Chapter 4

Cumulativity as a possible universal

In this chapter I will explore the cumulativity properties of verbal projections. My immediate goal is to find solid evidence for Lexical Cumulativity of basic verbs and thematic role predicates. But in the course of our investigation, we will also have the opportunity to gain insights into many other phenomena affected by cumulativity and events: collectivizing adverbs, downward entailing quantifiers, durational adverbials, collective nouns, groupings of pluralities, plural agreement morphology, and neo-Davidsonian argument association. We will find that Lexical Cumulativity interacts with many other phenomena in just the right way, supporting the points made in other places, in this book and in other books, by this author, and by others. In the end, we will have a comprehensive assessment of verbal cumulativity that brings together the efforts and agonies of many scholars in this lively field of semantic research.

4.1 Cumulativity

In this section, a Cumulativity Universal is introduced for basic lexical predicates in natural languages. It is then argued that simple nouns satisfy the Cumulativity Universal.

Over the last 15 years or so [1], Manfred Krifka has explored cumulativity as an important property of nominal and verbal predicates, and in the course of this work, the possibility emerged that cumulativity might correspond to a significant semantic universal: "simple predicates in natural language typically are cumulative".[2] Here is a way of stating the universal:

(1) Cumulativity Universal
The denotations of simple predicates in natural languages are cumulative.

Let us first see how the notion of cumulativity has to be generalized so as to apply to the full range of cases we are interested in, and then investigate whether the scope of the proposed universal can be extended beyond the cases we looked at in the last chapter.

Within the framework assumed here, the denotations of 1-place predicates are (the characteristic functions of) subsets of the domain of individuals D_e or the domain of events and states (that is, eventualities) D_s. According to Link 1983, the domain of individuals D_e contains singular, or atomic, individuals and plural individuals[3]. Plural individuals are sums of atomic individuals. The domain D_e is closed under sum formation. Closure under sum formation can mean that whenever x and y are members of D_e, then x+y (the sum of x and y) is a member of D_e. For non-finite D_e, closure under sum formation can

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1. Krifka 1986, 1987, 1992, 1998.

2. Krifka 1998, p.200.

3. I am neglecting denotations for mass nouns. Mass nouns do not pose a threat for the Cumulativity Universal in any case.

also mean that any non-empty subset of D_e, whether it is finite or not, has a sum in D_e. To keep things simple, I will mostly neglect the possibility of non-finite domains. Adjustments to the non-finite case are straightforward if needed. If the domains D_e is cumulative, certain subsets of D_e are cumulative as well, and cumulativity can be extended to the characteristic functions of those sets, that is, to the members of $D_{<et>}$. We have:

(2) Cumulativity (properties of individuals)
$\square P_{<et>} \square x \square y$ [[P(x) & P(y)] $\square$ P(x+y)]]

Assuming that the domain of events and states D_s is also cumulative, cumulativity for the members of $D_{<st>}$ comes out as expected:

(3) Cumulativity (properties of events)
$\square P_{<st>} \square e \square e'$ [[P(e) & P(e')] $\square$ P(e+e')]]

Cumulativity for the denotations of other relevant types of predicates can be defined in a parallel way.

We can now begin to look into the question whether it is true that the denotations of basic lexical predicates in natural languages are cumulative. Blatant counterexamples seem to be singular count nouns like **child**, **chair**, or **chin**. Following Link, the extensions of singular count nouns are usually taken to be sets of singularities, hence are not assumed to be cumulative. However, for count nouns, the singular feature has a completely compositional interpretation. When singular, a count noun always denotes a

set of atomic individuals[4]. It should be possible, then, to derive the denotation of a singular count noun compositionally from the denotation of the number feature, which might be a piece of inflection, and the denotation of a number-neutral noun stem, which is the lexical item itself. Müller 2000 proposes to derive the denotations of number marked count nouns in Brazilian Portuguese in exactly that way. The singular noun **child**, for example, is analyzed as consisting of the number-neutral lexical item **CHILD** and the meaningful number feature **singular**. Consequently, singular count nouns are not lexical items, but lexical items plus inflectional morphology, and can therefore have non-cumulative denotations without violating the Cumulativity Universal. The semantic separation of nouns and their number feature has to be present at some level of representation. One possibility is for number features to correspond to functional heads that are picked up by nouns in the course of a syntactic derivation via head movement[5]. Alternatively, nouns might start out fully inflected, but their inflectional features would be meaningless and would have to be checked against matching meaningful features carried by higher inflectional heads. In either case, we have to posit number neutral denotations for the nouns themselves. I am aware of two options that have been proposed, both of which are compatible with the Cumulativity Universal. On the first option, **CHILD** is predicative and denotes the smallest set that contains all atomic children and is closed under sums. This kind of number-neutral noun denotation is the one considered by Müller. It is a plural, but not a proper plural denotation in the sense of Link 1983. It is not a proper plural denotation since it contains

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4. For the status of collective nouns like **committee** see below.

5. Halle and Marantz 1996, section 6, has some discussion of syntactic processes of 'picking up' meaningful morphological features.

atomic individuals along with their sums. The inflectional feature **singular** now has to be a function that picks out the largest subset of atomic individuals from any set. Alternatively, we might assume that all inflectionless nouns are referential, and that they refer to kinds. Proposals of this kind are made in Longobardi 1994 and Krifka 1995[6]. The feature **singular** now denotes a function that maps kinds into the set of its atomic realizations. If nouns (all by themselves) denote sets of individuals that are closed under sums, they have cumulative denotations. If they denote kinds, they satisfy the Cumulativity Universal trivially. I conclude that we do not have to worry about nouns. In one way or other, they comply.

4.2 Cumulativity for verbs and thematic role predicates

This section illustrates the view that the denotations of all basic verbs and thematic role predicates are cumulative from the very start. Crucially, verbal cumulativity is not specifically linked to atelicity, as sometimes assumed erroneously.

As for verbs and the thematic role predicate 'agent', I already presented evidence in the previous chapter that motivated the hypothesis that there might be such a thing as a Cumulativity Universal in the first place. Cumulativity is also at the heart of Schein's argument we looked at in chapter 2. This chapter is about the repercussions of cumulativity within verbal projections. Is the Cumulativity Universal compatible with a mereological theory of plurality? Is lexical cumulativity enough? If there is

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6. Longobardi's and Krifka's proposals were inspired by Carlson 1977. However, Carlson's actual proposal is different. On Carlson's account, singular and plural count nouns start out with predicative denotations. The denotation of a plural count noun can then be lifted to a generalized quantifier that corresponds to a set of properties of kinds. Chierchia 1998 argues that nouns might denote kinds or properties as a matter of parametric variation between languages.

non-lexical cumulativity, where does it come from? What is the role of verbal number agreement?

In the nominal domain, we were able to maintain the Cumulativity Universal by distinguishing between the denotations of nouns themselves and the semantic impact of number features contributed by meaningful nominal inflection. The recognition that meaningful number marking is not necessarily a property of the nouns *per se* led to our positing number-neutral denotations for inflectionless nouns. In English, number marking is also part of the inflection of verbs, and verbs and their subjects agree in number. If there is an unpronounced agreement marker for accusative objects, there might also be non-overt number agreement between a verb and its object. It is not clear whether there is any number inflection related to the event argument. Event plurality might be indicated by pluractional markers, however. Crosslinguistically, the morphological status of pluractional markers is still an open question. Most known pluractional markers seem to be affixes, "frequently reduplicative, most often derivational rather than inflectional…"[7].

"The usual view of pluractional morphemes is that they function as a kind of plural marker for verbs. Of course plural marking on verbs is familiar from the phenomenon of number agreement with a plural argument, exhibited by a wide variety of languages; but here we mean something different. Pluractional markers do not reflect the plurality of a verb's arguments so much as plurality of the verb itself: the verb is understood to represent the occurrence of multiple events." Lasersohn, 1995, p. 241.

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7 . Lasersohn, 1995, p. 238.

Is overt number agreement on English verbs meaningful? Roberts 1987, 1990 has argued that verbal number morphology is a purely syntactic agreement phenomenon. One of her examples is (4):

(4) **John bought a house, and Bill and Mary did, too**.

Roberts' point is that assuming that in VP-ellipsis the elided VP and its antecedent have to have the same denotation, (4) seems to show that singular and plural VPs cannot have different denotations. From the present perspective, it is significant that in the VP ellipsis construction (4), the second conjunct has its own inflection, and therefore its own number marking (carried by the auxiliary **do**). The elided constituent in (4) is an inflectionless VP that is anaphoric to another inflectionless VP in the first conjunct. VP ellipsis cases like (4), then, do not establish that number marking on verbs is a mere syntactic agreement phenomenon.

When we ask about the meanings of verbs and VPs within the current framework of assumptions, we are talking about the meanings of 'bare' verbs and VPs, which are verbal projections that do not yet include any functional structure. Suppose the functional projections of verbs are built step by step in the course of a syntactic derivation by introducing ('merging') functional heads with possibly meaningful features. This is compatible with the view that verbs enter a syntactic derivation fully inflected[8], as long as the features of those initial pieces of inflection are not meaningful themselves. Possible carriers of inflectional meaning would be matching features carried by functional heads. The question is now whether the number features of verbal

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[8]. Chomsky 1995.

functional heads are ever meaningful. Suppose they are. Verbs and VPs, - and in fact all verbal projections below the point where functional heads with number features come in, - should then have denotations that allow us to construct singular and plural denotations with the help of number operators. Alternatively, suppose that verbal number features are not meaningful. In that case, verbs and verbal projections should have denotations that, without any further modification by number operators, directly make the right contributions to the truth-conditions of the sentences they occur in. The important point is that in either case, number-neutral denotations are needed for bare verbs and VPs. It is those number neutral denotations that I will be concerned with. The chunks of a verb's extended projection that we will be examining in this book are mostly located below the point where number features might leave their mark. We will mostly have to consider number-neutral denotations, then, that is, denotations that have not yet been affected by number operators, - if indeed they ever will be.

The prime candidates for number-neutral verb denotations are cumulative denotations, of course. If the denotations of verbs and thematic role predicates are cumulative from the start, the availability of cumulative[9] readings for sentences like 5(a) is expected, as pointed out in Krifka 1992. Assuming initial cumulativity, we can represent those readings as in 5(b)[10]:

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9 . The term is due to Scha 1981,1984. Kroch 1974 coined the name 'serially distributive reading' for the salient reading of **The men in the room are married to the girls across the hall** (p. 204 f.). Sauerland 1998 uses the term 'co-distributive reading'.

10 . Both Krifka 1992 and Landman 1996, 2000 work within a neo-Davidsonian event semantics and rely on initial cumulativity of verbs and thematic role predicates for the logical representation of cumulative readings of sentences analogous to 5(a).

(5) a. **Twenty children ate ten pizzas.**

b. $\exists e \exists x \exists y$ [children(x) & /x/ = 20 & $\exists$agent (x)(e) & pizzas(y) & /y/ = 10 & $\exists$eat (y)(e)] [11]

5(b) improves on early analyses of cumulative readings. Take Remko Scha's[12]. Scha's paraphrase for the cumulative reading of 5(a) would presumably be: The total number of children who ate a pizza was 20, and the total number of pizzas that were eaten by a child was 10. In contrast, 5(b) allows sharing of pizzas, and it doesn't impose 'exactly'-readings for the two numerals. Sharing of pizzas is automatically taken care of by neo-Davidsonian separation of the agent argument, as proposed by Schein. Landman uses a similar example as an objection to Schwarzschild's theory of plurality[13], which is not based on events. While 5(b) is a problem for Schwarzschild's actual theory, it is still not an argument for the highly structured nominal domains that Landman has proposed.

All predicates in 5(b) have cumulative denotations. As in Landman (1996, 2000), the basic verb and thematic role predicates of the logical representations are singular predicates that are pluralized with a $\exists$-operator that maps properties and relations into their smallest cumulative extensions. If every basic verb and thematic role predicate has a cumulative denotation

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[11] . For any individual x, /x/ is only defined if there is a set of atomic individuals that x is the sum of. If defined, /x/ is the number of atomic individuals that x is the sum of, that is, /x/ = /{y: y $\leq$ x & atom(y)}/.

[12] . Scha1981, 1984.

[13] . Landman 1996, p. 455.

from the start, there is no need to repeat that information for every lexical item, of course. However, using the *-operator even for those predictable cases is still pedagogically useful as a reminder that we are dealing with cumulative denotations. I will follow this practice for clarity.

To see the impact of cumulativity on verb denotations within an event semantics in more technical detail, let us examine a very simple example, the small clause in (6):

(6) (**We made**) **two children lift two boxes**.

On the intended cumulative reading, the small clause in (6) is compatible with a wide range of situations, as long as two children did the lifting and two boxes were lifted in all. The children might have acted individually or jointly. The boxes might have been lifted one at a time or both together. And either box or the two boxes together might have been lifted once or several times. How does (6) manage to cover so many different kinds of situations? Suppose the two children are Casey and Stacey, and the two boxes are Red and Green. Casey lifted Red on her own once, and Stacey did so twice. In addition, Casey and Stacey jointly lifted Green. We have four events, e_1, e_2, e_3, and e_4, then, which can be characterized as follows:

	Box lifted	**Box lifter**
e_1	Red	Casey
e_2	Red	Stacey
e_3	Red	Stacey
e_4	Green	Casey+Stacey

In truth-conditional semantics, the extensions of predicates depend on relations that hold in the actual world. A customary, non-cumulative, extension for 'lift' would pair actual lifting events with the objects actually lifted, for example. Disregarding Schönfinkelization, the relation would include the pairs listed in (7) (assuming our scenario is true):

(7) Extension of 'lift'

{<e_1, Red>, <e_2, Red>, <e_3, Red>, <e_4, Green>,.....}

The customary extension of 'agent' would include the pairs in (8):

(8) Extension of 'agent'

{<e_1, Casey>, <e_2, Stacey>, <e_3, Stacey>, <e_4, Casey +Stacey>,.....}

So far, we have a close match between what might be 'basic' relations in the actual world and the relations in the extensions of the predicates. Intuitively, there are four box lifting events and three different agents. One of the agents is a plural individual, and that means that there is collective action. These kinds of denotations reflect nicely what is going on in the world as we see it. At this stage, extensions satisfy what Fred Landman has called the 'Collectivity Criterion'[14]. All plural individuals paired with an event are collectively involved in that event. All plural agents are collective agents, then. Enters Cumulativity, and our extensions turn to mush:

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[14] . Landman 1996, 2000.

(9) a. Extension of '*lift'

{<e_1, Red>, <e_2, Red>, <e_3, Red>, <e_4, Green>, <e_1+e_2, Red>, <e_1+e_3, Red>, <e_1+e_4, Red+Green>, <e_2+e_3, Red>, <e_2+e_4, Red+Green>, <e_3+e_4, Red+Green>, <e_1+e_2+e_3, Red >, <e_1+e_2+e_4, Red+Green>, <e_1+e_3+e_4, Red+Green>, <e_2+e_3+e_4, Red+Green>, <e_1+e_2+e_3+e_4, Red+Green>, ... }

b. Extension of '*agent'

{<e_1, Casey>, <e_2, Stacey>, <e_3, Stacey>, <e_4, Casey+Stacey>, <e_1+e_2, Casey+Stacey>, <e_1+e_3, Casey+Stacey>, <e_1+e_4, Casey+Stacey>, <e_2+e_3, Stacey>, <e_2+e_4, Casey+Stacey >, <e_3+e_4, Casey+Stacey>, <e_1+e_2+e_3, Casey+Stacey>, <e_1+e_2+e_4, Casey+Stacey>, <e_1+e_3+e_4, Casey+Stacey>, <e_2+e_3+e_4, Casey+Stacey >, <e_1+e_2+e_3+e_4, Casey+Stacey >, ... }

The cumulative extensions in 9(a) and (b) include more than just the basic relations between individuals and events we might be prepared to recognize. There are more lifting events than we ever dreamed of, and, strangely, the sum of Casey and Stacey is the plural agent of most of them. There is nothing intrinsically bad about this state of affairs, however, as long as the truth conditions we predict are right. Are they?

Assuming the cumulative denotations partially listed in (9), the logical representation 10(a) correctly comes out true. The open sentence 10(b) is satisfied by several variable assignments, including the one in 10(c):

(10) a. $\exists e \exists x \exists y$ [children(x) & /x/ = 2 & *agent(x)(e) & boxes(y) & /y/= 2

& *lift(y)(e)]

b. children(x) & /x/ = 2 & *agent(x)(e) & boxes(y) & /y/= 2
& *lift(y)(e)

c. ‘e’ * e_1+ e_2+ e_3+ e_4
‘x’ * Casey+Stacey
‘y’ * Red + Green

Having cumulative, number-neutral, denotations yields correct results not only for plural VPs, as in 11(a) and (b) below, but also for singular VPs, as in 11(c) and (d). Assume the same scenario as before and look at the following sentences:

(11) a. **Casey and Stacey lifted Red**.
b. **Casey and Stacey lifted Green**.
c. **Casey lifted Red (at least) once**.
d. **Stacey lifted Red (at least) twice**.

11(a) to (d) should all come out true, and they do. 11(a) is verified by e_1+e_2, e_1+e_3, and e_1+e_2+e_3. 11(b) is verified by e_4. The fact that Stacey, but not Casey, lifted Red twice is in principle retrievable from 9(a) and (b) as well. There is an event (namely e_2+e_3) that has Stacey as its agent, and also has two proper subevents, each of which is a lifting of Red by Stacey. As for Casey’s liftings of Red, there is only one such event, e_1.

4.3 The challenge: Together

Assuming cumulative denotations for verbs and thematic role predicates seems to blur the distinction between collective and distributive predication. However, in the presence of adverbs like **together**, that distinction still needs to be made. In his dissertation and later

work, Peter Lasersohn has shown that within an event semantics, the distinction between collective and distributive predication can be retrieved, even if the predicates involved have cumulative denotations. "The basic idea was to base the semantics of *together* and related expressions .... around the part/whole structure of the events themselves."[15] Crucially, Lasersohn's method makes it possible to maintain the Cumulativity Universal without forcing us to posit more complicated denotations for plural definite DPs.

Within mereological frameworks, the potentially most serious problem with cumulative verb denotations is that the distinction between distributive and collective involvement of plural individuals in events might get lost. For those who have singular and plural predicates at their disposition, collective predication is the result of applying a singular property to a plural individual, and distributive predication comes about by applying a plural property to a plural individual. If we nevertheless insist on cumulativity for verbs and thematic role predicates, doesn't that mean that we have to put up with a more populated universe of pluralities in the nominal domain? In fact, Krifka's 1992 pitch for cumulative verb denotations concludes with the remark that

"to cover collective readings, as e.g., *John and Mary (jointly) own three houses*, we need of course a different representation, which will not be developed here."[16]

Following the spirit of Schwarzschild[17], but in a mereological framework, I have been relying on a simple 'sums theory' for pluralities. In view of the strong arguments Schwarzschild has given for this approach to pluralities, I

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15. Lasersohn 1995, 189.

16. Krifka 1992, 44.

17. Schwarzschild 1991, 1992, 1994, 1996.

would be reluctant to abandon it. However, we now have to take very seriously the question whether the assumption that verb denotations are cumulative from the very start still allows us to distinguish collective and distributive predication without overpopulating our universe of pluralities. Simplicity for verb denotations should not come at the cost of inflation in the nominal domain.

To get a feeling for the problem that Krifka was alluding to, look at the following sentences:

(12) a. **Casey and Stacey lifted Green**.
b. **Casey and Stacey lifted Red.**

(13) a. **Casey and Stacey lifted Green together**.
b. **Casey and Stacey lifted Red together**.

(14) a. **Casey and Stacey lifted Green individually**.
b. **Casey and Stacey lifted Red individually**.

Given our earlier scenario, 12 (a) is true when understood as collective predication, and false when understood as distributive predication. 12(b), on the other hand, is false as collective predication, and true as distributive predication. Even if we were reluctant to say that 12(a) and (b) are truly ambiguous, we would still have to be able to retrieve the distinction between collective and distributive predication from the extensions of verbs, since adverbs like **individually** and **together** depend on it. 13(a) and 14(b) are true, and 13(b) and 14(a) are false. The denotations we posit for verbs and

thematic role predicates, then, must contain enough information to provide adverbs with sufficiently fine-grained extensions to operate on.

