriate arity' (i.e. * for <e,t> nouns and ** for <e,<e,t>> nouns); or it could be more indirect. More empirical input is needed here to decide.[12] But even as it stands, it is clear that two cases would falsify this hypothesis:

(i) a noun is plural but the NP it heads doesn't denote a plurality.
(ii) a noun is singular but the NP it heads denotes a plurality.

Let's look at some potential counterexamples. For (i), so-called dependent plurals like (014) are the obvious problem (a problem that was not solved in Roberts (1987)). (98a) is from Chomsky (1975) and (98b) from Williams (1991). I give a formal discussion of (104a',b') instead, which avoid inconvenient aspects of (98a,b)[13] and preserve the point Chomsky and Williams wanted to make.

(104) a. The boys have living parents.
a'. The boys married Ethiopian physicists.
b. They gave each other new noses.
b'. They gave the boys new noses.

The observation is that the plural on *living parents* and on *noses* does not imply that people have more than one living parent (in (104a')): married more than one Ethiopian physicist) or more than one nose. Chomsky suggests that the plural on the object NP is not semantically meaningful, and shows up because somehow the whole sentence is plural. On the view advocated here, the plural is entirely justified if we take the sentences to involve cumulative readings.[14] (105a) is the LF for (104a'); (105b) and (105c) are plausible for (104b'). (105b) makes use of three-place cumulation, defined in (106) (see Sternefeld (1998) and Sauerland (1998) for generalized cumulation). (105c) uses the familiar ** operator and assumes that the referent of *they* acted collectively in providing the noses.

(105) a. [[the boys] [[**married] [Ethiopian physicists]]]
b. [[they][[***gave] [the boys] [new noses]]]
c. [[the boys] [[new noses] [**[2[1[they gave t1 t2]]]]]]

(106) *** is that function: D<e,<e,<e,t>>> -> D<e,<e,<e,t>>> such that for any R:
[***R](z)(y)(x) =1 iff
R(z)(y)(x) or
∃x1x2y1y2z1z2[x=x1&x2 & y=y1&y2 & z=z1&z2 & ***R(z1)(y1)(x1) &
***R(z2)(y2)(x2)]

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[12] I am thinking here of NPs like (i), which might have an analysis like (ii).
(i) the citizens of an EC country
(ii) max(*λx.∃y[EC_country(y) & citizen(y)(x)])

[13] (98b') avoids the reciprocal in (98b); in (98a) I'm not sure about the semantics of the relational noun *parents* combined with *have*.

[14] Thus it seems to have been premature to conclude that such "[...] plural sentences show, [that] even a principle of compositionality is suspect." (Chomsky (1975) p.81), and that we can indeed assign a meaning to the subject and a meaning to the predicate and then combine the two, contrary to what Chomsky claims.

We would have to analyze apparent dependent plurals uniformly as cases of polyadic pluralization. Data like (107) (from Roberts (1987), who attributes the example to Barbara Partee (p.c.)) lend further support to the idea that all NPs in such sentences are genuine plurals, since *similar* in the relative clause requires a group subject.

(107) Those men married wives who are similar.

For (ii), potential problems are cases like (108):

(108) a. Sue and Amy saw a premiere of two new operas.
b. **λyλx.x saw a premiere of y

Premiere is singular, yet more than one premiere is invloved. We have already analyzed these data in section 3, in terms of cumulation of the relation in (108b). This analysis explains (108a) without contradicting our hypothesis, since the NP itself is not pluralized. The NP introduces a singularity in dependence with the assignment of a value to y. The reading is derived by letting ** apply to a relation that properly contains the entire singular NP. An argument for this analysis was the specificity effect with these readings observed in section 3, which indicates that movement is involved in deriving this reading, cf. (109) (repeated from above):

(109) a. Sue and Amy discussed a review of two new books.
b. # Sue and Amy discussed Jill's review of two new books.

Also, we should compare (108) to data like (110):

(110) # Sue and Amy compared a premiere of two new operas.

(110), in contrast to (108), involves a 'roof' for pluralization: the NP complement of *compare* must denote a plurality, hence the way out for (108) does not work here. Other similar contrasts between data that allow an analysis in terms of non-local pluralization and 'roof'-data that don't are given below.[15]

(111) a. A review of these papers was published in LI.
b. # A review of these papers was separated by the editors.

(112) a. Laura climbed the highest mountain in France and Spain.
b. # Laura compared the highest mountain in France and Spain.