In his dissertation and later work, Peter Lasersohn[18] has developed an analysis for collectivizing adverbs within an event semantics that is compatible with cumulative verb denotations without automatically triggering inflation in the nominal domain. To see an example of the kind of analysis he proposed, let us go back to the extensions of '□lift' and '□agent' we looked at earlier:

(9) a. Extension of '□lift'

{<e_1, Red>, <e_2, Red>, <e_3, Red>, <e_4, Green>, <e_1+e_2, Red>, <e_1+e_3, Red>, <e_1+e_4, Red+Green>, <e_2+e_3, Red>, <e_2+e_4, Red+Green>, <e_3+e_4, Red+Green>, <e_1+e_2+e_3, Red >, <e_1+e_2+e_4, Red+Green>, <e_1+e_3+e_4, Red+Green>, <e_2+e_3+e_4, Red+Green>, <e_1+e_2+e_3+e_4, Red+Green>, ... }

b. Extension of '□agent'

{<e_1, Casey>, <e_2, Stacey>, <e_3, Stacey>, <e_4, Casey+Stacey>, <e_1+e_2, Casey+Stacey>, <e_1+e_3, Casey+Stacey>, <e_1+e_4, Casey+Stacey>, <e_2+e_3, Stacey>, <e_2+e_4, Casey+Stacey >, <e_3+e_4, Casey+Stacey>, <e_1+e_2+e_3, Casey+Stacey>, <e_1+e_2+e_4, Casey+Stacey>, <e_1+e_3+e_4, Casey+Stacey>, <e_2+e_3+e_4, Casey+Stacey >, <e_1+e_2+e_3+e_4, Casey+Stacey >, ... }

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18. The 1988 dissertation was published in 1991. The later works include Lasersohn 1990, 1995 and 1998.

Take $e_1 + e_2$. The event $e_1 + e_2$ is an event of lifting Red that has Casey+Stacey as agent. This is sufficient to make 12(b) true. We now want to find a condition that tells us why 13(b) is false. Here is a possibility: 13(b) is true if there is some event of lifting Red that has Casey+Stacey as agent, but doesn't have any subevent that is a lifting of Red by anybody but Casey+Stacey. Our scenario doesn't provide such an event. The only events that are events of lifting Red that have Casey+Stacey as agent are $e_1 + e_2$, $e_1 + e_3$, and $e_1 + e_2 + e_3$, but each of those events has subevents that are liftings of Red and have either Casey or Stacey alone as agents. 13(b), then, is correctly ruled false. Next, look at 13(a). Applying the same condition, 13(a) is true if there is some event that is a lifting of Green that has Casey+Stacey as agent, but lacks any subevent that is a lifting of Green by anybody but Casey+Stacey. Since we have a suitable event in our scenario, namely e_4, 13(a) winds up true, as it should. The condition we have just looked at can be stated as in (15)[19]:

(15) T(**together**) =

$\lambda R_{<e<st>>} \lambda y \lambda e[R(y)(e) \& plural(y) \& \neg \exists e' \exists z [[e' \leq e \ \& R(z)(e')] \rightarrow z = y]]$

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19. (15) is basically Lasersohn's condition for collectivizing **together** (Lasersohn 1988, 1990), adapted to the semantic framework I am using. Lasersohn's semantics is a situation semantics in the sense of Barwise and Perry 1983, whereas I am working within a Davidsonian event semantics. Rather than talking about events that <u>are</u> liftings of this box by Stacey, for example, Lasersohn would talk about events <u>in which</u> Stacey lifted this box. Having a Davidsonian event semantics makes neo-Davidsonian association of external arguments possible, an option Lasersohn does not have. This in turn has consequences for the analysis of Schein sentences. Lasersohn 1995 has a revised analysis of **together**, which makes assumptions about team credit that are not compatible with the present work.

Using (15), the denotation of sentences like 13(a) or (b) can be derived as follows:

1. T(**lift Green**) = λe [λlift(Green)(e)]
2. T(**[active]** (**lift Green**)) = $\lambda y \lambda e$[λagent(y)(e) & λlift(Green)(e)]
3. T(**together**) =
   $\lambda R_{<e<st>>} \lambda y \lambda e$[R(y)(e) & plural(y) & $\lambda e' \lambda z$ [[e' $\leq$ e & R(z)(e')] $\rightarrow$ z = y]]
5. T((**[active]** (**lift Green**)) **together**) =
   $\lambda y \lambda e$[λagent(y)(e) & λlift(Green)(e) & plural(y) & $\lambda e' \lambda z$ [[e' $\leq$ e &
   λagent(z)(e') & λlift(Green)(e')] $\rightarrow$ z = y]]
6. T(**Casey and Stacey**) = Casey+Stacey
7. T(**Casey and Stacey** ((**[active]** (**lift Green**)) **together**)) =
   λe[λagent(Casey+Stacey)(e) & λlift(Green)(e) & plural(Casey+Stacey)
   & $\lambda e' \lambda z$ [[e' $\leq$ e & λagent(z)(e') & λlift(Green)(e')] $\rightarrow$
   z = Casey+Stacey]]

As is, (15) might be too strong. (16) below, for example, seems compatible with a situation where one of the copy editors was looking for mistakes, but didn't find any, or where two copy editors found the very same mistakes:

(16) **The 10 copy editors together caught those 20 mistakes**.

In such situations, the events verifying (16) have subevents in which a proper subgroup of the 10 copy editors caught the 20 mistakes. Maybe what **together** does is convey that none of the copy editors alone caught those

mistakes. It is a marker of non-distributivity[20]. We might then have (17) instead of (15):

(17) T(**together**) =
$\lambda R_{<e<st>>}\lambda y\lambda e[R(y)(e) \& \forall z [[z \leq y \& atom(z)] \rightarrow \exists e'[e' \leq e \& R(z)(e')]]]$

(17) assumes wrongly that the relevant parts of a plurality are always the atoms it is composed of. This is not necessarily so, however, a point Roger Schwarzschild has emphasized in his works on plurality. Suppose the ten copy editors work in teams of two, and each of the five teams found all 20 mistakes. (16) would not be true in such a situation, even though none of the individual copy editors alone found the 20 mistakes. Quantification over plural parts of pluralities is context dependent. (17) might reflect this context sensitivity with the help of a free variable 'C':

(17') T(**together**) =
$\lambda R_{<e<st>>}\lambda y\lambda e[R(y)(e) \& \forall z [[z \leq y \& C(z)] \rightarrow \exists e'[e' \leq e \& R(z)(e')]]]$

Following Schwarzschild, possible values for 'C' might be restricted to properties picking out cells of a contextually salient partition or cover of y[21]. I will not try to choose between (15) and (17). The following discussion will target the kind of account given to collectivizing adverbs by Lasersohn,

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[20] . Schwarzschild 1993-94 captures this intuition in a non-event-based framework. Schwarzschild 1993-94 also has provisions for the context dependency affecting **together** and discusses possible restrictions for what the relevant parts of a plurality are.

[21] . A cover of a plurality y is any set of parts of y whose sum is y. A partition is a cover, but without overlap between its members.

rather than the exact conditions for togetherness imposed. To stay close to the Lasersohn-Schwarzschild debate in this area, I will continue with (15) while keeping its competitor (17') in the background as a possible alternative.

We are now ready to deal with a complication that I have completely neglected so far: Different positions of **together** can produce different readings. Look at the following pair of sentences, for example:

(18) a. **Casey and Stacey washed every single car together**.
b. **Casey and Stacey together washed every single car**.

18(a) and (b) differ in meaning possibilities. 18(a) implies that Casey and Stacey collaborated on every single car. In addition to true collaborative action cases, 18(b) can also be used to describe events where Casey and Stacey didn't work together at all, but between them, they happened to wash all the cars. 18(b) covers all the varied scenarios familiar from cumulative readings: We sum up Casey and Stacey's collective and individual car washing actions and the cars they washed.

What is it that accounts for the difference between 18(a) and (b)? A possible answer is "quantifier scope". In 18(a), the quantifier phrase could be scoped out, and the input for semantic interpretation would then be a structure of the following kind, whose interpretation is straightforward:

(19) (**Every single car**)$_1$ (**Casey and Stacey washed t$_1$ together**).

18(b) is a Schein sentence of the sort we discussed in chapter 2. As we saw then, the reading we are interested in can be obtained by combining the

denotation of the verb and the quantifier phrase directly. Assuming neo-Davidsonian association of the agent argument in the syntax, the next step would be to add the agent argument. The adverb **together** could then operate over the resulting constituent:

1. T(**every single car**) = $\lambda R_{<e<st>>} \lambda e \exists x$ [car(x) $\wedge$ $\forall e'[e' \leq e$ & R(x)(e')]]
2. T(**wash**) = $\lambda x \lambda e$ wash(x)(e)
3. T(**wash** (**every single car**)) = $\lambda e \exists x$ [car(x) $\wedge$ $\forall e'[e' \leq e$ & wash(x)(e')]]]
4. T(**[active]**) = $\lambda y \lambda e$ agent(y)(e)
5. T(**[active]** (**wash** (**every single car**))) = $\lambda y \lambda e$ [agent(y)(e) & $\exists x$ [car(x) $\wedge$ $\forall e'[e' \leq e$ & wash(x)(e')]]]
6. T(**together**) = $\lambda R_{<e<st>>} \lambda y \lambda e$[R(y)(e) & plural(y) & $\forall e' \exists z$ [[e' $\leq$ e & R(z)(e')] $\rightarrow$ z = y]]
7. T(**together** (**[active]** (**wash** (**every single car**)))) = $\lambda y \lambda e$[R(y)(e) & plural(y) & $\forall e' \exists z$ [[e' $\leq$ e & R(z)(e')] $\rightarrow$ z = y]], where R = $\lambda y \lambda e$ [agent(y)(e) & $\exists x$ [car(x) $\wedge$ $\forall e'[e' \leq e$ & wash(x)(e')]]].
   Etc.

According to this derivation (once you finish it), 18(b) says that there is an event e, Casey+Stacey is the plural agent of e, e is an event in which every single car is washed, and e has no subevents in which every single car is washed by anybody but Casey or Stacey. These are the correct truth-conditions for 18(b), granting some simplifications[22].

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[22] . We really want to talk about completed events of washing every single car, rather than about events <u>in</u> which every single car is washed. This can be accomplished by amending the interpretation of **every single car** as follows, using Link's σ-operator:

If quantifier scope alone accounted for the ambiguity between 18(a) and (b), there should be no ambiguity if the direct object is not a quantifier phrase. This is not so, however. Look at (20), due to Roger Schwarzschild[23]:

(20) a. **Leakey and Livingston together excavated the cave**.
b. **Leakey and Livingston excavated the cave together**.

For (20), Schwarzschild invokes a situation where Livingston excavated the western part of the cave, and many years later, Leakey arrived on the scene and excavated the eastern part. In this situation, 20(a) is true, and 20(b) is false. Unlike 20(a), 20(b) requires true collaboration between Leakey and Livingston. In 20(a), **together** is structurally higher than in 20(b). It might even be part of the subject DP, as Schwarzschild has suggested. Be this as it may, how come a merely cumulative interpretation is only available if **together** is in the higher position? With 18(b), we saw that we can obtain the intended reading if we leave the object *in situ* and introduce **together** just after **[active]**. If we do the same in 20(a), we also get the right result. 20(a) describes events e that are excavations of the cave, Leakey and Livingston are the agents of e, and there are no parts of e that are excavations of the cave with anybody but Leakey and Livingston as agents. This is right. If the higher position of **together** is just above **[active]**, where is the lower position? Given the semantic type of **together**, we would expect a lower **together** to operate over the verb. It could do so at a stage of the

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T(**every single car**) = $\lambda R_{<e<st>>} \lambda e[\exists x [car(x) \wedge \forall e'[e' \leq e \rightarrow R(x)(e')]] \wedge e = \iota e'\exists x [car(x) \wedge R(x)(e') \wedge e' \leq e]]$. It is now required that e be identical to those of its subevents that are washings of a car.

derivation where the verb hasn't moved up to a higher inflectional head yet. However, using definition (15) wouldn't give us the meaning of 20(b):

1. T(**excavate**) = $\lambda x \lambda e$ [excavate(x)(e)]
2. T(**together**) =
   $\lambda R_{<e<st>>} \lambda y \lambda e$[R(y)(e) & plural(y) & $\lambda e' \lambda z$ [[e' $\leq$ e & R(z)(e')] $\rightarrow$ z = y]]
3. T(**together excavate**) =
   $\lambda y \lambda e$[excavate(y)(e) & plural(y) & $\lambda e' \lambda z$ [[e' $\leq$ e & excavate(z)(e')]
   $\rightarrow$ z = y]]
4. T((**together excavate**) (**the cave**)) =
   λe[excavate(the cave)(e) & plural(the cave) & $\lambda e' \lambda z$ [[e' $\leq$ e &
   excavate(z)(e')] $\rightarrow$ z = the cave]]

Since the cave is an atom, and not a plural individual, the property derived in step 4 is not true of any event. Having the plural **the caves**, rather than the singular **the cave**, is a little better, even though it is not all too clear how to excavate the caves as collectives, rather than as individual caves. Change the verb to **sell**, and things become very plausible. I can sell the caves together in a single transaction, or individually. Combining **sell** directly with one or the other adverb gives us that difference. This is all to the good, but we still don't know how to derive the meaning of 20(b). In 20(b), **together** enforces a team action reading. This is the only reading, given that **together** can't successfully relate to the singular direct object in 20(b).

Lasersohn has pointed out that postverbal **together** has a whole variety of closely related uses. In addition to collaborative or team action, it may

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[23]. Schwarzschild 1993-1994, p. 246.

indicate temporal or spatial proximity, or social accompaniment, for example. Lasersohn has also emphasized that one of the main attractions of an analysis of preverbal **together** along the lines of (15) is that it generalizes to its other uses:

(21) a. **We sat together**.
b. **We stood up together**.
c. **We worked together**.
d. **We went to Brazil together**.
e. **We put the bike together**.
f. **I can only sell you the hat and the gloves together**.

Following the spirit of Lasersohn, but exploiting neo-Davidsonian argument association, the team action reading of postverbal **together** might come via (22), where f_{agents} is a partial function that maps actions with plural agents to their agents, and is undefined for any other kind of eventuality.

(22) T(**together**) =
$\lambda R \lambda y \lambda e[R(y)(e) \& \forall e' \sqsubseteq z [[e' \leq e \ \& R(z)(e')] \rightarrow f_{agents}(e) = f_{agents}(e')]]$

Using (22), we derive the meaning for the relevant part of 20(b) as follows:

1. T(**excavate**) = $\lambda x \lambda e [*excavate(x)(e)]$
2. T(**together**) =
$\lambda R \lambda y \lambda e[R(y)(e) \& \forall e' \sqsubseteq z [[e' \leq e \ \& R(z)(e')] \rightarrow f_{agents}(e) = f_{agents}(e')]]$
3. T(**together excavate**) =
$\lambda y \lambda e [*excavate(y)(e) \& \forall e' \sqsubseteq z [[e' \leq e \ \& *excavate(z)(e')]$

$\rightarrow f_{agents}(e) = f_{agents}(e')]]$

4. T((**together excavate**) (**the cave**)) =

$\lambda e[\lambda excavate(the\ cave)(e) \& \forall e' \exists z [[e' \leq e \& \lambda excavate(z)(e')] \rightarrow f_{agents}(e') = f_{agents}(e)]]$

According to this derivation, 20(b) is expected to imply that Leakey and Livingston collaborated on every relevant stage of the excavation of the cave. This is what team action is all about. If Leakey and Livingston have any claim to having excavated the cave together, then in some way or other, they were jointly in charge of all parts of the excavation. The individuation of events is notoriously underdetermined and context dependent, of course, a fact emphasized and exploited by Lasersohn and discussed extensively in Moltmann 1997. (22) allows for realistic cases of collaboration, then. It does not commit us to the view that Leakey and Livingston literally dug out each and every part of the cave together.

As is, (22) closely follows the format of (15), but might contain a redundant part. Whenever e is an excavation of something, then any subaction of e is an excavation of something, too. Likewise, whenever e is a reading, eating, building, pushing, or petting of something, and e' is a subaction of e, then e' is a reading, eating, building, pushing, or petting of something as well. If this is a general principle for verb meanings, we can replace (22) by (23) without any losses for postverbal **together**:

(23) T(**together**) =

$\lambda R \lambda y \lambda e[R(y)(e) \& \forall e' [[e' \leq e \ \& action(e')] \rightarrow f_{agents}(e) = f_{agents}(e')]]$

If there are a variety of meanings **together** can have, we expect each of them to be available, unless excluded for some principled reason. We wouldn't want any one of those instances of **together** to come with a stipulation for where it can appear in a syntactic derivation. We have already seen that (15) is available for postverbal **together**, but will then automatically relate to the object. There is nothing to prevent (23) from being used for preverbal **together**, so long as the predicate it operates over is an action predicate. It will then impose a team action reading, hence require collaboration. Since team action is also covered by using (15) instead of (23), no real ambiguity is perceived for preverbal **together**. There are collectivizing adverbs, however, which only have a team action reading, - even in pre-VP positions. German **gemeinschaftlich** is an example:

(24) a. **Newton und Einstein haben zusammen die moderne**
Newton and Einstein have together the modern

Physik begründet.
physics founded.
Newton and Einstein together created modern physics.

b. **Newton und Einstein haben die moderne Physik**
Newton and Einstein have the modern physics

zusammen begründet.
together founded.
Newton and Einstein created modern physics together.

(25) a. **Newton und Einstein haben gemeinschaftlich die**
Newton and Einstein have jointly the

moderne Physik begründet.
modern physics founded.
Newton and Einstein jointly created modern physics.

b. **Newton und Einstein haben die moderne Physik**
Newton and Einstein have the modern physics

gemeinschaftlich begründet.
jointly founded.
Newton and Einstein created modern physics jointly.

Since Newton and Einstein lived too far apart in time to collaborate as a team, 24(b) and 25(a) and (b) are all false. Only 24(a) is true: The cumulated achievements of the two men created the field of modern physics. In 25(a) and (b), I used the English adverb **jointly** to translate German **gemeinschaftlich**. With action verbs, **jointly** also imposes a team action reading in preverbal and postverbal position. Unlike **gemeinschaftlich**, however, **jointly** is also acceptable with verbs like **imply**, for example, hence doesn't necessarily relate to collaborative action or collective ownership. The existence of collectivizing adverbs that require collaboration even in pre-VP positions supports (23) against (22). (22) would not generally produce a team action interpretation in those positions. Consequently, (23) has to be available as a meaning assignment, even if my rationale for obtaining it from (22) might eventually turn out to be flawed.

Here is a summary of the account of **together** and **gemeinschaftlich** I have proposed. To start with the conclusion, - we need both (23) and our old (15):

(15) T(**together**) =
$\lambda R_{<e<st>>} \lambda y_e \lambda e[R(y)(e) \& plural(y) \& \neg\exists e' \exists z [[e' \leq e \ \& R(z)(e')] \wedge \neg z = y]]$

In pre-VP position, adverbs with the denotation in (15) are expected to produce interpretations that are compatible with both collaborative and merely cumulative action. Pre-VP **together** has that range of interpretations, hence should denote (15). On the other hand, pre-VP **gemeinschaftlich** is not compatible with merely cumulative action, hence needs to denote (23). With that denotation, it is also expected to generate a collaborative action reading even if it directly combines with the verb. This is so. In postverbal position, English **together** can relate to the direct object, as in 21(f) from above:

(21) f. **I can only sell you the hat and the gloves together**.

This interpretation is automatically generated if post-verbal **together** has the denotation in (15) and combines directly with the verb. Since postverbal **together** can also have a collaborative action interpretation, we have to assume that **together** is ambiguous and can optionally have the meaning specified in (23). Between them, (15) and (23) cover quite a bit of ground, then.

The notion of collaboration formalized in (23) is based on a crucial assumption about team action that needs more discussion. A first intuition about what teams or groups are is that they are pluralities 'seen as ones' - as singularities, that is. Since pluralities can't literally be singularities[24], it is likely that they are seen as 'ones' because they behave as 'ones'. We should now look into the behavior of singular agents. What might very well be the

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[24] . There is, of course, the trickery made possible by set theory. I am siding with Lewis 1991 here. For a different opinion, see Landman 1989, 1996, 2000.

most distinctive property of singular agents is that they satisfy what I want to call the 'Single Agent Constraint': even complex actions by singularities do not have subactions by anyone but those very same singularities. Actions with singular agents obey (26), then:

(26) Single Agent Constraint
If e is an action, and x is the agent of e, then x is the agent of any subaction of e.

I am just one person, and all of my actions are in line with (26). If e is my cooking dinner tonight, for example, then I am the agent of all subactions of e. Plural agents do not generally satisfy (26). If you and I cooked dinner yesterday independently of each other, and e is that event, then the sum of you and me are the agents of e. But that sum is not the agent of all subactions of e.

That (26) holds for actions with singular agents follows from what we have been assuming: Singular individuals are atoms; any action has a unique agent, and the agent relation is cumulative. Suppose e is an action with a singular agent x, and e' is a subaction of e whose agent is y. Cumulativity of the agent relation implies that x+y is the agent of e+e'. Since e' is part of e, e+e' = e. Consequently, x+y is the agent of e. But agents are unique, hence x+y = x, and therefore $y \leq x$. Since x is atomic, y = x.

What I want to propose is that (26) also holds for group actions. It's not that group agents have to be singularities. They might as well be regular pluralities, - as long as they behave like singularities. For group agents to behave like singularities means to satisfy (26) with respect to their actions.

If we watch the Red Sox play, for example, we might see that game or a part of it as group action. Consequently, that action would be represented as conforming to (26) in our domain of eventualities. There might have to be 'team credits' for home runs, then:

"It is common practice to attribute to a group an action which is properly performed only by some (or even just one) of the group's members. This is especially true in a context where the group acts as a team; consider sentences such as *The Islanders scored a goal*, for example. We accord "team credit" to the Islanders, even though the goal might have been scored through the efforts of just one player."[25]

Lasersohn extends the notion 'team credit' beyond the cases of true collaborative action, however, which is going too far, I think. (27) might very well be true, for example, even though Newton wasn't part of a team that developed the Theory of Relativity, and the Laws of Motion weren't discovered by a crew that included Einstein.

(27) (**Between them**,) **Newton and Einstein are responsible for every single influential physical theory of modern times**.

Since Lasersohn doesn't have neo-Davidsonian association of agent arguments, he invokes team credit even for the merely cumulative interpretations of Schein sentences. According to Lasersohn, (27) could only be true, for example, if the plural individual consisting of Newton and Einstein was responsible for each and every influential physical theory of modern times. For this analysis not to be obviously wrong, Lasersohn relies on team credit. "Team credit is more-or- less automatic whenever the

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[25] . Lasersohn 1995, 197.

combined effects of a group's actions are pragmatically relevant"[26]. The combined efforts of Newton and Einstein are pragmatically relevant for (27), yet we can't grant team credit in the absence of any actual team grouping. Since Newton and Einstein weren't a team on anybody's account, they should not be entitled to team credit. Teams aren't created by the mere powers of imagination. They correspond to substantive groupings of pluralities in the actual world[27]. The Red Sox are a team, but Newton and Einstein were not. On the analysis I am pursuing, team credit may be given in cases of true collaborative or team action, but not when we are merely summing up the actions of singular individuals. Most importantly, this hard-line approach to team credit gives us an account of the differences between collectivizing adverbs that we observed in (20), (24), and (25). Some collectivizing adverbs tolerate mere cumulativity, but there are others that require true collaboration.

If there are group actions, there should also be group states, states of being a team, for example. Theoretically, a group state would have to be a state of a plurality that has no substate whose possessor is anything but that very same plurality. It is very important to keep in mind that mereology alone gives us nothing in the way of substantive pluralities. If our domains D_e and D_S are closed under sums, they have countless members that are a far cry from anything we might be willing to recognize as actually existing groupings. To see one of those abnormal specimens, take David Lewis' trout-

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[26] . Lasersohn 1995, p. 198.

[27] . Substantive groupings of pluralities are 'integrated wholes' in the terminology of Moltmann 1997.

turkey[28]:

"I accept a principle of *Unrestricted Composition*: whenever there are some things, no matter how many or how unrelated or how disparate in character they may be, they have a mereological fusion. … That means that if I accept individuals and classes, I have to accept mereological fusion of individuals and classes. Like the mereological fusion of the front half of a trout plus the back half of a turkey, which is neither fish nor foul, these things can be mostly ignored. They can be left out of the domains of all but our most unrestricted quantifying. They resist concise classification: all we can say is that the salt beef sandwich is part animal, part vegetable, part mineral; the trout-turkey is part fish and part fowl; and the mereological fusion of Possum plus the class of all cat-whiskers is part individual and part class."

I suggest that group states and actions are states and actions of substantive actual pluralities. This gives the notions 'group state' and 'group action' their empirical bite. You can't just stipulate the existence of substantive groups. They are there in reality. Actual teams, piles, bunches, flower arrangements, clubs, committees, congregations, and what have you - all correspond to substantive groupings of pluralities in the actual world. My proposal is a particular hypothesis about the connection between substantive groupings of pluralities and the part structure of events: Actions by substantive groups satisfy the Single Agent Constraint, and states of substantive groups satisfy an analogous Single Possessor Constraint.

It's easy to mix up mere mereological sums and substantive pluralities. Let's try not to.

"I myself take mereology to be perfectly understood, unproblematic, and certain. This is a

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[28]. Lewis 1991, p. 7f.

minority opinion. Many philosophers view mereology with the gravest suspicion. Sometimes they suspect that originally the notion of part and whole was understood not as topic-neutral, but rather as a spatiotemporal - or merely spatial - notion. They conclude that any application of it to things not known to be in space and time is illicit. The original idea, supposedly, was that x is part of y iff y is wherever x is.
That is wrong thrice over…".[29]

Spatial and temporal proximity plays an important role in the creation of substantive groupings of pluralities, however. This is illustrated by an example of Barry Schein. Schein asks us to imagine a tree whose leaves are allergenic when they come in bunches larger than three. We are now asked to consider

" a context for (107) in which the fallen leaves of the allergenic tree have been raked up into several bunches scattered on the lawn:

(107) All the bunches of leaves (on the lawn) are allergenic.

…(107) is true if each of the bunches one sees on the lawn contains more than three leaves. The sentence is not falsified by the one-, two-, or three-leafed bunches that can be created from the actual bunches lying there. The domain of the quantifier *all the bunches of leaves* (*on the lawn*) is thus not closed under combinations of the atoms. Note that the domain of actual bunches is essentially a partition of the atoms on the lawn, since no leaf is in two places at once. A domain of actual individuals observed at a given moment will never attribute to its atoms more than one location. This property always holds even of stuff in constant flux, like the bits of glass, the atoms, constantly regrouping in a kaleidoscope to form new clusters, the individuals."
Schein 1993, p. 104

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[29] . Lewis 1991, p. 75.

Given the connection between substantive actual groupings and spatial and temporal proximity, fewer different meanings for English **together** might have to be posited than Lasersohn suspected[30]. Look at the following examples from above:

(21) a. **We sat together**.
b. **We stood up together**.
d. **We went to Brazil together**.

With activities like sitting, standing up, or going to Brazil, spatial proximity of the agents and temporal closeness and coordination of their actions contributes essentially to establishing them as substantive groups, and their actions as collective actions. It might very well be, then, that we do not need separate spatial and temporal uses of **together**. When we sat together, we sat as a group. When we stood up together, we stood up as a group. And when we went to Brazil together, we traveled as a group. The groups were all substantive groups, and this means that there were group actions and states that came with them, satisfying the Single Agent or Possessor Constraint.

It may be helpful to compare the present account of group states and actions to the account of groups in Link 1984 and 1991[31]. Link has group individuals that are 'impure atoms'. They are denoted by singular collective DPs such as **the committee**, **the choir**, or **the army**. In addition to the soldiers that constitute the army and are a plurality, then, there is also the army, which is a group, and hence a singularity. Link 1991 posits a group forming operation

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30 . A unified analysis based on flexible part structures is advocated in Moltmann 1997.

31 . A related account is given in Landman 1989, 1996, 2000.

that maps all sums of 'pure atoms' like the soldiers or the children into corresponding groups. The outputs are entities that have no longer any pure atoms as parts. In contrast, our group actions might very well have regular pluralities as agents. Their distinctive property is that they are not sums of actions by singularities. Likewise, group states might very well be states of ordinary sums of individuals. What's special about them is that they are not sums of states of singularities. Most importantly, I have suggested that group actions and states are actions and states of substantive groupings of pluralities. As a consequence, the inventory of group states and group actions of our world is a matter of contingent fact.

Having group actions and states opens up new possibilities for the semantics of collective nouns. Rather than describing special breeds of individuals - Link's groups - collective nouns like **committee**, **choir**, or **army** might in truth be relational. They might denote relations between regular pluralities (sums, that is) and particular groupings of those pluralities, which are collective states. **Choir**, for instance, would express a relation that holds between a plurality x and a state s just in case s is a choir grouping of x. An immediate consequence of this proposal is that it accounts for the fact that one and the same plurality might be grouped in more than one way at the same time, a possibility that Link's proposal does not cover. The same children might be the school choir and the school lunch committee, for example. On the present account, this would mean that there are two different groupings of the children, hence two different collective states for

them, a school choir grouping and a school lunch committee grouping[32]. Both states might happily coexist over a stretch of time.

If **choir** is relational, and its external argument is a state argument, we expect that the number marking of **choir** does not reflect the singularity of the individuals that constitute choirs, but the singularity of the grouping of those individuals. Likewise, when we count choirs, we count groupings of plural individuals, not plural individuals themselves. Two different choirs may be made up by the very same singers. The way we count choirs is reminiscent of the way we count passing ships[33]:

(28) **Four thousand ships passed through the lock last year**.

(28) could be true, for example, if a total of 200 hundred ships passed through the lock again and again, adding up to 4000 different passages. Each of those 4000 events contains a different stage of a ship. Rather than counting passages, then, we might as well count passing stages of ships. If the noun **ship** has a state argument that can refer to temporal stages of individual ships, we understand why we are allowed to count ship stages when evaluating the truth of (28). Here is an actually attested case of quantification over stages. The Boston Globe of August 6, 2001 quotes an unidentified Republican as saying "In most White Houses, the chief of staff is first among equals." As far as buildings go, the quote does not assume there to be any other White Houses apart from the one in our nation's capital.

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[32] . Those relatively permanent groupings correspond to the guises of Landman 1989. See also Moltmann 1997 for discussion of related cases.

[33] . Krifka 1990.

What is being quantified over are temporal stages of the White House that correspond to different presidencies. The current president's chief of staff, who "leaves no footprints in the sand", is compared in the article to the high visibility of the chiefs of staff of former presidencies. It seems, then, that common nouns - and even proper names - can have eventuality arguments, an assumption that fits well into the program of Higginbotham 1989, 2000. James Higginbotham has argued over the years that predicates of all kinds can have eventuality arguments.

To have at least a concrete proposal on the table for further thought, (29) is a first idea of what an analysis of collective nouns might eventually look like[34]:

(29) a. **A boys' choir sang**.

b. $\exists x \exists e \exists s$ [choir(x)(s) & boys(x) & $\exists$agent(x)(e) & $\exists$sing (e) & $\forall e' \forall y$ [[e' $\leq$ e & $\exists$agent(y)(e')] $\rightarrow$ [y = x & s < e']]]

c. 'There is a choir of some boys x and, as a choir, x is the collective agent of a singing event'.

29(b) accounts for the fact that 29(a) requires group action by a plurality of boys, and implies that a choir grouping of them be present throughout the event[35]. In the end, then, we might not need Link-style groups for the

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[34] . To flesh out that proposal, we would have to derive all the hybrid properties of collective nouns in an insightful compositional way. I will not do this here, since the issue is not that central to my plot.

[35] . If the analysis is right, group actions by some plurality x can include group states. If so, the possessors of those states should have to be identical to x.

semantics of collective nouns any longer[36]. Collective actions and states might be able to take their place. Those, we need anyway.

Abolishing Link-style groups in favor of collective states and actions could make life easier in other ways, too. Take (30):

(30) **John destroyed that pile of plates**.

On the relational view of collective nouns, we might take the denotation of **that pile of plates** to be a pair consisting of the plates and that particular pile state they were in. The direct object of **destroy** in (30) would then denote such a pair, and we could easily account for the fact that destroying that pile of plates might involve destruction of the state or the plates. This looks good. (30) is true in situations where John destroyed the actual pile arrangement without destroying the plates. Or he might have destroyed the state along with the plates. He couldn't have destroyed the plates (completely) without destroying the pile, though. How come? If an individual is gone, its particular states are gone, too. Perfect.

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[36] . Link himself does not subscribe to his group theory any longer. Referring to Schwarzschild's work he writes: "Recently, intriguing arguments have been advanced to the effect that there is no need to introduce a new kind of entities over and above the mereological i-sums." Link 1998, p. 174. Link does not discuss the status of collective nouns in this connection, though. Schwarzschild 1996, chapter 9: "In the end we concluded that in a purely extensional theory, collectives and plural individual noun phrases could not be coreferent, however we raised the possibility that this conclusion could be avoided by adopting a non-extensional theory to explain the data." (p. 192.) My proposal above is to avoid that conclusion through a relational theory of collective predicates.

What would a theory based on Link-style groups say about (30)? Here is what I imagine. Our domain of individuals would contain two different objects: those plates, which are the sum of singular plates, and the pile of plates, which is a group, hence an impure atom. **That pile of plates** might be ambiguous. It might denote the sum or the group. Suppose John destroyed the group. What would happen to the sum? And what if he destroyed the sum? What would happen to the group? Could he destroy the mere arrangement by destroying the group? Not if groups are essentially like the corresponding sums, except for their being atoms.[37] Then the groups should be gone whenever the sums are, and the other way round. Suppose John could destroy the arrangement by destroying the group and leaving the sum alone. Then we would have to say something special about why it is that he couldn't destroy the sum and leaving the group alone. Or could he? I have no clue. Things just can't seem to fall in place in any obvious way.

I will have more discussion of group states and substantive pluralities in the following section. For now, let us retain that we need mereology, because we need to be able to merely sum up individuals, actions, states, and other kinds of events. Otherwise, we couldn't account for the merely cumulative readings we have encountered on our way. But we also need to be able to talk about substantive actual groupings of pluralities. Otherwise, we couldn't do justice to collective nouns and the full range of collectivizing adverbs. What we do not seem to need, however, is groups of the kind originally proposed by Link and developed more fully in the work of Landman:

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[37] . Link 1984, 1998 (p. 81).

"I am arguing for a theory that reduces distributivity to semantic plurality. Without groups, cases of distribution to collections are an insurmountable problem for such a theory. These cases require a certain amount of 'grid' that sums alone are not able to provide: i.e. we want to distribute in these cases, but not all the way down to the individuals."[38]

It looks like the part structure of states and events might very well be able to provide the 'grid' that sums of individuals alone are not able to provide.

The connection between substantive pluralities and part structures is a central topic in Moltmann 1997, which surveys a large range of phenomena where substantive pluralities (her 'integrated wholes') play a role, including plural and mass quantification, collective nouns, and collectivizing adverbs. Moltmann abandons standard mereology and develops a new theory of part structures, however. Moltmann's work documents the role of substantive pluralities in the semantics of natural languages and presents novel analyses based on this notion. While following Moltmann in exploiting the notion 'substantive plurality' for the analysis of phenomena involving collectivity, I have raised the possibility that an account of substantive pluralities can be given while maintaining a standard mereological account of pluralities[39]. The only special assumption needed was that there are such things as truly collective eventualities. Among those, I have singled out collective states and actions for further discussion. Collective actions are actions by pluralities that have no subactions by anybody but those very same pluralities. Likewise, collective states have plural possessors who are also the possessors

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[38] . Landman 2000, p. 160.

[39] . I do not mean to suggest that non-mereological part relations have no role in natural language semantics. The situation semantics introduced in Kratzer 1989, for example, has a part relation for situations that cannot be identified with the mereological part relation, nor can the spatio-temporal part relation.

of all of their substates. Pluralities are perceived as integrated wholes, then, because they are the participants in perceptually salient collective states and events.

The individuation of events is known to be a thorny matter. When attorney John Lord O'Brian delivered his closing arguments, was that a speech by him alone or by the defense team that also included his colleague Hollingsworth? The answer depends in part on the facts of the case. Was Hollingsworth present, standing close to O'Brian? Did he help prepare the statement? But even with satisfactory answers to those last two questions, we can't always expect to come up with an obvious answer to the question at the beginning of this paragraph. Was there a single collective speech? A single individual speech? Or were there two speeches, one by an individual, and another one by a team? The last possibility sounds absurd, but remember that when it comes to quantification over events in everyday English, we couldn't have both of those speeches in our quantification domain, even if there were in fact two of them. If O'Brian's speech and the one by the defense team can't both be in one and the same quantification domain (in non-philosophical discourse), it would simply be false for us to claim: **There were two speeches**. There weren't. You can only have one of the two. Which one? Context may settle the question. Or not. There is only so much a context can do for you.

What is it that could prevent O'Brian's speech and the defense team's speech from entering the same quantification domain? One contributing factor is likely to be complete or almost complete overlap in spatio-temporal location. Avoidance of too much spatio-temporal overlap is a known constraint for quantification over locations. Suppose someone claims that there is only one

place in the whole world where you can eat well, and that's the 'Student Prince' (a restaurant in Springfield, Massachusetts). I personally think that claim is true. Yet, strictly speaking, it couldn't possibly be. If you can eat well in the 'Student Prince', you might also eat well in its Heidelberg Room. And you will certainly be able to eat well in Springfield, in Massachusetts, in the United States, and so forth. There is nothing wrong with acknowledging the existence of all of those places. We just can't have all of them in one and the same quantification domain. Likewise, I suggest, there is nothing wrong with assuming the existence of two speeches in our story, as long as we keep them out of the same quantification domain.

Let me summarize where we are in our plot. We have seen that within an event semantics, cumulative verb denotations do not eliminate the difference between distributive and collective predication. They are compatible with a promising semantics for collectivizing adverbs that preserves the spirit of Lasersohn. Most importantly, we can have this without giving up standard mereology. We do not need a new theory of part structures as advocated by Moltmann, nor special breeds of pluralities as advocated by Landman. Standard mereology allows us to make all the necessary distinctions. This is a good result. However, we are not over the hill yet. There are some nasty looking counterexamples for Lasersohn's analysis of collectivizing adverbs that have to be cleared before we can be confident that 'cumulativity from the start' is even a viable option for basic lexical items in natural languages.

4.4 Collective states and covers

This section starts out with a potential counterexample to Lasersohn's semantics of **together** that seems to threaten the whole enterprise of retrieving collective predications that I have been pursuing. I will argue that the counterexample goes away if we assume - as

we did in the previous section - that there are group states satisfying the Single Possessor Constraint. To further boost the case for the group states we are committed to, I will argue that that very commitment also yields an account of cover effects, that is, for the context-dependent groupings of pluralities.

Let us begin with what looks like a very threatening example by Roger Schwarzschild[40]:

(31) **The ax and the box together are light enough to carry**.

Schwarzschild's point is that whenever an ax and a box together are light enough to carry, it follows that the ax and the box alone are light enough to carry, too. Doesn't this go right against (15)? Wouldn't we predict that (31) should be necessarily false?

(15) T(**together**) =
$\lambda R_{<e<st>>}\lambda y_e[R(y)(e) \& plural(y) \& \neg\exists e'\exists z [[e' \leq e \ \& R(z)(e')] \wedge z \neq y]]$

Instead of discussing Schwarzschild's example directly, I will first examine (32), which prepares for Lasersohn's reaction to Schwarzschild's threat:

(32) **Casey and Stacey together fit this ad**.

Suppose the ad is by a theater company that is looking for either a child with red hair and freckles or a pair of children who are twins. Casey and Stacey fit the ad both individually and collectively. They are children with red hair and freckles, and they are twins. We have the following situation:

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40. Schwarzschild 1993-1994, 213.

s_1	State of Casey fitting the ad (red hair & freckles)
s_2	State of Stacey fitting the ad (red hair & freckles)
s_3	State of Casey+Stacey fitting the ad (twins)

Assuming cumulativity for the denotation of **fit** gives us (33):

(33) Extension of '□fit'

{<s_1, Casey, the ad>, <s_2, Stacey, the ad >,
<s_3, Casey+Stacey, the ad >, <s_1+s_2, Casey+Stacey, the ad >,
<s_1+s_3, Casey+Stacey, the ad>, <s_2+s_3, Casey+Stacey, the ad >,
<s_1+s_2+s_3, Casey+Stacey, the ad >, ... }

Now consider the following sentences:

(34) a. **Casey and Stacey together fit this ad**.
b. **Casey and Stacey each fit this ad**.

Both sentences are intuitively true in the situation I set up. But they are also predicted to be true by our analysis of **together**. Since we are dealing with statives, only (15) can be used as a meaning assignment for **together**. The verifying state for 34(a) is Casey and Stacey's fitting the ad in virtue of the group state s_3, then, while the verifying state for 34(b) is Casey and Stacey's fitting the ad in virtue of s_1+s_2. The important observation is that there is no reason to assume that the two ways of fitting the descriptions should correspond to one and the same state. Intuitively, the state of Casey's fitting the ad in virtue of her red hair and freckles, for example, is not part of the group state of Casey+Stacey's fitting the ad in virtue of being twins. (32),

then, is no problem for (15). Lasersohn reacts to Schwarzschild's counterexample (31) in exactly this way in his 1995 book:

"Although it will normally be the case that if there is an eventuality of the axe and the box together being light enough to carry, there will also be an eventuality of the axe being light enough to carry and an eventuality of the box being light enough to carry, I see no reason to assume that these latter eventualities must be parts of the first." [41]

In the conceptual framework of the last section, the assessment is that (31) talks about the existence of a group state - the collective weight of the axe and the box. That state should not be confused with the mereological sum of the two individual weights. The possessors of collective weights are substantive pluralities, most likely occupying adjacent or nearly adjacent spatial regions. The analysis of **together** I have been endorsing predicts that (31) can only come out true if the axe and the box are a substantive plurality. This prediction is confirmed by the following example from Lasersohn 1995:[42]

"…. the ease with which something can be carried depends not just on its weight, but on the ratio of its weight to that of a comparable volume of air (or whatever the surrounding medium may be). For example, an anvil might be too heavy to carry, but the anvil and a helium balloon together could still turn out to be light enough to carry."