(113) the difference between Bob and Eleanor/the children of Carla and Robin/#the child of Carla and Robin
(Eleanor is Robin's daughter and Bob is Carla's son.)

Each time the roof case is bad with an NP that we don't expect to be able to denote a plurality. Hence so far, hypothesis (103) looks promising.

[15]My thanks to The Organic Cow of Vermont, who print the following sentence on their milk cartons and thereby started my interest in these data.
(i) No difference has been found between the milk of treated and untreated cows.

5. Conclusion

I have argued in favour of polyadic pluralization and that it takes the form of a syntactic operator. While morphological plural marking on nouns corresponds to semantic plurality, there is no such correspondence between verbal plural morphology and pluralization of predicates.

References

Barss, Andrew and Lasnik, Howard (1986). A note on anaphora and double objects. Linguistic Inquiry 17, 347-354.

Bartsch, R. (1973). The semantics of number and numbers. In: Kimball, J.P. (ed.): Syntax and Semantics, Vol. 2. Seminar Press, New York, London.

Beck, Sigrid (1999). Contextual Restrictions on Plural Operators. Ms., University of Connecticut. To appear in UConn Working Papers in Linguistics.

Bennett, M. (1974). Some Extensions of a Montague Fragment of English. Doctoral dissertation, University of California at Los Angeles.

Chomsky, Noam (1975). Questions of Form and Interpretation. Linguistic Analysis 1, 75-109.

van der Does, J.M. (1992). Applied Quantifier Logics. Doctoral dissertation, University of Amsterdam.

Fiengo, Robert & Higginbotham, James (1981). Opacity in NP. Linguistic Analysis 7, 395-421.

Heim, Irene, Lasnik, Howard & May, Robert (1991a). Reciprocity and Plurality. Linguistic Inquiry 22, 63-101.

Hoeksema, J. (1983). Plurality and Conjunction. In: ter Meulen, A. (ed.): Studies in Modeltheoretic Semantics (GRASS 1). Foris, Dordrecht, 63-83.

Johnson, Kyle (1996) Topics in Syntax. Lecture notes, University of Massachusetts, Amherst.

Johnson, Kyle (2000). Few Dogs Eat Whiskers or Cats Alpo. This volume.

Krifka, Manfred (1986). Nominalreferenz und Zeitkonstitution. Zur Semantik von Massentermen, Pluraltermen und Aspektklassen. PhD dissertation, University of Munich. Published by Wilhelm Finck, Munich 1989.

Langendoen, D. Terence (1978). The Logic of Reciprocity. Linguistic Inquiry 9, 177-197.

Lasnik, Howard (1995). A note on Pseudogapping. In: Pensalfini, Rob and Ura, Hiroyuki (eds.): Papers on Minimalist Syntax. MITWPL.

Link, Godehard (1983). The Logical Analysis of Plurals and Mass Terms: A Lattice-Theoretical Approach. In: R. Baeuerle, C. Schwarze & A. von Stechow (eds.): Meaning, Use and Interpretation of Language. De Gruyter, Berlin, 303-323.

Moltmann, Friederike (1992a). Coordination and Comparatives. PhD dissertation, MIT.

Moltmann, Friederike (1992b). Reciprocals and Same/Different: Towards a Semantic Analysis. Linguistics and Philosophy 15, 411-462.

Nijt, Anneke (1979). Gapping. Foris, Dordrecht.

Sauerland, Uli (1998). Plurals, Derived Predicates and Reciprocals. In: Uli Sauerland and Orin Percus (eds.): The Interpretive Tract. MIT Working Papers in Linguistics 25, 177-204.

Scha, Remko (1984). Distributive, Collective and Cumulative Quantification. In: Jeroen Groenendijk, Martin Stokhof and Theo Janssen (eds.): Truth, Interpretation and Information. Dordrecht, Foris.

Schwarzschild, Roger (1996). Pluralities. Kluwer, Dordrecht.

Sharvy, R. (1980). A More General Theory of Definite Descriptions. The Philosophical Review 89, 607-624.

Sternefeld, Wolfgang (1998). Reciprocity and Cumulative Predication. Natural Language Semantics 6.3, 303-337.
Williams, Edwin (1991). Reciprocal Scope. Linguistic Inquiry 22, 159-173.
Winter, Yoad (1997). Dependency and Distributivity of Plural Definites. Ms., Utrecht University.
Winter, Yoad (1998). Flexible Boolean Semantics. Coordination, Plurality and Scope in Natural Language. PhD dissertation, Utrecht University.

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