With Lasersohn's scenario in mind, look at the following sentences:

(35) a. **The anvil was too heavy to carry**.

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41. Lasersohn 1995, 225.

42. Lasersohn 1995, p. 217, footnote 14.

b. **The anvil and the helium balloon together were too heavy to carry**.

The truth of 35(a) in no way guarantees the truth of 35(b). Given the weight of the anvil, whether or not 35(b) is true depends on the actual arrangement of the anvil and the helium balloon, hence on a substantive grouping of the two.

Here is another example confirming that the likes of (31) are about substantive pluralities. Suppose I am corresponding with some far away stranger on the Internet and take a liking to him. After a while, I ask him what he looks like. Here are two versions of a reply:

(36) I have no idea what YOU look like. But I can tell you for sure that

a. **You and I together are heavy**.
b. **You and I together would be heavy**.

There is something slightly inappropriate about 36(a). The fact that that inappropriateness can be repaired by 36(b) suggests that 36(a) presupposes some substantive actually existing grouping of the two of us, more true togetherness than there was at that point.

Why is it that 36(a) requires a substantive grouping of me and the stranger to be true? Here is an answer. For 36(a) to be true, there must be some state s such that the pair consisting of s and the sum of the stranger and me is in the extension of '□heavy'. There are only two possibilities for this to be so. The pair <s, the stranger+I > might have gotten into the extension of '□heavy' via

cumulation. This is precisely the case excluded by **together**. The pair <s, the stranger+I > must therefore already be in the extension of the uncumulated predicate 'heavy'. It then has to satisfy Landman's Collectivity Criterion, and s must be a collective state, hence a state of a substantive plurality.

Interestingly, a slight change of example yields different judgements - and is expected to. Suppose I revealed to that stranger how much I weigh. He might have replied:

(37) I can now tell you that

a. **You and I together weigh 250 pounds**.

b. **You and I together would weigh 250 pounds**.

This time round, 37(a) is quite appropriate. Unlike 37(b), it doesn't even evoke the possibility of physical togetherness. Why? Look at the logical form of 37(a), where f_{pound} is a measure function defined for states of weight:

(38) $\exists s [\Box\text{weigh}(\text{the stranger+I})(s) \ \& \ f_{pound}(s) = 250 \ \& \ \forall s' \exists x [[s' \leq s \ \& \ \Box\text{weigh}(x)(s') \ \& \ f_{pound}(s') = 250] \rightarrow x = \text{the stranger+I}]]$

Suppose the verifying state for (38) is s. The pair <s, the stranger+I > could now have entered the extension of '$\Box$weigh' via cumulation of our individual weights without running against the demands of **together**. 37(a) doesn't suggest physical togetherness, then, because the participating pluralities could in principle be the result of mechanical cumulation.

We have seen that collective weights must be distinguished from sums of individual weights. In our domain D_s states must be represented so as to let us draw that distinction. We need group states that are not mere sums of individual states. The distinction is a very important one for the semantics of adjectives. Take the reasoning in 39(a):

(39) a. **Each of those 100 plates are light**. **Therefore, those 100 plates are light**.

b. **Those 100 plates are light**.

Is 39(a) intuitively valid? It depends. In a sense it is, in another sense it is not. Is 39(a) predicted to be valid on our analysis? Yes, so it seems. Whenever the first sentence of 39(a) is true, there exists a verifying state for the second sentence. Given the cumulativity of **light**, the sum of the 100 individual states of being light in weight is a state characterized by the AP of 39(b). What about the 'it depends', then? Wouldn't we want to predict <u>that</u> judgement? Shouldn't there be an ambiguity? How can we account for the reading of 39(b) that's behind the intuition that 39(a) is not necessarily valid?

39(b) does not have to be understood as a claim about the existence of a state. We can also use it to refer to a particular state. The 100 plates' collective weight would be a plausible state to refer to. If this is a group state, it might not be in the extension of the AP of 39(b), even if the first part of 39(a) is true and **light** is cumulative.

If adjectives have eventuality arguments that are represented as variables in logical-conceptual representations, those variables do not have to be quantified. They may be left free and would then have to be supplied with a

value by the utterance context. We could have the following kind of logical-conceptual representations, for example:

(40) light(the 100 plates)(s)

The predicate 'light' in (40) expresses a cumulative relation between individuals and states that can be compared to a standard weight. Those states should then themselves be weights. The 'light' relation holds between you and a state s, for example, if s is your weight and s is low on the weight scale[43]. If the variable 's' is left free, contextually plausible values for 's' would be the collective weight of the 100 plates, or else the mereological sum of their individual weights. If the two states are different, the truth of (40) can vary from one context to the next, even if the 100 plates and their individual weights don't change. The 'it depends' judgement for 39(a) is thus explained while sticking to the cumulativity of **light**.

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[43] . The proposal suggests that with adjectives, the eventuality argument can take over the role of what is customarily assumed to be a degree argument, - an extra bonus of having a state argument for adjectives. When a rope is 20 yards long, for example, it is in a state of length that measures 20 yards. That adjectives have eventuality arguments is again in line with James Higginbotham's program that provides eventuality arguments for lexical predicates of all kinds. Higginbotham 1989, 2000. If **light** has an eventuality argument, it does not automatically follow that phrases like **be light** have eventuality arguments, too, an issue that is crucial for making Higginbotham's proposal compatible with Kratzer 1989, 1995. **Be** might be an aspectual operator that quantifies off the eventuality argument of **light**. **Be light**, then, could denote a relation between individuals and times, rather than a relation between individuals and states. This account of the difference between **light** and **be light** would have to be evaluated by looking at the many pertinent facts discussed in Rothstein 1999, 2001. (40) neglects the contribution of **be** so as to avoid complications that are not relevant just now.

That natural languages have demonstrative devices that can refer to events and states in the world and are described by sentences was advocated by John Austin:

".....there must be two sets of conventions:
Descriptive conventions correlating words (=sentences) with the *types* of situation, thing, event, &c., to be found in the world.
Demonstrative conventions correlating the words (=statements) with the historic situations, &c., to be found in the world.
A statement is said to be true when the historic state of affairs to which it is correlated by the demonstrative conventions (the one to which it 'refers') is of the type with which the sentence used in making it is correlated by the descriptive conventions."
J. L. Austin, 1979, 121 f.

Quoting Peter Strawson as saying

"What 'makes the statement' that the cat has mange 'true' is not the cat, but the *condition* of the cat, i.e. the fact that the cat has mange. The only plausible candidate for the position of what (in the world) makes the statement true is the fact it states; but the fact it states is not something in the world."

Austin replies:

"I cannot swallow this because it seems to me quite plain:
(1) that the condition of the cat is a fact;
(2) that the condition of the cat is something-in-the-world - if I understand that expression at all.
How can Strawson have come to say that the condition of the cat is *not* something in the world?"
J. L. Austin, 1979, 156.

Austin's views were taken up in Barwise and Perry's Situation Semantics, and also by Lasersohn.

"The crucial insight needed goes back to Austin. … As Austin put it, a statement is true when the actual situation to which it refers is of the type described by the statement. That is, just as there are conventions about what situations can be used as resource situations, there are also conventions about what situation a person is describing. One can make a false statement by violating these conventions just as surely as one can by using a different statement." Barwise and Perry 1983, 160.

Within an event semantics, eventuality arguments can be the demonstrative devices used by natural languages to make claims about particular states and events in the actual world[44]. Within our present framework, eventuality variables may remain free in logical-conceptual representations and then receive a value from the context of use. Alternatively, we might allow contextual restrictions for the state argument, which could then be existentially quantified at a later point in the derivation. In 39(b), the values of the state variable would be restricted to states corresponding to salient groupings of plates and their sums, and the referential interpretation would come out as a special case.

Roger Schwarzschild has defended the context dependency of talk about the groupings of pluralities in his works, which are not framed within an event semantics. For Schwarzschild, the utterance context partitions the domain of plural individuals into possibly overlapping groups, and plural predication

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44 . I am very open to the possibility that eventuality arguments are also represented in the syntax. In fact, I am pretty convinced that they are. I am just not exploring this issue in this book.

depends on such contextually provided groupings. On the account I am pursuing, substantive groups of individuals are the possessors of a host of group states. If the plates are in a pile, for example, their sum is the possessor of many collective states, including a pile state, a collective weight, a collective height, and what have you. An adjective's state argument is a variable that can refer to those states. (38) is context dependent because there is a state variable whose values can be provided or constrained by context. Salient states of weight are possible values in that particular case. In the absence of other salient acceptable values, the collective weight of the plates or the mereological sum of their individual weights are the two default candidates. Consequently, (40) can have a distributive or a collective interpretation.

Schwarzschild posits a free cover variable as part of logical representations. (41) illustrates one way of executing his proposal:

(41) The plates Distr_C light.

Adapted to a mereological framework, possible values for the cover variable 'C' in (41) would be those subsets of the domain of individuals D_e whose sum is identical to the sum of D_e itself. Those subsets 'cover' D_e, hence are covers of D_e. I am assuming that D_e is closed under sums, and I take that to mean here that any non-empty subset of D_e has a sum in D_e. The generalized distributivity operator Distr in (41) introduces universal quantification over relevant parts of the plates. (41) is then true in a context just in case all parts of the plates that are members of the cover that the context assigns to 'C' are in the extension of **light**. For the purposes of illustrating Schwarzschild's proposal, I take **light** to denote a mere set of individuals, rather than a

relation between individuals and states. Moreover, I am (temporarily) not assuming that the extension of **light** is cumulative. It contains all the things that are light individually or collectively, but excludes all those pluralities that are merely light through cumulation. If the cover assigned to 'C' has only atomic plates in it, we get the distributive reading of (41). If it has the sum of all the plates, but no atomic plates or other sums of plates, the collective reading results.

If the denotation of **light** is cumulative from the start, no distributivity operator is needed to account for the distributive reading of 39(b). That reading is already taken care of by lexical cumulativity, and so is the collective interpretation. Yet there is ambiguity. And there is evidence for the relevance of Schwarzschild's covers for plural predication. If there is no distributivity operator, what is it that could produce cover sensitivity in sentences like 39(b)? Contextual restrictions for eventuality variables are the obvious candidates. Within an event-based framework, the context dependency of Schwarzschild's groupings of plural individuals would boil down to the context dependency brought in by eventuality variables. No special devices would be employed by natural languages to produce grouping effects in plural predications. The possibility that Schwarzschild's cover effects might ultimately come from the vagueness and context dependency of the individuation of states and events was raised by Barry Schein in correspondence with Roger Schwarzschild. Schwarzschild 1996, p. 96 reports the following:

"The following example, based on one from Barry Schein (p.c.), is a particularly surprising case in which a mentioned cover is nevertheless unlikely to produce the relevant reading:

(227) The vegetables, which are the beets and the carrots, weigh 5 lbs.

Even though the partition into beets and carrots is mentioned, Schein would find the intermediate distributive interpretation impossible."

In footnote 27 on the same page, Schwarzschild notes:

"If I understood him correctly, the source of the problem in Schein's view is that explicit mention of a covering is insufficient and what is needed are individuating events."

There are no covers in Schein's own work on plurality, which precedes Schwarzschild's. In their stead we find contextual restrictions for event variables[45]. The impact of event individuation on plural quantification is a topic that Schein has consistently pursued since his 1986 dissertation, a time when events were not yet commonly accepted in semantic theorizing.

To have an illustration for how cover effects reduce to constraints on event quantification, let us look at a slightly more complicated case, one of many very convincing examples that Schwarzschild uses to illustrate the importance of his covers[46]:

"Imagine a situation in which two merchants are attempting to price some vegetables. The vegetables are sitting before the merchants, piled up in several baskets. To determine their price, the vegetables need to be weighed. Unfortunately, our merchants do not have an appropriate scale. Their grey scale is very fine and is meant to weigh only a few vegetables at a time. Their black wholesale scale is coarse, meant to weigh small truckloads. Realizing this, one of the merchants truthfully says: [sentence 42(a) below, A.K.]".

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45 . Schein 1986, 1993.

46 . Schwarzschild 1996, 67.

(42) a. **The vegetables are too heavy for the grey scale and too light for the black scale**.
b. **The vegetables are heavy for the grey scale**.
c. **The vegetables are light for the black scale**.

To make things easier, let us work with 42(b) and (c). On Schwarzschild's scenario, there is a contextually salient cover that groups the vegetables in the same way as they are in fact grouped by the baskets. All vegetables that share a basket are lumped together. On Schwarzschild's account, 42(b) and (c) both quantify over those parts of the vegetables that are in the contextually supplied cover, and that's all basketfuls of vegetables.

Let's play with Schwarzschild's story. Imagine that the merchants have a range of options, as far as baskets go. There are various sizes available, including small crates. Suppose further that the grey scale can handle a bit more than just a few vegetables at a time. Upon discovering that the vegetables were delivered in biggish baskets, one of Schwarzschild's merchants complains:

(43) **I wished the vegetables were light**. (**Then I could weigh them with the grey scale**.)

That merchant isn't necessarily longing for new breeds of vegetables that are lighter in weight. More likely, he would have preferred the vegetables to be arranged differently, in smaller crates, for example. The salient cover in the utterance context is the same we had before. It groups the vegetables in the way they are arranged in the actual world. But by uttering (43), the

merchant in fact requests a grouping of the vegetables that is different from the one in the actual world.

The example shows that in intensional contexts, the grouping involved in plural predication does not have to be the same as any grouping in the actual world. The covers relied on, then, must be capable of changing from one possible world to the next. This kind of phenomenon is familiar from the semantics of modals[47]. Modals depend for their interpretation on a contextually provided set of accessible worlds. But when we look at modals in intensional contexts, we find that the accessible worlds they depend on must be able to change from one world to the next. Consequently, the context must supply an accessibility function, not a mere set of possible worlds. Accessibility functions are functions from possible worlds to sets of accessible worlds. Amending Schwarzschild's account of plural predication, we would want to say that plural predication depends on contextually provided cover functions, not just on contextually provided covers. What are cover functions, then, and how can utterance contexts provide them?

A cover function is a partial function that assigns covers to eligible possible worlds or situations. Just any old covers? No way. We cannot evaluate (42), for example, in a world where the vegetables are <u>actually</u> arranged in baskets, using a cover where the grouping of those very same vegetables mirrors the quantities that would fill a whole silo.

(44) The vegetables Distr_C light.

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47 . Kratzer 1978 has much discussion of this kind of context dependency, and Kratzer 1977 has some. See also Schwarzschild 2000.

The values of cover variables cannot be chosen independently of what is the case in the evaluation world. We are only allowed to consider covers that correspond to existing arrangements in the worlds we are looking at. That constraint also has a parallel in the semantics of modals. An accessibility function for an epistemic modal, say, must assign to any possible world a set of possible worlds that are compatible with what is known in that world. Returning to cover functions, they should be functions that assign to any possible world w in their domain a cover that - as far as our vegetables are concerned - lumps them in a way that matches one of their existing arrangements in w. That means that what a cover function does for our vegetables is pick a salient actual arrangement of them, and link it to existing comparable arrangements in other possible worlds. In our example, a basket arrangement in the actual world might be linked to crate arrangements in other worlds.

The insight we have just gained is that covers (and cover functions) have to respect substantive pluralities in the evaluation worlds. But that means that covers correspond directly to sums of group states in the evaluation worlds, with individuals being special cases of groups. Take the basket arrangement of the vegetables. Each basketful of vegetables is a substantive plurality of vegetables. The vegetables in each basket are the possessors of a wide range of group states. Among those are collective weights. The sum of those collective weights is a state itself, and is moreover a state of the sum of all the vegetables, assuming cumulativity for the possessor relation. Such a sum of group states has all the information of a Schwarzschild cover. Let's look at an illustration. We are still dealing with vegetables and Schwarzschild's

merchant. Suppose we have just three baskets of vegetables, one with eggplants, one with zucchini, and one with carrots:

Basket 1	x = the eggplants in 1	s_1: collective weight of x
Basket 2	y = the zucchini in 2	s_2: collective weight of y
Basket 3	z = the carrots in 3	s_3: collective weight of z

Cover = {a: ∃s [s < $s_1 + s_2 + s_3$ & Possessor(a)(s)] } = {x,y,z}.

The state $s_1 + s_2 + s_3$ is the sum of the three group states s_1, s_2, and s_3. Being group states, they satisfy the Single Possessor Constraint, the analogue of the Single Agent Constraint. As a consequence, any substate of s_1 is a state of x, any substate of s_2 is a state of y, and any substate of s_3 is a state of z. The cover determined by $s_1 + s_2 + s_3$ is thus {x,y,z}, which is what we want. Let us now return to 42(b) and (c) and see what our analysis would say about those examples. Not fussing too much about the exact semantic representation of adjectives (cheating, in fact - are those adjectives really basic predicates?), the logical representations for 42(b) and (c) could be 45(a) and (b) respectively:

(45) a. ∃$\text{heavy}_{\text{grey scale}}$(the vegetables)(s)

b. ∃$\text{light}_{\text{black scale}}$(the vegetables)(s)

45(a) and (b) have free state variables. Given our story, the state $s_1 + s_2 + s_3$ would be a contextually salient value for the free variable 's' in 45(a) and (b). The resulting statements would both be true, assuming cumulativity for both

adjectives, and given that each basketful of vegetables is heavy for the grey scale, and light for the black scale. The facts come out right, then.

Let us now look at the intensional case (43). On the account I am pursuing, the merchant's complaint (43) might have a free state variable that would refer to $s_1 + s_2 + s_3$ in the context of our story. The merchant would then say that he would prefer to live in a world where the pair consisting of the counterpart of the vegetables and the counterpart of $s_1 + s_2 + s_3$ is in the (cumulative) extension of **light**. The intensional context introduces talk about the counterparts of the actual state $s_1 + s_2 + s_3$. However, what would the counterparts of $s_1 + s_2 + s_3$ be in the worlds that correspond to the merchant's wishes? In those worlds, the counterparts of the vegetables are arranged differently, in small crates, for example. The vegetables in each crate would be a substantive plurality of vegetables, and we would have corresponding group states, including collective weights. For our account to go through, the sums of those collective weights would have to be the counterparts of the actual state $s_1 + s_2 + s_3$. This might be stretching the notion of 'counterpart' beyond tolerable boundaries. We would have to accept, for example, that $s_1 + s_2 + s_3$ can have counterparts in worlds in which s_1, s_2, and s_3 themselves do not have any counterparts at all. More plausibly, then, (43) involves radically restricted existential quantification over plural states[48]. Quantification could then be restricted in each possible world to

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[48]. See Schwarzschild 2000 for the use of such radical (singleton) quantifier restrictions for indefinites. If radically restricted existential quantification rather than reference is at work here, we might wonder whether radically restricted existential quantification isn't generally at work when apparently referential expressions occur in the scope of intensional operators. Maybe that's how individuals are identified across possible worlds. Another possibility to be considered is that events might not be particulars at all, but functions that

'analogues' of $s_1 + s_2 + s_3$, that is, sums of collective weights of vegetables in baskets, crates, and other kinds of containers. Neglecting details, we could have the following logical representations[49]:

(46) $\text{Should}_w\ \exists w'\ \exists s\ [C(w')(s) \ \&\ \exists\text{light}_{w'}\ (\text{the vegetables}_{w'})(s)]$

(46) has an existential quantifier over states, which is restricted by the free cover variable 'C'. Plausible values for 'C' in the context of our story are highly specific properties of states that hold of just $s_1 + s_2 + s_3$ in the actual world and of analogous states corresponding to possibly different arrangements of the vegetables in other possible worlds. As expected, overt event quantifiers over states can be restricted in precisely this way, too. The vegetable merchant might have said: "Whenever the vegetables are light, I can weigh them with the grey scale," for example. Or: "Only twice have the vegetables been light so far. Usually, they are too heavy for the grey scale." In all those cases, the states quantified over are sums of collective weights of substantive pluralities of vegetables in the evaluation worlds.

Not everything is left to the vagaries of context when it comes to filling in a value for the free variable 'C' in (46). When we talked about Schwarzschild's covers, we encountered in fact a generalization: The cells of a cover have to correspond to salient substantive pluralities. Here is a rather dramatic example to underline this point. Suppose you and I each have a donkey and a

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map possible worlds to one of their parts. A related notion of events is argued for in David Lewis' paper "Events", in his Philosophical Papers, volume II, chapter 23, p. 241-269.

49. For the purposes of this discussion, we are temporarily switching to an intensional language that has overt quantification over possible worlds. The variables w and w' range over possible worlds.

cat, and these are all the animals we have. It so happens that my donkey looks just like your donkey, and my cat looks just like your cat. In this situation, 47(a) is true, and 47(b) is false. How come?

(47) a. **My animals look just like your animals**.
b. **My animals look very different from your animals**.

Given the facts of the case and cumulativity of the relations 'look like' and 'look different', both 47(a) and (b) should be true. But 47(b) seems false, and the intuition that there is a difference between 47(a) and (b) is very strong. We have:

<u>Look like</u>

My donkey ⟷ Your donkey s_1

My cat ⟷ Your cat s_2

<u>Look different</u>

My donkey ⟷ Your cat s_3

My cat ⟷ Your donkey s_4

It's not that 'look alike' behaves very differently from 'look different' as far as cumulativity is concerned. If my donkey looked different from your donkey, and my cat looked different from your cat, my animals would look different from your animals. It seems, then, that the difference between 47(a) and (b) in the scenario I set up is due to a difference in substantive pluralities. 47(a)

and (b) have radically restricted existential quantification over (or reference to) plural states, and the domain of eligible plural states should not include states like $s_3 + s_4$. The participants in s_3 and s_4 are not substantive pluralities. If we are comparing looks, we have to compare donkeys with donkeys and cats with cats. The substantive pluralities in the situation we are looking at are my donkey + your donkey, and my cat + your cat, but not my donkey + your cat, and your donkey + my cat. Substantive pluralities are parts of natural kinds in this case.

Not surprisingly, grouping effects are well documented with spatial examples. Take Scha's rectangles[50] and 48(a) and (b):

(48) a. **The sides of rectangle A are parallel to the sides of rectangle B**.

b. **The sides of rectangle A are perpendicular to the sides of rectangle B**.

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[50]. Scha 1981, 1984.

Assuming cumulativity of 'parallel to' and 'perpendicular to' and no further constraints, 48(a) and (b) should both be true. Yet only 48(a) is commonly judged true in Scha's scenario. Grouping seems to account for the difference. You are comparing each side of triangle A with the corresponding side of triangle B. Each side of triangle A, then, forms a substantive plurality with the corresponding side of triangle B. No side of triangle A forms a substantive plurality with a non-corresponding side of triangle B.

Relations group individuals. In our earlier example, the 'look alike' relation groups our donkeys together, and our cats. Both of those pluralities are substantive and are parts of natural kinds. In contrast, the 'look different' relation groups my donkey and your cat together, and your donkey and my cat. None of those pluralities is substantive in the absence of context. Quantification over states, then, respects substantive pluralities:

Constraint for quantification over states

Quantification over states is restricted to sums of states whose participants are substantive pluralities.

The constraint covers quantification over singular states or states of singular individuals as well. This is so because singular states are also sums, and singular individuals are always substantive groups. The constraint is likely to be a special case of a more general constraint, but for our present concerns

it will do as is[51]. It amounts to a substantial constraint for quantification over states and does justice to the strength of the intuitions that we have regarding examples like (47) and (48).

Examples (47) and (48) have relational predicates and are thus cases where Schwarzschild would have to posit cover variables whose values are 'paired covers'. Beck 1999, 2001, and 2002 observes that all convincing examples of relational cover effects present us with situations that are made up of salient subsituations[52]. Schwarzschild's own comments on Scha and Stallard's frigates and carriers example (his example (208)) are revealing in this respect[53]:

(208) **The frigates are faster than the carriers**.

"……. We just need to think partitionally. Imagine, for example, that (208) is uttered in a context in which it is clear that these ships are sent out in teams to different areas of the globe with each team consisting of frigates and carriers. It may be that one area calls for very fast action while another will tolerate a sluggish response. If that were the case, I would judge (208) true just in case the frigates in a given area were faster than the carriers of that area, regardless of what speed relations obtained between ships of different areas."

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51 . For a more general discussion of plural quantification, see Schein 1986, 1993, Roberts 1987, 1990 (3.2.4), as well as Schwarzschild's work. Schein very explicitly links quantification over plural individuals to event quantification, an important move.

52 . Beck does not go so far as to eliminate all statements about cover dependence in her logical representations. Her argument only targets the use of Schwarzschild's paired covers. She still uses cover dependent restrictions for the argument variables of verbs that are affected by a cumulation operator.

53 . Schwarzschild 1996, p. 87. Scha and Stallard 1988.

That apparent cover effects are triggered by salient states or events is entirely compatible with a cover approach, of course. Those covers just have to be restricted so as to respect salient states or events. This is one way how context can affect covers. The cover approach is only threatened if we have independent motivation to posit devices that take care of quantification over or reference to salient states and events. Davidsonian event and state variables are such devices. We do not need separate quantification over covers, then.

To summarize this section, we started out with Schwarzschild's apparent counterexample (31) to Lasersohn's analysis of **together**:

(31) **The ax and the box together are light enough to carry**.

I supported Lasersohn and argued that (31) can only be true if the ax and the box are a substantive plurality. (31) must then describe a group state, which has to satisfy the Single Possessor Constraint. To muster additional support for the theoretical importance of the notion of a group state, I ended this section by showing that, given that notion, cover effects in plural quantification can be reduced to constraints on event quantification, as Schein suggested.

4.5 More Schwarzschild vs. Lasersohn

Schwarzschild has also argued that Lasersohn's method of retrieving collective predication within an event semantics fails in cases that have objects with downward entailing quantifiers. While Schwarzschild's arguments do not literally affect Lasersohn's actual analysis, they fully apply to the adaptation of it I have been endorsing. I will argue that

there are independent reasons to assume that the problematic quantifier phrases are not interpreted in the domain of **together**. They are scoped.

All would be well for **together** and cumulative verb denotations, if Schwarzschild 1993-94 hadn't set up what looks like yet another fatal trap for definition (15) and its kin.

(15) T(**together**) =
$\lambda R_{<e<st>>} \lambda y \lambda e[R(y)(e) \& plural(y) \& \forall e' \sqsubseteq z [[e' \leq e \ \& R(z)(e')] \rightarrow z = y]]$

As before, if we lose (15), we lose our method for distinguishing distributive and non-distributive predication, and that puts the whole enterprise of starting out with cumulative verb denotations in jeopardy. Sentence (49) is a sentence of the kind Schwarzschild has drawn attention to:

(49) **The two copy editors together caught fewer than three mistakes**.

In this case, Schwarzschild's objection would go as follows: According to (15) (plus routine interpretation procedures including existential closure of the event argument), (49) says that there was an event e that had the two copy editors as agents, fewer than three mistakes were caught in e, and there was no subevent of e where fewer than 3 mistakes were caught, and whose agent was anybody but the two copy editors. But this is not right. (49) might very well describe an event e that has a subevent in which just one of the copy editors found just one mistake, for example. Such an event e, then, has a

subevent whose agent found less than three mistakes, but who is not identical to the two copy editors. This looks like a deadly blow for (15) [54].

For Schwarzschild's argument to go through, we have to assume that (49) does not necessarily describe collaborative action. If it did, we could dismiss the case right away. (49) would not be a problem for (15), because we are assuming that any true collective action by the two copy editors could only have subactions that are themselves actions by the two copy editors. The following examples confirm that sentences following the model of (49) do not necessarily talk about collective states, actions, or mishaps:

(50) a. **The two real estate agents together own fewer than 10% of all houses in this area**.

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[54] . Schwarzschild's objection does not apply to the original analysis of Lasersohn 1988, 1990, as pointed out in Lasersohn 1995, 1998. Here is what Lasersohn's analysis says about (49), simplifying slightly. (49) is true iff there is an event e, the two copy editors caught fewer than three mistakes in e, and whenever there is a subevent e' of e in which fewer than three mistakes were caught, the ones who caught fewer than three mistakes in e' are the same as the ones who caught fewer than three mistakes in e. Suppose the copy editors were Casey and Stacey, and they caught exactly one mistake each. Casey caught Addition, and Stacey caught Omission. Let e be the minimal event in which Casey and Stacey caught the mistakes they did. (49) is intuitively true in e. Now let e' be the subevent of e that includes Casey's catching Addition, but excludes Stacey's catching Omission. It's true in e', then, that Casey caught fewer than three mistakes. According to Lasersohn, it would also be trivially true that Stacey caught fewer than three mistakes in e', and the same is true for all other individuals in the universe. Consequently those who caught fewer than three mistakes in e' are the same as those who caught fewer than three mistakes in e. This argument assumes a semantics for the quantifier phrase, where the mere fact that Stacey does not exist in e' is

b. **The three cows together produced less than 100 gallons of milk last month**.

c. **Those 50 patients together suffered less than 5 heart attacks last year**.

In 50(a) to (c), all we do is sum up houses owned, milk produced, and heart attacks suffered by the relevant individuals, and count or measure the result[55].

In order to address Schwarzschild's objection, we have to get clear about the interpretation of downward entailing quantifiers. Downward entailing quantifiers are known to require special care in semantic frameworks based on events or situations[56]. Take (51):

(51) **Casey caught fewer than three mistakes** (**yesterday**).

What are the conditions for (51) to be true? The first important observation is that the existence of an event of Casey catching one, two, three, or no mistakes at all isn't sufficient to make (51) true. Even if Casey caught a hundred mistakes, there are still events that are events of Casey catching no

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sufficient for it to be true that she caught fewer than three mistakes in e', an undesirable consequence.

55. 50(c) shows quite clearly that we want the meaning assignment (17') for **together**. We do not want to require that each of the patients contribute a heart attack.

56. Krifka 1989, Kratzer 1989, Bonomi and Casalegno 1993, Schein 1993, Lasersohn 1995, and Landman 1998, 2000.

mistake, one mistake, two mistakes, or three mistakes. To find out whether (51) is true, we have to find out about the total number of mistakes Casey caught. (51) is true just in case that number is less than three. The interpretation of **fewer than three mistakes** in (51), then, depends on the total number of mistakes caught by the agent during a contextually specified reference time. Within the current framework of assumptions, this means that we can't obtain the correct interpretation for (51) if we leave the direct object *in situ*. It would then be interpreted at a stage where the agent argument has not yet been added, hence no information about the total number of mistakes caught by the agent of the action described by the verb is available. We can conclude that **fewer than three mistakes** has to scope beyond the point where the agent argument is introduced. Since we are interested in the number of mistakes caught during a reference time, **fewer than three mistakes** has to end up in a place where the events being described are related to a reference time. This gives us a lowest possible landing site: The specifier position of **Aspect**.

Kratzer 1998 argues that at some point in the hierarchy of inflectional heads, properties of events[57] are mapped into properties of times, and I conjectured that aspectual heads related to viewpoint aspect in the sense of Smith 1991 have the function to carry out this mapping. **Aspect** heads mark a switch of perspective from events to reference times. Perfective aspect, for example, locates events within a reference time. More technically, it maps a property of events P into a property of times that is true of a time t just in case t

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[57] . If the event argument is to receive an indexical interpretation, we could 'pseudo-saturate' the event argument position by applying the operator 'λe [P(e) & e = e_0]' to the relevant predicate of events, rather than applying that predicate to the variable 'e_0'.

includes the running time of a P-event. If i is the type for intervals of time, and τ(e) is the running time of e, we have:

1. T(**[perfective]**) = $\lambda P_{<st>}\lambda t_i \exists e$ [P(e) & τ(e) ⊆ t]
2. T(**1** (**[perfective]** (**Casey** (**[active]** (**caught** $\mathbf{t_1}$))))) =
   $\exists x \lambda t \exists e$ [catch(x)(e) & agent(Casey)(e) & τ(e) ⊆ t]

If downward entailing quantifier phrases are to move to a position beyond **Aspect**, they must be given appropriate denotations. Instead of operating over relations between individuals and events, they should operate over relations between individuals and times. The denotation of **fewer than three mistakes** might be as in (52), then[58]:

(52) T(**fewer than 3 mistakes**) =
$\lambda R_{<e<it>>} \lambda t \exists x$ [[mistakes(x) & R(x)(t)] ⊆ /x/ < 3].

If a quantifier phrase must operate over relations between individuals and times, scoping beyond **Aspect** is forced by its semantic type. Continuing our most recent derivation we end up with the following:

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[58] . Verbs with intensional object positions show that quantifier phrases like **fewer than 3 mistakes** or **less than 10 new winter coats** might require decomposition. See Hackl 2000. **The children need less than 10 new winter coats** is true on the relevant reading, for example, iff for all n such that the children need n-many new winter coats, n < 10. A decomposition analysis is unlikely to affect the essence of the point made in this section.

3. T ((**fewer than 3 mistakes**) (1 ([**perfective**] (**Casey** ([**active**] (**caught** t_1)))))) =
$\lambda t \exists x [\exists e [mistakes(x) \& \tau(x)(e) \& agent(Casey)(e) \& \tau(e) \subseteq t] \& |x| < 3]$.

Applying the property of times we just derived to a reference time (e.g. yesterday), we obtain the correct denotation for sentence (51) from above:

(51) a. **Casey caught fewer than 3 mistakes** (**yesterday**).
b. $\exists x [\exists e [mistakes(x) \& \tau(x)(e) \& agent(Casey)(e) \& \tau(e) \subseteq yesterday] \& |x| < 3]$

(51) says that the total number of mistakes Casey caught yesterday is less than 3, and (52) brings about this result, provided that the object is quantified in right above **Aspect**. Downward entailing quantifier phrases, then, would be forced by their very meaning to a position above **Aspect**. But this means that downward entailing quantifier phrases do not stay within the scope of **together**, - and that's how we can safely get around Schwarzschild's objection. It is crucial to that objection that the downward entailing quantifier phrase be interpreted within the scope of **together**.

The explanation I offered for why downward entailing quantifier phrases have to scope beyond **Aspect** implies that they should have to scope out of any constituent that denotes a property of events. That this might be at least a preference is suggested by the following examples:

(53) a. **The <u>construction of fewer than 10 barns</u> was captured on video**.
Marginal: Fewer than 10 barns were constructed and that was captured on video. Preferred: There were fewer than 10 barns whose construction was captured on video.

b. **We saw <u>fewer than 10 guests leave</u>**.
Marginal: Fewer than 10 guests left and we saw that. Preferred: There were fewer than 10 guests whose departure we saw.

c. **The teacher made <u>fewer than 10 students stand up</u>**.
Marginal: Fewer than 10 students stood up, and the teacher made that happen. Preferred: There were fewer than 10 students that the teacher made stand up.

The underlined expressions in 53(a) to (c) denote properties of events and include a downward-entailing quantifier phrase. In every case, the quantifier phrase prefers to scope out. Narrow scope interpretations are not readily available. Apparently, those quantifier phrases do not like to be interpreted *in situ*.

That downward entailing quantifiers prefer to scope to a higher position can be detected directly in languages where surface order reflects scope relations more directly than is the case in English. The German sentence 54(a) is awkward, for example, since a downward entailing quantifier phrase is trapped within the scope of a manner adverb that selects a property of events.

(54) a. ? **Ich hab' genüsslich weniger als 3 Äpfel gegessen**.
I have with enjoyment less than 3 apples eaten
I ate less than 3 apples with enjoyment.

b. **Ich hab' weniger als 3 Äpfel genüsslich gegessen**.
I have less than 3 apples with enjoyment eaten.
I ate less than 3 apples with enjoyment.

c. **Ich hab' genüsslich 3 Äpfel gegessen**.
I have with enjoyment 3 apples eaten
I ate 3 apples with enjoyment.

If uttered out of the blue, there is clear contrast in acceptability between 54(a) on the one hand, and 54(b) and (c) on the other. In 54(b), the quantifier phrase has scope over the adverb, rather than the other way round. In 54(c), the quantifier phrase is not downward entailing, and is comfortable within the scope of the adverb.

In English, a deviance like the one in 54(a) appears when we prevent a downward entailing quantifier phrase from scoping out of an event nominalization:

(55) ? **John's construction of fewer than 10 barns was captured on video**.

In (55), the genitive within the event nominalization acts as a barrier for movement, and forces the quantifier phrase to stay within the DP. The result sounds awkward. Good, - but why only awkward? Why aren't 54(a) and (55) outright ungrammatical? Why is it that in 53(a) to (c) the quantifier phrase only prefers to scope out? Don't we need a more solid result?

(55) and its kin become acceptable if the right kind of context is created. Suppose John is a participant in a contest where a series of 10 Lego barns have to be constructed within two hours, following specifications that become

increasingly harder with every barn. Few participants manage to build all 10 barns within the two hours allotted to them. John's time was up after barn 8. Talking about that particular event, my uttering (55) would not be awkward. Similar contextual restrictions improve the German sentence 54(a). What is going on?

Since (55) is acceptable in the context I just described, it must be possible for downward entailing quantifier phrases to be interpreted within predicates denoting properties of events after all. In addition to (52), we might have a the meaning assignment in (56).

(56) a. T(**fewer than 10 barns**) =
$\lambda R_{<e<st>>}\lambda e\exists x$ [barns(x) & R(x)(e) & /x/ < 10]

b. T((**construction of** (**fewer than 10 barns**)) =
$\lambda e\exists x$ [[barns(x) & λconstruction(x)(e) & /x/ < 10]

56(a) is the kind of definition that I didn't want to consider earlier. For good reasons. It yields properties of events that are too easy to satisfy. Even if a thousand barns were constructed in all, there are still events in which less than 10 barns were constructed. However, the acceptability of (55) in certain contexts suggests that 56(a) might be available if the context provides the right quantifier restrictions. The scenario I set up for (55) characterized a particular event that was presupposed to be a construction of barns. I used (55) to make a claim about that very event, and informed you that it was one where fewer than 10 barns were constructed in all. Properties of events like 56(b) are only dangerous if the event argument is quantified without further contextual constraints. With strong contextual restrictions, those properties can do no harm. In those cases, then, downward entailing quantifier phrases

might not have to scope out. They, too, might be interpreted within predicates that denote properties of events.

Quantifier interpretations following the model of 56(a) are also needed for the cumulative reading of (57):

(57) (**In this department**), **at most 5 professors are supervising at most 10 dissertations**.

As documented in Schein 1993, the likes of (57) pose considerable challenges to theories of logical form. They are often taken to require the resources of branching or binary quantification[59]. I will not be able to even begin to face the empirical coverage of relevant cases in Schein's work. I have to stick to a few simple examples so as to not lose track of what I am after. What does (57) mean on its cumulative interpretation? On the intended reading, (57) is most natural in a context where ongoing thesis supervisions in a particular department are being discussed. It implies that at most 10 dissertations are being supervised, and that at most 5 professors are supervising dissertations. The two quantifier phrases do not scopally interact. This suggests strongly that they have existential interpretations as in (58):

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59 . Sher 1990, and references cited there. For a different perspective within an event-based semantics, see Landman 2000. Landman aims at a unified account of maximalization claims for both asserted and implicated meaning components, a project that is much more ambitious than the one I am engaged in here. Landman proposes an interpretation system with several new design features affecting the grammar as a whole, which makes it difficult to assess the cost of his analysis in comparison with other approaches.

(58) a. T(**at most 5 professors**) =
$\lambda R_{<e<st>>}\lambda e\exists y$ [professors(y) & R(y)(e) & /y/ ≤ 5]

b. T(**at most 10 dissertations**) =
$\lambda R_{<e<st>>}\lambda e\exists x$ [dissertations(x) & R(x)(e) & /x/ ≤ 10]

c. T (**at most 5 professors supervising at most 10 dissertations**) =
$\lambda e\exists y$ [professors(y) & $\exists$agent(y)(e) & /y/ ≤ 5 &
$\exists x$ [dissertations(x) & $\exists$supervise (x)(e) & /x/ ≤ 10]]

What is still needed for an appropriate logical form of (57) on the intended reading is event quantification without commitment to any actual dissertation supervisions, and the usual provision for contextual restrictions. We should understand (57) as a contextually restricted universal quantification over possibly plural events, then:

(59) $\exists e$ [[C(e) & now $\subseteq \tau$(e) & in(this department)(e)] $\rightarrow \exists y$ [professors(y) & /y/ ≤ 5 & $\exists$agent(y)(e) & $\exists x$ [dissertations(x) & /x/ ≤ 10 & $\exists$supervise(x)(e)]]]

Context would be expected to restrict the event quantifier in (59) to sums of dissertation supervisions, and quantification is then over sums of current dissertation supervisions in this department. Any such sum you may pick (including singular thesis supervisions, of course) has at most 5 supervising professors and at most 10 supervised dissertations. Assuming that those who use (59) intend to say something non-trivial and true, it is easy to fill in the

contextual restriction. The consequent of the conditional has all the information needed.

One way of thinking about (59) is to take it as the formalization of a statement that could be more explicitly expressed by 60(a) or 60(b):

(60) a. **What is going on in this department is that at most 5 professors are supervising at most 10 dissertations**.

b. **All that's happening in this department is that at most 5 professors are supervising at most 10 dissertations**.

If downward entailing quantifier phrases can in principle be interpreted at a stage where the event argument is still available, where does this leave us with respect to Schwarzschild's threat? Doesn't it come to bite us after all? It would, if we found cases where a downward entailing quantifier phrase must stay within the scope of **together**. (61) looks like a relevant example:

(61) **The 5 professors together taught at most 50 students in at most 10 classes**.

(61) only has a cumulative interpretation, which means that there are no scope interactions between **at most 50 students** and **at most 10 classes**. We know that to get that interpretation, we need to interpret those two quantifier phrases before the event argument is quantified off. But then they can't be scoped beyond **Aspect**. Could they still be scoped beyond **together**, though? Before we explore this possibility, it is time to be serious about the syntactic status of **together**. Roger Schwarzschild has shown that preverbal

together is in fact in a DP internal position[60]. Here are some of his examples:

(62) a. **The credit risk and the interest rate together can affect the value of the bond in complicated ways**.

b. **At least ten bullets hit John and Mary together**.

c. **To John and Mary together**, **I bequeath my sterling silverware**.

If preverbal **together** is always in a DP-internal position, it has to modify DPs or NPs. Not just any NP or DP. DP internal **together** can only modify referential DPs:

(63) a. *** At least 2 professors together are currently supervising 10 dissertations**.

b. *** Professors together are currently supervising 10 dissertations**.

c. *** Many professors together are currently supervising 10 dissertations**.

DP-internal **together** could now have the denotation 64(a) or (b), corresponding to (15) and (17') respectively:

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[60]. Schwarzschild 1993-94, p. 244

(64) a. T(**together**) =
$\lambda y \lambda R_{<e<st>>} \lambda e[R(y)(e) \& plural(y) \& \lambda e' \lambda z\ [\ [e' \leq e\ \& R(z)(e')\ ] \rightarrow z = y]\ ]$

b. T(**together**) =
$\lambda y\ \lambda R_{<e<st>>}\ \lambda e[R(y)(e) \& \lambda z\ [\ [z \leq y \& C(z)] \rightarrow \lambda\lambda e'[e' \leq e \& R(z)(e')]\ ]\ ]$

What would a derivation of (61) look like? Let's answer this question for the simpler sentence (65), with the understanding that **at most five students** in (65) is to be given an existential interpretation following the model of (56) or (58):

(65) **The 5 professors together taught at most 50 students**.

The derivation of the Logical Form for (65) is likely to include the following stage:

(66) (**at most 50 students**) (**1** (((**the 5 professors**) **together**) (**[agent] teach** $\mathbf{t_1}$))).

In (66), **at most 50 students** is scoped, but its landing site could still be below **Aspect**, hence the event argument could still available. Even for (65), then, scoping could in principle allow us to derive the intended interpretation:

(65') $\exists$e [[C(e) & τ(e) $\subseteq$ then] $\rightarrow$ $\exists$x [students(x) & /x/ $\leq$ 50 &
$\exists$agent(the 5 professors)(e) & $\exists$supervise(x)(e) &
$\forall$e'$\forall$z [[e' $\leq$ e & $\exists$agent(z)(e') & $\exists$supervise(x)(e')] $\rightarrow$
z = the 5 professors]]]

Context is expected to restrict quantification in (65') to thesis supervisions by those 5 professors.

So far, so good, but <u>is</u> there a stage corresponding to (66) in the derivation of (65)? In (66), the subject is still in the position where it entered the derivation as the argument of **[agent]**. In contrast, the object is caught at a stage where it has moved over the base position of the subject. In much recent syntactic work, objects are assumed to undergo this kind of movement to reach a position where they can check accusative case. The position is an outer specifier position within the **[agent]** projection for some, and in the specifier position of a separate agreement projection for others. As long as the landing site is below **Aspect**, either possibility is compatible with the facts we have seen. Movement of objects is seen overtly in languages with object shift. Research on overt object shift has shown that object shift is only possible for certain types of DPs[61]. In particular, it is never possible for bare plurals or mass nouns. If the interpretation of (65) we are interested in comes about through object shift, that kind of interpretation should not be available for sentences with objects that are known not to undergo that shift[62]. We now have a testable prediction. It is borne out:

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[61] . Diesing & Jelinek 1995, Diesing 1997.

[62] . See Kratzer 1988, 1995 for evidence showing the connection between overt object shift in German and covert object shift in English.

(67) a. **The two real estate agents together own houses in this area**.

b. ? **The three cows together produced milk last month**.

c. ? **Those 50 patients together suffered heart attacks last year**.

67(a) is about collective ownership. 67(b) and (c) sound funny out of the blue. 67(b) might be about a dairy cooperative run by three cows. Or we might think of scenarios where milk production is enhanced by keeping several cows together in the same stall. 67(c) evokes collective suffering of heart attacks. In each case, the plurality denoted by the subject has to be substantive. A mere 'summing up' interpretation of **together** is not available. Why? It is not expected to be available if the direct objects are interpreted *in situ*. The resulting claims would then be contradictions. If we end up with milk when we sum up the milk production of the three cows, it can't be that none of the individual cows produced any at all. The only available ways for 67(a) to (c) to wind up true, then, is if the real estate agents, the cows, and the patients are substantive pluralities engaged in truly collective states and events.

The contrast between 68(a) and (b) makes the same point:

(68) a. ? **Die 3 Kühe zusammen haben keine Milch produziert**.
The 3 cows together have no milk produced
'The 3 cows together produced no milk.'

b. **Die 3 Kühe zusammen haben keinen Tropfen Milch**
The 3 cows together have no drop milk

produziert.
produced.
'The 3 cows together didn't produce a drop of milk.'

The object in 68(a) is a weak negative existential. 68(a) sounds funny, as does its English counterpart. As before, we imagine a cow cooperative, or 3 cows put in the same stall to increase milk production. 68(b) has a strong negative existential. It is fully compatible with a mere 'summing up' interpretation saying that there isn't a single drop of milk that the three cows together produced. That is, the milk production of the three cows didn't add up to a single drop of milk. What we see in 65(a), then, is exactly what we would expect to see in (50) from above if there wasn't the possibility of object shift:

(50) a. **The two real estate agents together own fewer than 10% of all houses in this area**.

b. **The three cows together produced less than 100 gallons of milk last month**.

c. **Those 50 patients together suffered less than 5 heart attacks last year**.

We have found evidence that scoping of the direct object makes it possible for **together** in 50(a) to (c) to have a mere 'summing up' interpretation. If we

block scoping, we see the expected effects, a forced switch to substantive groupings and collective events. In the case of direct objects, the scoping is regular object shift, a movement that all but the weakest objects undergo, most likely for reasons of case. In the case of prepositional phrases, scope shifts are known to be sensitive to the weak-strong distinction as well, but the driving force for their movement is still a matter of debate.

One more time, we have been able to avert a serious threat for Lasersohn's method of retrieving the difference between collective and distributive predication. This time round, I appealed to scoping. We saw interesting new data showing that the scoping I relied on does indeed exist.

4.6 A single source for lexical and phrasal cumulativity?

The preceding sections looked at a series of apparent obstacles to the 'cumulativity from the start' agenda for verbs and thematic role predicates, and got those obstacles out of the way. Not all instances of cumulative readings can be reduced to lexical cumulativity, however. There are irreducibly phrasal cases of cumulativity. Isn't it likely, then, that lexical and phrasal cumulativity have a single source? Whatever that source may be, it seems to

undermine the motivation for having a Cumulativity Universal for basic verbs and thematic role predicates.

That there is no obstacle to assuming cumulative denotations for bare verbs and thematic role predicates doesn't mean that there is strong motivation in favor of such an assumption, of course. Let us briefly remind ourselves why we wanted cumulative denotations in the verbal domain to begin with. We started out with the observation that cumulative denotations for basic verbs and thematic role predicates explain why sentences like (69) can have cumulative readings:

(69) **Ten movers carried 500 boxes**.

On its cumulative interpretation, sentence (69) allows a whole range of relationships between a plurality of 10 movers and a plurality of 500 boxes. Some movers might have jointly carried some of the heavier boxes. Individual movers might have carried more than one of the lighter boxes at a time. Some of the boxes might have been carried more than once by the same movers or by different movers. (69) covers all those scenarios, and the Cumulativity Universal tells us why.

While the existence of cumulative readings for sentences like (69) indicates that verbal projections are pluralized at some point, we can't quite conclude yet that data of this sort show that basic verbs and thematic role predicates are obligatorily pluralized from the very start. Pluralization of those predicates could still come about in a number of ways. Several authors, most

prominently Wolfgang Sternefeld, Uli Sauerland, and Sigrid Beck[63], have argued that the denotations of verbs do not have to start out cumulative, but can be rendered cumulative through the optional presence of syntactically represented *-operators which map properties and relations into their smallest cumulative extensions and can be inserted freely. Those operators seem to be independently needed. The vast literature on plurals and distributivity has documented beyond any doubt that lexical cumulativity alone cannot account for all cases of cumulativity there are. Let us look at some representative examples of non-lexical cumulativity:

(70) a. **The women from Boxborough brought a salad**.
(Roberts, 1990, p. 102, 146)

b. **The boys gave the girls a flower**.
(Winter 2000, p. 39)

c. **John and Mary made less than $10,000 last year**.
(Lasersohn 1990, p. 32)

d. **John and Mary made more than $10,000 last year**.
(Lasersohn 1990, p. 32)

70(a) has an interpretation where each of the women from Boxborough brought a salad. For 70(b), Yoad Winter designed the following scenario: There were two boys, John and Bill, and four girls, Mary, Sue, Ann, and Ruth. John met Mary and Sue and gave them a flower. Bill met Ann and

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63 . Sternefeld 1998, Sauerland 1998, Beck 2000, Beck and Sauerland 2000, Beck 2001.

Ruth and gave them a flower. 70(b) is true in this case. As for 70(c) and (d), Peter Lasersohn observes that they could both be simultaneously true in a situation where John and Mary each made $6,000 last year, pointing to an ambiguity. 70(c) would be true, since John and Mary each made less than $10,000. And 70(d) would be true, since the combined income of John and Mary was more than $10,000. Those facts cannot be accommodated in a theory that only has lexical cumulativity. Anybody who subscribes to the Cumulativity Universal, then, has to come up with a convincing source for the many instances of non-lexical cumulativity. Optional *-operators would automatically cover both lexical and phrasal cumulativity. They are very serious threats to our Cumulativity Universal, then. They knock the wind right out of it. There would no longer be any need for such a universal.

"A final issue we would like to address is that of lexical predicates. Once we have the □□-operator [a □-operator mapping binary relations into their smallest cumulative extension, A.K.] at our disposal, this operator can be held responsible for cumulative readings with lexical predicates, too. We have throughout the paper kept open the possibility that there is an independent mechanism that cumulates lexical predicates (the meaning postulates approach from Scha); this was done for the purpose of establishing the need for □□ independently of assumptions about lexical predicates. Given our theoretical conclusions, however, we see no need to keep an independent lexical mechanism, and we suggest to use □□ on lexical relations instead." Beck and Sauerland 2000, p. 370.

Beck and Sauerland are not working within an event semantics, hence cannot rely on the event-based characterization of collective action that Lasersohn's work has made possible. The difference between the collective and the distributive reading of 70(a), for example, is now attributed to an option for the VP denotation, which could be 71(b) or (c):

(71) a. **Casey and Stacey lifted the piano**.

b. *x[lifted(the piano)(x)]

c. **x[lifted(the piano)(x)]

71(b) has the uncumulated VP denotation, 71(c) the cumulated one. The underlying assumption is that the uncumulated predicate 71(b) can be true of singularities and pluralities, but if it is true of pluralities, those pluralities have to be collective agents[64]. Using 71(b) for the interpretation of the VP in 71(a), then, gives us the collective action reading. If we use 71(c), the resulting reading is compatible with collective or distributive action. Given that the two readings posited are not logically independent, we might wonder why we need the uncumulated V and VP denotations to begin with. We have learned from Lasersohn's work that the real test cases for accounts of the distinction between collective and distributive action come from the family of closely related collectivizing adverbs. But here, event-based accounts are called for independently[65]. It's at least not necessary, then, to account for the ambiguity of 71(a) via absence versus presence of cumulation.

A serious problem for optional *-operators is that we miss generalizations about cumulative inference. The following inference is clearly valid, for example:

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64 . The Singularity Constraint of Landman 1996, 2000 has to be satisfied.

65 . Schwarzschild 1993-94 has an ingenious, non-event-based, account of at least the 'non-distributivity' reading of **together**. See Lasersohn 1995, chapter 11.5 and Schwarzschild 1996, chapter 10.3.1 for challenges and commentary.

Cumulativity Inference

Casey is sleeping happily.
Stacey is sleeping happily.

Casey and Stacey are sleeping happily.

There is no reading of the conclusion of the Cumulativity Inference where the inference does not go through. Yet if **are sleeping happily** could optionally have a non-cumulative denotation, there should be a reading where the Cumulativity Inference is not valid. Generalizations like these were a crucial force behind Landman's reduction of distributivity to pluralization, where pluralization was now uniformly accounted for by cumulation[66]. The same generalization also led to Schwarzschild's assumption that all plural VPs are obligatorily translated with the *-operator, hence always have cumulative denotations[67].

"My star, by contrast, appears on the translations of *all* plural verb phrases. I also differ here from Landman (1989), who optionally translates plural verb phrases with a star. My star is obligatory: it is there whenever the verb is plural."
Schwarzschild 1993-94, p. 206

66. Landman 1989. For a current perspective, see Landman 2000.

67. Schwarzschild 1993-94

Linking cumulativity to verbal plural agreement morphology is not an option, of course, for those who maintain that the collective readings of sentences like 71(a) must come from uncumulated VP denotations. We would then be pushed to deny any connection between verbal plural agreement morphology and cumulation. Within an event-based semantics, linking verbal plural agreement morphology and cumulation becomes an option again. Verbal plural agreement morphology could then reemerge as a source of cumulativity. It could in principle be the source of the phrasal cumulativity we see in 70(a) to (d).

Before attempting to derive the cumulative readings of 70(a) to (d) from cumulation operators linked to verbal plural agreement morphology, we have to remind ourselves that up to now, we haven't yet seen any direct argument in favor of lexical cumulativity of basic verbs and thematic role predicates. We have eliminated obstacle after obstacle, but so far, direct evidence for initial cumulativity of basic verbs and thematic role predicates is still missing. Given our concerns in this chapter, we urgently need proof that basic verbs and thematic role predicates are indeed cumulative all by themselves, that is, independently of overt or non-overt verbal plural agreement morphology. The following section will give us that piece.

4.7 Direct evidence for initial cumulativity

This section presents direct evidence for Lexical Cumulativity of verbs. Lexical cumulativity makes it possible for verbs to have iterative interpretations without the help of operators or plural agreement morphology linked to plural verb arguments. If we combine such iterative verbs with a singular indefinite, we should observe a 'failure of distributivity' effect. Interestingly, this is exactly what we find. We will also see that the possibility of initial event iterativity solves an old scope puzzle in connection with durational adverbials that was recently discussed in van Geenhoven 2000 and Zucchi and White 2001.

If verbs are cumulative from the very start, they can describe iterated events without the help of operators bringing about that iterativity or plural agreement morphology linked to plural verb arguments. Look at the following examples, which all have singular indefinite objects and describe iterated events:

(72) What does this intern do?

a. **She guards a parking lot**.

b. **He cooks for an elderly lady**.

c. **She waters a garden**.

d. **He watches a baby**.

e. **She cleans an office building**.

(73) a. **I dialed a wrong phone number for 5 minutes**[68].

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[68] . Examples like these are discussed in van Geenhoven 2000 and in Zucchi and White 2001. Van Geenhoven proposes lexical decomposition of **dial** into a frequentativity operator and an abstract remnant predicate 'dial'. The singular direct object **a wrong phone number** would then be given automatic wide scope over the frequentativity operator unless the verb is semantically incorporating in the sense of van Geenhoven 1998, hence has an object position of a property type. Van Geenhoven makes a difference between 'non-stop' and

b. **She bounced a ball for 20 minutes**.
c. **He kicked a wall for a couple of hours**.
d. **She opened and closed a drawer for half an hour**.
e. **I ran up and down a hill for half a day**.

What is remarkable about those sentences is that the singular indefinite objects invariably fail 'to distribute'[69]. They look as if they were taking wide scope over an event quantifier: A single parking lot is guarded habitually, a single elderly lady is cooked for repeatedly, a single ball is bounced again and again, and so on. What is it that produces this apparent wide-scope effect? The phenomenon is an automatic consequence of the Lexical Cumulativity hypothesis. It shouldn't exist if we allowed free optional insertion of unpronounced star operators. Nor if plural verbal agreement morphology was the only source of cumulativity. That last possibility is immediately ruled out by the fact that all subjects and objects in (72) and (73) are singular. As for freely inserted star operators, they could immediately

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'again and again' frequentativity and posits three different realizations of frequentativity in the decomposition of verbs. I suspect that within an event semantics, initial cumulativity might cover all of those different cases. I also conjecture that van Geenhoven's incorporating verbs might be related to the kind denoting direct objects discussed in the next footnote.

[69] . Apparent exceptions are **she drives a Ford** or **he wears a suit**. The verbs **drive** and **wear** can readily take kind denoting objects, however. Compare **would she drive this car?** or **would he wear this suit?** with **would he travel with this lady?** or **would she take care of this garden?**. In the first two cases, the demonstratives can refer to a kind, in the other two cases they can't. If **a Ford** can be used to introduce existential quantification over kinds, multiple events of driving a Ford can involve different cars, while still involving the same kind.

produce 74(b) from 74(a), for example, hence derive unattested readings for the sentences in (72) and (73)[70]:

(74) a. $\exists e \exists x$ [ball(x) & $*$bounce(x)(e)]

b. $* \exists e \exists x$ [ball(x) & $*$bounce(x)(e)]

74(b) describes possibly repeated events in which more than a single ball might be bounced. In contrast, given the singularity of 'ball', each event described by 74(a) can only have a single ball in it. The facts in (72) and (73), then, do indeed fall out from Lexical Cumulativity. No scoping has to be stipulated. To see this more clearly look at the computation of the denotation of the VP in (75):

(75) [**bounce a ball**]$_{VP}$.

(76) a. $\exists x \exists e$ $*$bounce(x)(e)

b. $\exists R_{<e<st>>} \exists e \exists x$ [ball(x) & R(x)(e)]

c. $\exists e \exists x$ [ball (x) & $*$bounce (x)(e)]

'being a possibly plural event e such that there is a ball x and e is an event of bouncing x'.

In a Davidsonian event semantics, events are 'minimal' in the sense that an event of bouncing this ball, for example, is an event in which this ball is being bounced and which contains nothing above and beyond that ball and whatever it takes to bounce it. Crucially, it can't have a second ball in it. Assuming lexical cumulativity, the relation 76(a) is cumulative. As a result,

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70 . To emphasize lexical cumulativity for 'bounce', I used the $*$-operator here, which is in principle superfluous, since we are assuming that <u>all</u> basic lexical items are cumulative.

the property 76(c) can describe an iterated event made up of events which themselves have the property 76(c). However, whenever 76(c) is true of an event e and a subevent e' of e, the ball in e' is bound to be the same as the ball in e. Otherwise, e would have two balls, rather than one. Each event in the iteration, then, has the same ball in it.

To summarize, we have found a non-trivial consequence of the Lexical Cumulativity hypothesis. Assuming Lexical Cumulativity, iterativity is possible from the very start, and iterativity without concurrent 'object distributivity' is the automatic result of introducing an ordinary singular indefinite in the early stages of a syntactic derivation. That the phenomenon illustrated in (72) and (73) does indeed affect ordinary, non-specific, indefinites in low positions can be shown by looking at comparable constructions in German:

(77) a. **Ich hab' 10 Minuten lang einen Hasen gestreichelt**.
I have 10 minutes long a rabbit petted.
I petted a rabbit for 10 minutes.

b. **Ich hab' einen Hasen 10 Minuten (lang) gestreichelt**.
I have some / one rabbit 10 minutes (long) petted.
I petted some /one rabbit for 10 minutes.

(78) a. * **Ich hab' 10 Minuten lang manche Hasen gestreichelt**.
I have 10 minutes long SOME rabbits petted.
I petted SOME rabbits for 10 minutes.

b. **Ich hab' manche Hasen 10 Minuten (lang) gestreichelt**.
I have SOME rabbits 10 minutes (long) petted.
I petted SOME rabbits for 10 minutes.

In 77(a) the indefinite DP is within the scope of the durational modifier, hence low. It is then typically pronounced with a pitch accent on **Hasen**, and there is no presupposition that rabbits have been talked about in the previous discourse. However, 77(a) still implies that there was a single rabbit that I petted for 10 minutes, just like it's English translation and 77(b). In 77(b), the indefinite DP is outside the scope of the durational adverbial. It is typically pronounced with a pitch accent on the determiner, and then presupposes that rabbits have been under discussion. 78(a) and (b) have the specific indefinite determiner **manche**. DPs headed by **manche** are plain ungrammatical in the scope of a durational adverbial. The apparent 'wide scope' behavior in iterative constructions, then, affects non-specific indefinites sitting in low positions within the VP[71]. This gives further support to the hypothesis that the apparent 'wide scope' effects in (72) and (73) are an automatic consequence of a singular existential combining with a cumulative relation between individuals and events.

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[71] . All complex quantifier phrases are awkward in the scope of durational adverbials, e.g. **höchstens zwei Hasen** ('at most two rabbits'), **weniger als 5 Hasen** ('less than 5 rabbits'). This is expected, given the discussion in 4.5. Interestingly, the preferred reading of the sentence **The construction of some barns took longer than 5 months** has wide scope for **some barns**, in particular when **some** is emphasized, suggesting that **some barns** prefers not to be interpreted within a predicate denoting properties of events. To see the difference between **a barn** and **some barns**, compare **we vetoed the construction of a barn** and **we vetoed the construction of some barns**. Given those facts, the apparent wide scope effects with singular indefinites in (72) and (73) should not be attributed to the same source as the true wide scope effects with DPs headed by **some**. See Zucchi and White 2001 for extensive discussion of those issues, but a different conclusion.

Starting out with cumulative verb denotations also opens up exciting possibilities for the interpretation of adverbs of duration. We can now posit the following denotation of **for 20 minutes**, for example[72]:

(79) T(**for twenty minutes**) =
$\lambda P \lambda e [P(e) \& f_{minute}(e) = 20 \& e = \sigma e'[e' < e \& P(e')]]$

To see what this meaning assignment does, take the VP **bounce a ball for 20 minutes**. Using (79), that VP is true of e just in case e is an event of bouncing a ball, lasts 20 minutes, and is made up of proper subevents that are themselves events of bouncing a ball. Since e has just one ball, all its subevents must have the same ball. Ergo, one and the same ball is being bounced for twenty minutes. Compare this to the result for the VP **bounce balls for 20 minutes**. We now have events of bouncing balls that last 20 minutes and are made up of proper subevents of bouncing balls. Different balls can be bounced in such events. Finally, look at **eat a bagel for 20 minutes**. This VP is true of an event e just in case e is a completed event of eating a bagel, lasts 20 minutes, and is made up of proper subevents that are themselves completed events of eating a bagel. Since e has just one bagel, it's a completed event of eating that bagel, and our definition now requires that it be made up of proper subevents that are themselves completed events of eating that very same bagel. Looks pretty impossible to me. Similar

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[72] . The definition uses Link's σ-operator. In our case, the operator maps the events in the set {e': e' < e & P(e')} to their supremum. We are talking about the sum of all events e' that are proper parts of e and have the property P. The requirement is that that sum be identical to e.

impossibilities are derived for **eat 2**, **3**, **4**, …..**bagels for 20 minutes**, **eat this bagel for 20 minutes**, and **eat the bagel for 20 minutes**.

I have used a measure function in (79), as does Manfred Krifka in his work. What exactly does this measure function measure? What should it measure? Here are some examples:

(80) a. **I worked in your garden for 7 hours**.
b. **We climbed Mount Monadnock for 10 years**.
c. **I have been sick for the last two days**.

Suppose you pay me by the hour for working in your garden. I could then utter 80(a) when I demand my pay. In this case, the measure function measures the times of my working in your garden in hours, and adds up the numbers. If I worked in your garden for one hour for seven days, the result is 7. That's not the kind of measuring that should be done in 80(b). Here we are looking at the times of our climbs of Mount Monadnock, and we measure the smallest interval that contains all of them. 80(b) would be true, for example, if we started a habit of climbing Mount Monadnock in 1990 and continued it until the year 2000. Both 80(a) and 80(b) have both of those readings, of course, it's just that the reading I illustrated for 80(a) is rather implausible for 80(b). (80) can be used to generate both readings depending on what measure function you fill in. In 80(c), the temporal expression **the last two days** denotes a particular interval of time, and in this case, the requirement is that the time of my sickness include that interval. A slight variation of (80) will accommodate that case, too.

Assuming Lexical Cumulativity for verbs, then, we gain an insightful account of durative adverbials, without giving any thought to principles of aspectual composition or the algebraic properties of VPs. The facts fall out on their own. The well-known constraints on combining durative adverbials with different kinds of VPs follow compositionally from the meanings of the participating parties. In that sense, (80) preserves the spirit of the pioneering analysis of Dowty 1979 and the related account of Moltmann 1991, but without the scope problems brought in by letting durational adverbials introduce universal quantification over events or times. If durational adverbials introduced a universal quantifier over events or times, the indefinites in (73) should be able to take narrow scope with respect to that quantifier. But we have seen that that narrow scope reading is absent. If we have cumulativity from the start, we can have iterated events from the start, and we do not need any operator to give us that iteration.

We can now be fairly confident that there is Lexical Cumulativity in the verbal domain. Basic verbs and thematic role predicates are obligatorily cumulative from the very start. We were able to detect that cumulativity in the absence of any plural subjects or objects. Our next task is to identify a plausible source for the many cases of non-lexical cumulativity. What we are looking for, then, is a 'Lexical Cumulativity Plus' theory. The overall plausibility of our approach to cumulativity will depend on how well the 'Plus' part can be motivated.

4.8 In search of a Lexical Cumulativity Plus theory

After having presented direct evidence for lexical cumulativity of basic verbs, we have to identify possible sources for phrasal cumulativity. We need a Lexical Cumulativity Plus theory, then, where lexical and phrasal cumulativity have different sources. In this section,

an event-based modification of Winter's highly constrained Lexical Cumulativity Plus theory (Winter 2000) is defended against apparent counterexamples.

A promising Lexical Cumulativity Plus proposal is defended in Winter 1998, 2000. Winter argues for two sources of real or apparent non-lexical cumulativity. The first one is linked to the phenomenon of dependent definites. Winter asks us to consider sentence (82) in the context of (81)[73]:

(81) At a shooting range, each soldier was assigned a different target and had to shoot at it. At the end of the shooting we discovered that

(82) **Every soldier hit the target**.

In the context of (81), (82) is most likely to be understood as reporting that every soldier hit the target assigned to him. To assure this interpretation, we might posit a contextually salient function f that maps each soldier to the target he was assigned. (82) can then be given the interpretation in (83):

(83) $\forall x[soldier(x) \rightarrow hit(f(x))(x)]$.

Within an event semantics, **every soldier** could be combined with a verbal projection denoting a relation between individuals and events, and would then most naturally be understood as saying that for every soldier x, there was an event e and x hit the unique target in e. This would allow the targets to vary for the different soldiers in cases like (82), but would all by itself not necessarily deliver the right result. Suppose Winter's soldiers were a rather

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[73] . Winter 2000, p. 36.

unskilled bunch. They each hit a target, but it wasn't the one assigned to them. In this situation, (82) is intuitively false. Yet it's true that for every soldier x there was an event e and x hit the unique target in e. I conclude that there are such things as dependent definites, and that we need some device that takes care of them.

The second component of Winter's Lexical Cumulativity Plus account is a unary, atomic, D(istributivity)- operator of the kind found in the work of Link, Roberts, and Dowty[74]. This operator has the following denotation:

(84) $\lambda P_{<et>}\lambda x\lambda y$ [[atom(y) & $y \leq x$] $\rightarrow$ P(y)].

Within our event semantics, we have to think about where D-operators could be introduced in the course of a syntactic derivation. If they are optional and there are no particular constraints, we have to be prepared for the possibility that they might appear at a point where the event argument is not yet quantified or saturated. As a consequence, there should be a binary D-operator that operates over relations between individuals and events. A first approximation is (85):

(85) $\lambda R_{<e<et>>}\lambda x\lambda e\lambda y$ [[atom(y) & $y \leq x$] $\rightarrow$ $\exists e'$ [$e' \leq e$ & R(y)(e')]].

The operator in (85) is still faithful to the spirit of Winter, since it 'affects' a single non-event argument at a time. It is furthermore an atomic D-operator, that is, it quantifies over the atomic parts of pluralities, hence contrasts with

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[74] . Link 1991. Roberts 1987, 1990. Dowty 1987.

Schwarzschild's generalized distributivity operator, which can quantify over subpluralities if they are members of a salient cover.

Together, the D-operator and whatever device is needed for dependent definites account for 70(a) to (d), repeated from above:

(70) a. **The women from Boxborough brought a salad**.
(Roberts, 1990, p. 102, 146)

b. **The boys gave the girls a flower**.
(Winter 2000, p. 39)

c. **John and Mary made less than $10,000 last year**.
(Lasersohn 1990, p. 32)

d. **John and Mary made more than $10,000 last year**.
(Lasersohn 1990, p. 32)

On their distributive readings, 70(a), (c) and (d) have silent D-operators. The fact that 70(c) and (d) can both be true on Lasersohn's scenario is explained by assuming that D-operators are optional, hence create ambiguities. If John and Mary each made $6,000 last year, then 70(c) comes out true if there is a D-operator, and 70(d) comes out false if there isn't. 70(b) illustrates the need to pay attention to dependent definites. With Lexical Cumulativity alone, we only get a single reading for 70(b), the one where there is a single flower that the sum of the boys gave to the sum of the girls. Adding the possibility of silent D-operators produces three more readings, assuming the possibility of

movement of DPs of all kinds in the Logical Form branch of the derivation[75]: Each of the boys might have given the sum of the girls a flower, each of the girls might have received a flower from the sum of the boys, and each of the boys might have given each of the girls a flower. Winter's scenario is not yet covered by any of those readings. Treating **the girls** as a dependent definite gets that case, too. 70(b) could then be read as saying that each of the boys gave the sum of the girls he met a flower, or that each of the boys gave each of the girls he met a flower.

A theory like Winter's is an attractive, interestingly constrained, version of a Lexical Cumulativity Plus theory. Unfortunately, it has not remained unchallenged. While there seems to be a consensus that there is a phenomenon of 'dependent definites', it is far less clear how much that phenomenon buys us in the way of explaining away apparent cumulative readings. Beck and Sauerland 2000 mention the following example[76]:

(86) **These five teachers gave a bad mark to those 20 protesting students**.

(86) has a cumulative reading. It can be true in a situation where each of the students got a bad mark from only one of the teachers. The cumulative reading of (86) cannot be reduced to a 'dependent definite' effect. Both DPs in (86) are indexicals with numerals, hence tolerate no further restrictions.

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75. Heim and Kratzer 1997. Winter 2000 considers the possibility of a D-operator that can directly operate over plural individuals: $\lambda x_e \lambda P_{<et>} \lambda y_e$ [[atom(y) & $y \leq x$] $\rightarrow$ P(y)]. See Schwarzschild 1993-94 for discussion of this option.

76. Beck and Sauerland 2000, p. 356.

Beck and Sauerland's point is that if a dependent definite analysis is not available for (86), its intended reading can only be derived by using a polyadic distributivity operator. In this case, we would need an operator that takes the relation $\lambda x \lambda y \exists z$ [bad-mark(z) & gave-to(y)(z)(x)] as its argument and simultaneously 'distributes over' both the subject and the indirect object argument as in (87), for example:

(87) $D_2 = \lambda R_{<e<et>>} \lambda x \lambda y$ [$\forall$ x' [[atom(x') & x' $\leq$ x] $\rightarrow$ $\exists$y' [y' $\leq$ y & R(x')(y')]] & $\forall$y'[[atom(y') & y' $\leq$ y] $\rightarrow$ $\exists$x' [x' $\leq$ x & R(x')(y')]]].

In our event-based semantics, the intended reading can still be derived within the limits of Winter's theory. (87) can be analyzed as a Schein sentence with neo-Davidsonian association of the agent argument. The indirect object would be moved out of its VP, and the resulting predicate could be pluralized with just the simple D-operator. We have:

1. T(**gave a bad mark to**) = $\lambda y \lambda e \exists z$ [bad-mark(z) & τgave-to(y)(z)(e)]
2. T(D (**gave a bad mark to**)) =
   $\lambda x \lambda e \lambda y$ [[atom(y) & y $\leq$ x] $\rightarrow$ $\exists$e' [e' $\leq$ e & $\exists z$ [bad-mark(z) & τgave-to(y)(z)(e')]]]
3. T((D (**gave a bad mark to**)) **those 20 students**) =
   $\lambda e \lambda y$ [[atom(y) & y $\leq$ those 20 students] $\rightarrow$ $\exists$e' [e' $\leq$ e & $\exists z$ [bad-mark(z) & τgave-to(y)(z)(e')]]]

The property of events we just computed is not quite the one we want, but all that is needed is to 'size it down' to one that can't be true of events that do not contain parts that have nothing to do with giving a bad mark to those 20

students. We can do so by amending the definition for the D-operator as follows, using Link's *-operator[77]:

(88) $\lambda R \lambda x \lambda e$ [$\exists y$ [[atom(y) & $y \leq x$] $\wedge$ $*\lambda e'$ [$e' \leq e$ & R(y)(e')]] &
$e = *\lambda e' \exists y$ [atom(y) & $y \leq x$ & $e' \leq e$ & R(y)(e')]].

If used in the derivation of the meaning of (86), (88) requires that the event under discussion be made up of subevents of giving a bad mark to one of those students. After making the necessary adjustments in step 3 of the computation above, we add the agent argument, as usual. The predicted interpretation says that these five teachers are the agents of a minimal event in which those 20 students were each given a bad mark. This allows for the possibility that each of the students received a bad mark from only one of the teachers.

As another challenge for Winter, Beck and Sauerland 2000 present (82), which also doesn't submit to a dependent definite analysis:

(89) **The two women wanted to marry the two men**.

The reading of (89) that we are interested in is true in a situation where each of the two women wants to marry one of the two men. According to Beck and

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[77] . In our case, the *-operator maps the events in the set {e': $\exists y$ [atom(y) & $y \leq x$ & $e' \leq e$ & R(y)(e')] } to their supremum. We are talking about the sum of all subevents of e that are events of giving a bad mark to one of those students. This sum is required to be identical to e itself. But then e is made up of subevents that are all events of giving a bad mark to one of those students.

Sauerland, the intended reading of (89), too, has to be derived by applying a polyadic distributivity operator to a non-lexical relation, in this case the relation $\lambda x \lambda y$ [y wants to marry x]. However, in an event semantics, the cumulative reading of (89) can again be accounted for within Winter's constraints, making certain natural assumptions.

Suppose the infinitival complement in (89) expresses a property of individuals, as many have argued[78]. Within the current framework, **want** should then denote a relation between properties of individuals and states. The relation holds between a property P and a state s just in case s is a wish with content P. That a property P is the content of the wish s means that s is only fulfilled in worlds in which the possessor of s has P.

Assuming lexical cumulativity, the 'want'- relation has to be cumulative:

(90) $\lambda P_{<et>} \lambda Q_{<et>} \lambda s \lambda s'$ [[λwant(P)(s) & λwant(Q)(s)] $\rightarrow$ [λwant(P+Q)(s+s')]]

We now have to think about the sum operation for properties. Most plausibly, it should amount to non-Boolean predicate conjunction, an operation argued for in Link 1984 and Lasersohn 1992[79].

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[78] . This doesn't necessarily mean that there is no **PRO** subject for **marry**. Heim & Kratzer 1998 have proposed that **PRO** is invisible to the semantic interpretation component, but visible to the syntax, which means that it can be displaced, leaving a trace. The result could be LFs like [**PRO**$_1$ [t_1 **love himself**$_1$], for example, which are interpreted as λx [x love x], treating the index on **PRO** as a binder (neglecting events).

[79] . See also Lasersohn 1995.

(91) $\lambda P_{<et>}\lambda Q_{<et>}$ [P+Q = $\lambda x\exists y\exists z$[x = y+z & P(y) & Q(z)]]

(91) is motivated by the conjunctions in (92):

(92) a. **Yoyo and Beverly are a cat and a rabbit**[80].

b. **Der Schreibtisch war aus Holz und Metall**.
The desk was of wood and metal
The desk was made of wood and metal.

92(a) is true just in case one of Yoyo and Beverly is a cat, and the other one a rabbit. 92(b) is true just in case some of the desk is made of wood, and the rest is plastic.

Returning to (89), (89) is a statement about the marriage wishes of the two women. Suppose the wish of the first woman is a wish to marry Willie Brigham. This is a wish whose content is the property P of marrying Willie Brigham. Now take the wish of the second woman and assume that it is a wish to marry Spencer Hubbard. That wish is a wish whose content is the property Q of marrying Spencer Hubbard. The content of a wish states a necessary condition for the possible worlds in which it is fulfilled. The wish s_1, for example, is only fulfilled in worlds in which the possessor of the wish marries Willie Brigham. And the wish s_2 is only fulfilled in worlds in which the possessor' of s_2 marries Spencer Hubbard. The state s_1+s_2, then, is a plural wish whose content is P+Q. In our case, P+Q is computed as follows, switching to an intensional framework that has quantification over possible worlds, but still neglecting time for convenience:

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80. I am assuming that in their predicative uses, **a cat** and **a rabbit** denote properties of individuals.

(93) a. $P = \lambda y \lambda w \exists e [*marry_w(Willie\ Brigham)(e) \& *agent_w(y)(e)]$

b. $Q = \lambda z \lambda w \exists e [*marry_w(Spencer\ Hubbard)(e) \& *agent_w(z)(e)]$

c. $P + Q = \lambda x \lambda w \exists y \exists z [x = y+z \& \exists e [*marry_w(Willie\ Brigham)(e) \& *agent_w(y)(e)] \& \exists e[*marry_w(Spencer\ Hubbard)(e) \& *agent_w(z)(e)]]$

If the two women's plural marriage wish has the content P+Q, it is only fulfilled in worlds in which they have the property P+Q. Those worlds correspond to the proposition p in (94):

(94) $p = \lambda w \exists y \exists z [the\ 2\ women = y+z \& \exists e [*marry_w(Willie\ Brigham)(e) \& *agent_w(y)(e)] \& \exists e[*marry_w(Spencer\ Hubbard)(e) \& *agent_w(z)(e)]]$

Given that the 2 men are Willie Brigham + Spencer Hubbard, and that the relations '$*agent_w$' and '$*marry_w$' are cumulative for any given value for 'w', p logically implies q:

(95) $q = \lambda w \exists e [*marry_w(the\ 2\ men)(e) \& *agent_w(the\ 2\ women)(e)]$

If the 2 women's plural wish s_1+s_2 is only fulfilled in worlds that have the property p, it is only fulfilled in worlds that have the property q. But then sentence (89) is true, given our scenario. In this case, lexical Cumulativity alone derived the correct interpretation. No movement or even a D-operator was needed at all.

The analysis of (89) I just went through has some interesting consequences. Look at (96):

(96) a. Scenario: My parents are having a disagreement. My mother wants me to marry Dr. Heintz. My Father wants me to marry Dr. Dietz.

b. **My parents want me to marry those two doctors**.

There is something very odd about 96(b). We seem to be talking polygamy. For some reason, then, 96(b) just can't seem to get across what (97) can:

(97) **Each of my parents wants me to marry a different one of those 2 doctors**.

Our analysis of **want** explains what's wrong with 96(b), once it is adapted to the case where **want** embeds a proposition. In that analysis, 96(b) is about a plural wish of my parents and characterizes its joint content. If p is the proposition that I marry Dr. Heintz, and q is the proposition that I marry Dr. Dietz, my mother's wish is only fulfilled in p-worlds, my father's wish is only fulfilled in q-worlds, and the sum of their wishes is jointly fulfilled only in worlds in which both p and q are true, - interpreting the sum operation for propositions as conjunction. But then, according to 96(b), I should marry both of those men, as far as my parents' joint wishes are concerned. This conclusion does indeed follow from the facts of the case, but why on earth would we ever want to give a joint characterization of my parents' marriage wishes for me? Weren't they having a disagreement? Our analysis says that 96(b) misfires because it is odd to lump together two fairly incompatible wishes and then talk about their joint content. See what you get! It is like

taking an article from Scientific American and another one from Martha Stuart Living and then go ahead and give a concise joint characterization of what they are about.

The proposed analysis of (89) establishes that no polyadic distributivity operator is needed for sentences of this kind. Within an event semantics, lexical cumulativity alone can account for the observed cumulative reading. An event semantics is crucial for other cases as well. A central theme in Beck's and Sauerland's work is to show that cumulation can affect predicates derived by movement, and that the limits for the phrasal predicates that can be cumulated are set by the usual constraints on movement. However, without the resources of an event semantics, Beck and Sauerland's generalization cannot be maintained. Take (98) below:

(98) **He broke those 2 toys to upset those 2 children**.

Without events, the cumulative reading of (98) would have to be derived by cumulating the relation '$\lambda x \lambda y$ [he broke x to upset y]'. Movement cannot plausibly derive this predicate, since **those two children** would have to be extracted from an adjunct:

(99) *** Who$_1$ did he break those 2 toys to upset t$_1$**?

In an event semantics, we can piece together the cumulative reading of (98) as follows, assuming cumulativity for the basic predicates 'λbreak', 'λmean to', and 'λupset': If action a meant to P and action b meant to Q, then action a+b meant to P+Q. Action a was breaking toy 1 and action 2 was breaking toy 2, hence action a+b was breaking toy1+toy2. P is upsetting child 1, and Q is

upsetting child 2, hence P+Q is upsetting child1+child2. Ergo: Breaking toy1+toy2 meant to upset child1+child2, and hence breaking those 2 toys meant to upset those 2 children.

Let me summarize where we stand. I looked at two powerful and intriguing examples that Beck and Sauerland offered as problems for Winter's account of phrasal cumulativity. I have shown that within an event semantics, those examples do not require an analysis that forces us to go beyond the boundaries set by Winter's Lexical Cumulativity Plus theory. More specifically, we haven't yet seen any evidence that polyadic cumulation operators that affect more than one non-event at a time are ever truly needed. Moreover, we found that Beck and Sauerland's important generalization about the kind of predicates that can be cumulated is only tenable if we assume an event-based theory. Adapted to an event semantics, then, a Lexical Cumulativity Plus theory along the lines of Winter looks like a very promising starting point.

There are two features of Winter's theory that need further scrutiny, however. First: Do atomic D-operators yield the correct account of phrasal cumulativity? If not, what kind of operators do? And second: What is it in the syntax that is responsible for pluralization of phrasal verbal projections? What are the carriers of the operators that bring about phrasal cumulativity? I will address those important issues in the next and final section of this chapter.

4.9 Agreement morphology as the source of phrasal cumulativity

In this section, it is argued that [plural] agreement features related to functional projections that are the landing sites for DP movement are the source for phrasal cumulativity. We thus

have good support for a particular Lexical Cumulativity Plus theory, hence for the Cumulativity Universal that inspired this chapter.

Sentences (72) and (73) above all had singular subjects since we wanted to observe the effects of initial cumulativity for verbs:

(72) What does this intern do?

a. **She guards a parking lot**.

b. **He cooks for an elderly lady**.

c. **She waters a garden**.

d. **He watches a baby**.

e. **She cleans an office building**.

(73) a. **I dialed a wrong phone number for 5 minutes**.

b. **She bounced a ball for 20 minutes**.

c. **He kicked a wall for a couple of hours**.

d. **She opened and closed a drawer for half an hour**.

e. **I ran up and down a hill for half a day**.

In this section we want to observe the effects of verbal plural number agreement. The next step in our experiment, then, is to replace the singular subjects with plural ones.

(100) What do your interns do?

a. **They guard a parking lot**.

b. **They cook for an elderly lady**.

c. **They water a garden**.

d. **They watch a baby**.

e. **They clean an office building**.

(101) a. **They dialed a wrong phone number for 5 minutes**.
b. **They bounced a ball for 20 minutes**.
c. **They kicked a wall for a couple of hours**.
d. **They opened and closed a drawer for half an hour**.
e. **They ran up and down a hill for half a day**.

What happened? Take 100(e). 100(e) has an interpretation where each of the interns cleans a possibly different office building. But even on that interpretation, the sentence still requires that for each of them, there be an office building that she is in the habit of cleaning. Using scope talk for convenience, we have added an apparent intermediate reading for **an office building**, but we still do not seem to get anything amounting to a narrow scope interpretation. The effect is stronger in the examples of (101). 101(a) allows for different people dialing different wrong phone numbers, for example, but requires that each person dial the same wrong phone number for 5 minutes. Again, we have an apparent 'intermediate' scope effect, and a 'narrow scope' interpretation for the direct object is missing.

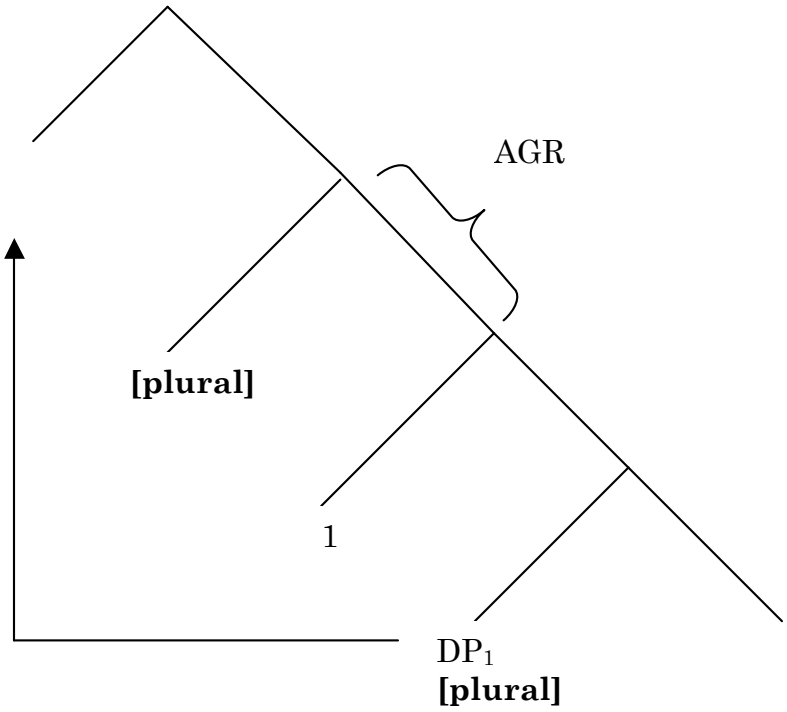
The main result of the test we just ran is that plural DPs bring in a distributivity operator. This is why we got an additional reading. Phrasal distributivity, then, is tightly linked to plural DPs, hence possibly to verbal plural agreement morphology, as we suspected earlier. Let's be concrete about what that would mean in syntactic terms. I already spelled out what I take to be the available options in a passage at the beginning of this chapter:

When we ask about the meanings of verbs and VPs within the current framework of assumptions, we are talking about the meanings of 'bare' verbs and VPs, which are verbal projections that do not yet include any functional structure. I assume that the functional

projections of verbs are built step by step in the course of a syntactic derivation by introducing ('merging') functional heads with possibly meaningful features. This is compatible with the view that verbs enter a syntactic derivation fully inflected, as long as the features of those initial pieces of inflection are not meaningful themselves. Possible carriers of inflectional meaning would be matching features carried by functional heads. The question is now whether the number features of verbal functional heads are ever meaningful. Suppose they are. Bare verbs and VPs, - and in fact all verbal projections below the point where functional heads with number features come in, - should then have denotations that allow us to construct singular and plural denotations with the help of number operators. Alternatively, suppose that verbal number features are not meaningful. In that case, verbs and verbal projections should have denotations that, without any further modification by number operators, directly make the right contributions to the truth-conditions of the sentences they occur in. The important point is that in either case, number-neutral denotations are needed for bare verbs and VPs. It is those number neutral denotations that I will be concerned with. The chunks of a verb's extended projection that we will be examining are mostly located below the point where number features might leave their mark. We will mostly have to consider number-neutral denotations, then, that is, denotations that have not yet been affected by number operators, - if indeed they ever will be.

Suppose that there are meaningful number features within a verb's extended projection, and that it is those number features that introduce the operators that account for all irreducibly phrasal cases of cumulativity. Here is a way of fleshing out this proposal. Within Chomsky's Minimalist Program, Agreement projections are the landing sites for certain types of movement. Agreement projections are headed by features, and features can 'attract' DPs with matching features. What does it take for a DP to move? Minimally, the DP needs an index, and a matching binder index has to be present in a higher position. We can think of indices as privative features. Indices are

interpretable on pronouns and traces and as binder indices, but not on DPs[81]. If they carry an index, DPs need to be attracted by a binder index, then, to eliminate their uninterpretable index. The next step is to give the binder index some 'strength' by adding agreement features[82]. Among those, the only one we are interested in just now is the number feature. For the purposes of semantic interpretation, the features have to be 'scattered'[83], with the number feature ending up above the index feature. We have a multi-headed Agreement projection of the following kind:



81 . If the DP is a pronoun, the pronoun has a lexically assigned interpretable index. See Heim and Kratzer 1998.

82 . Chomsky 2000, 2001.

83 . "Feature Scattering Principle: Each feature can head a projection." Giorgi and Pianesi 1997, p. 15. Giorgi and Pianesi also argue for a fixed hierarchical order among the features. For our purposes, it is crucial that the number feature be above the index feature.

Here is what happens next. The DP moves into the specifier position of the 'multi-headed' AGR projection, leaving a co-indexed trace. The trace is bound by the binder index in AGR[84]. The interpretable plural features are interpreted as pluralization operators, and the uninterpretable index of the DP is eliminated[85].

We have built a structure that is in principle interpretable. We also have an account of DP movement that can no longer build structures that would trigger the insertion of pluralization operators that can simultaneously affect more than one non-event argument. Recall that Beck and Sauerland 2000 argued for polyadic □-operators to account for the cumulative readings of sentence (86) and (89):

(86) **These five teachers gave a bad mark to those 20 protesting students**.

(89) **The two women wanted to marry the two men**.

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84. Heim and Kratzer 1998. The present account differs slightly from the one in Heim and Kratzer, however. There, the index on the moved DP itself is 'parsed' as a □-operator.

85. I am not excluding the possibility that nominal number features might sometimes be uninterpretable, in dependent plurals, for example. They can then be eliminated via agreement.

We established that within an event semantics that has neo-Davidsonian association of the agent argument, the cumulative reading of (86) can be accounted for without positing a polyadic pluralization operator. As for (89), we convinced ourselves that lexical cumulativity alone could be held responsible for its cumulative reading. Our account of DP-movement, then, might constrain the configurations that can be created by movement in just the right way.

Given the proposed syntactic analysis, we also expect a tight link between the displacement of plural DPs and phrasal cumulativity. That pluralization operators can operate over predicates that are the result of non-overt movement is a recurrent claim in the semantic literature, starting at least with Roberts 1987, 1990. That phrasal cumulativity is constrained by the constraints on movement is documented in Sauerland 1998, Beck 2000, and Beck and Sauerland 2000. That a plural DP is necessary for phrasal cumulativity was shown by the difference between (72) and (73) on the one hand, and (100) and (101) on the other. We saw that distributive readings are absent in (72) and (73). In (100) and (101), distributive readings come into existence as soon as plural subjects are introduced.

If movement is needed for phrasal cumulativity, we should find inertia effects in out of the blue utterances. Suppose a distributive reading would require a DP to move beyond the point where it would have to move otherwise - for checking a case feature or a wh-feature, for example. In this case, we would expect a distributive reading to be dispreferred, unless there are contextual pressures for a particular interpretation. On the other hand, if a distributive reading can be picked up on the way to a landing site that a DP is headed to anyway, a distributive reading should be much easier to get. Examples (102)

to (104) show such inertia effects. For the (a)-examples, a distributive reading is much harder to perceive than for the (b)-examples. In the (a) cases, the plural DPs have no other reason to move over the subject apart from producing a distributive interpretation. They can check or receive their case in lower positions. In the absence of any contextual forces, then, there is no motivation for those DPs to move. They should prefer to stay put in lower positions. In the (b) example, the plural DP is relativized, hence has moved overtly over the subject. As expected, distributive readings are much easier to perceive:

(102) a. **I want to climb a mountain in New Hampshire and Vermont**.
b. **The states I want to climb a mountain in are New Hampshire and Vermont**[86].

(103) a. **A student saw me do all the experiments**.
b. **All the experiments that a student saw me do didn't work out**.

(104) a. **A student wants me to read the papers in this pile**.
b. **The papers that a student wants me to read are in this pile**.

The connection between phrasal cumulativity and movement of plural DPs is also shown by the following examples from German, where object shift creates distributive readings that are not available if the object is left *in situ*:

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[86]. 102(b) is a variation of an example in Beck 2000.

(105) a. **Ich hab' 10 Minuten lang zwei Hasen gestreichelt**.
I have 10 minutes long two rabbit petted.
'I petted a group of 2 rabbits for 10 minutes'.

b. **Ich hab' zwei Hasen 10 Minuten (lang) gestreichelt**.
I have two rabbits 10 minutes (long) petted.
'I petted a group of 2 rabbits for 10 minutes'.
'I petted 2 rabbits for 10 minutes each'.

(106) a. **Ich hab' nach und nach 10 Bücher gelesen.**
I have little by little 10 books read.
'Little by little, I read a total of 10 books'.

b. **Ich hab' 10 Bücher nach und nach gelesen**.
I have 10 books little by little read
'Little by little, I read a total of 10 books'.
'I read each of 10 books little by little'.

There is considerable support for the hypothesis, then, that phrasal cumulativity involves movement of plural DPs.

Our final task is to find out what kind of pluralization operator is introduced by plural DPs. The main options to decide between are the atomic D-operator (adapted to our event semantics), or a cross-categorial $*$-operator.

Look at (107).

(107) **They bounced a ball for 20 minutes**.

Using the D-operator, (107) winds up saying that for each of those (athletes?) there was a 20-minute interval during which one and the same ball kept being bounced. Using the *-operator instead, we would moreover cover cases where we have teams bouncing one and the same ball for 20-minutes, and we could also describe multiple events of bouncing a ball for 20 minutes. There might be regular 20-minute ball bouncing warm-up sessions at the beginning of basketball practice, for example. (107) can be understood to describe situations of this kind, and with the *-operator things come out right. Similar comments apply to habitual cases. Take (108):

(108) What do those interns do?
They watch a baby.

Minimally, habitual aspect contributes the information that we are dealing with a plurality of events of the kind described by the VP. Using the D-operator, (108) would convey that for each of the interns, there is a string of iterated actions of watching one and the same baby. The □- operator additionally allows for teams of interns, as well as for pluralities of strings of iterated actions of watching one and the same baby. It could be, for example, that during every 6 month internship, the babies to watch change monthly. (108) can describe such situations. Neglecting the habitual part, the pluralized predicate of (108) should have the denotation in (110), then, where the □-operator simultaneously affects the subject argument and the event argument[87]. Literally, we would have a binary □-operator, then, but crucially, only one non-event argument is affected:

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[87] . See Beck 2002 for discussion of more cases of this kind in connection with pluractional markers.

(112) $\exists$x$\exists$e$\forall$y [baby(y) & watch(y)(e) & agent(x)(e)]

Do the cases we have just looked at truly require the full resources of the $\exists$- operator ? The most tangible differences between the D-operator and the $\exists$-operator have to do with intermediate grouping effects. If we use the D-operator to pluralize predicates, we predict that all non-trivial cover effects must be reducible to lexical cumulativity, or involve other mechanisms like dependent definites. When we looked at Schwarzschild's merchant, who wished the vegetables were light, we had an example of a non-trivial cover effect - distribution was to intermediate pluralities. But the predicate involved was just the adjective **light**, hence lexical cumulativity alone accounted for that case. We have to examine non-trivial cover effects, then, that come from predicates that are essentially phrasal. We saw such non-trivial cover effects with (107) and (108). What we still have to think about, however, is whether those apparent cover effects couldn't be produced by dependent definites.

Rather than pluralization of properties of events, there could be implicit universal quantification over events. Winter argues for an implicit universal quantifier over events or situations in the following case[88]:

(114) "In each of the years 2000-2010, one grand opera will be commissioned by the municipal opera house. Each year, two composers chosen by a special committee will be asked to collaborate in writing a new opera."

The selected composers will earn $ 5,000.

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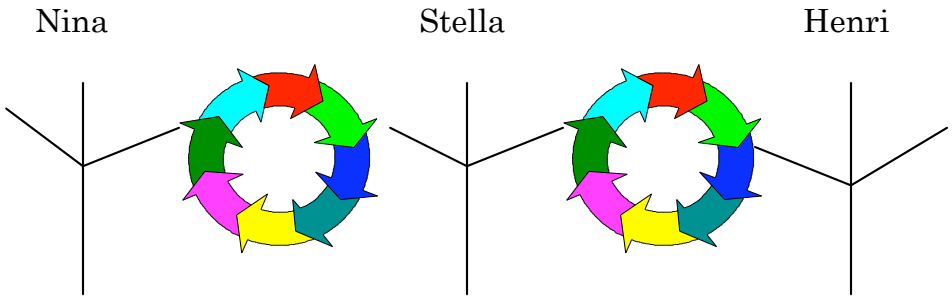
88 . Winter 2000, p. 64

In this context, there is implicit quantification over years between 2000 and 2010, and relying on a 'dependent definite' mechanism, we get an immediate cover reading: In each year between 2000 and 2010, the composers chosen in that year will receive $5,000. A similar move is not possible for the intermediate cover readings of (107) and (108). In both cases, the subject is a referential pronoun, hence the dependent definite mechanism can't be at work. We do seem to need the □- operator, then, as the source of phrasal cumulativity.

Are there cases where the □- operator would be too powerful? Winter presents potentially relevant cases, and here is one of them[89]. Suppose three children, Stella, Nina, and Henri, are lined up in a row. Nina and Stella are holding one wheel, and Stella and Henri are holding another:



Winter observes that in such a situation, sentence (110) is "false or highly strange":

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89 . Winter 2000, p. 63. My apologies to Yoad Winter for having distorted his lovely picture. I don't have a scanner and I am not an artist

(110) **The children are holding a wheel**.

(110) doesn't seem to be able to describe the situation depicted above, and we want to know why. Winter's answer is that non-lexical cases of distributivity are due to a D- operator that enforces atomic distribution. Having chosen the δ-operator over its competitor, how could we explain why is (110) false or strange on Winter's scenario? Suppose the DP **the children** in (110) is interpreted *in situ*. In this case, Lexical Cumulativity is all we have, and that means that you can't get more than one wheel in all, as we have seen. Suppose now that **the children** is interpreted in a raised position. This requires the presence of a δ-operator pluralizing the sister constituent of the raised DP. If that sister constituent expresses a relation between individuals and events, it is that relation that is cumulated. (110) can now describe possibly multiple events of one or more children holding a single wheel. What it still can't do, however, is describe events of the kind depicted by Winter. There we have a single event where two wheels are being held. Winter's scene is not easily parsed as a plural event. We might force ourselves to partition Winter's scene into two subscenes, though, hence try to perceive it as a plural event. One with Nina and part of Stella holding a wheel, and one with Henri and the other part of Stella holding another wheel. We resist that way of dividing up the scene, but trying to be cooperative we might go as far as that:

Nina Where is Stella? Henri

(110) is true in this situation, but parsing the original scene that way is 'strange'. Equally strange is allowing overlap by having all of Stella in both situations. Having opted for the σ-operator as the source of phrasal cumulativity, then, still allows us to explain Winter's important observation about (110).

We have finally come to the end of what turned out to be a *tour de force* in verbal cumulativity. In this last section of chapter 4, I have defended a Lexical Cumulativity Plus theory that is a variation of Winter's. The main variation concerns the nature of the operator that is responsible for phrasal cumulativity effects, differences coming from an event-based framework, and a commitment to a particular syntactic realization of pluralization operators. I have supported the view pioneered by Krifka and Landman that there is lexical cumulativity for verbs and thematic role predicates. I have argued furthermore that cumulation operators cannot be inserted freely, and that phrasal cumulativity comes from [plural] features that are needed to get plural DPs to move. As an extra benefit for the event based approach to the semantics of verbs, I have shown that lexical cumulativity implies no commitment to inflated NP meanings of the kind argued for in Landman's work nor to quantification over covers, as proposed by Schwarzschild. The flexible part structure of events and states gives us all the necessary distinctions, a point made years ago by Barry Schein and exploited extensively in the work of Peter Lasersohn.

There is very strong support for a Cumulativity Universal, then. With respect to the big plot of this book, this means that, most likely, there is no

such thing as a general thematic role ‘theme’ or ‘object’. It would violate a substantial universal for basic lexical meanings.