Chapter 2

Schein's Argument

Schein's argument is very sophisticated and laid out in great detail in his book, so I can do no more than sketch what I take to be its essence for our current concerns. In particular, I will neglect foundational issues, and rely on a mereological account of plural individuals, which goes right against what Schein actually says. My strategy will be to look at a fairly simple example that illustrates the phenomenon that Schein is after, and take the reader step by step through the process of first finding a suitable logical representation for it, and then deriving that logical representation from an appropriate syntactic structure. For consistency, the whole discussion will be placed within the semantic framework assumed here. Look at sentence (1), a variation of Schein's more complicated (2):

(1) **Three copy editors caught every mistake in the manuscript**.

(2) **Three video games taught every quarterback two new plays**.

(1) can have a 'cumulative' interpretation, in which case it would be true, say, in a situation where we hired three copy editors to look at a manuscript independently of each other, and between them, they caught all the mistakes in the manuscript[1]. Some mistakes might have been caught by one of the

[1]. By stipulating that the three copy editors work independently of each other, I tried to discourage an understanding of the scenario where we might be inclined to grant 'team

copy editors, some by two and the rest by all three. A cumulative reading for (1) is surprising, since **every** is an otherwise distributive quantifier. (2) is especially interesting since it has a reading that can be paraphrased as 'three video games were responsible for the fact that every quarterback learned two possibly different plays'. On this reading, **every quarterback** and **three video games** are related cumulatively: between them, a total of three video games taught all the quarterbacks. On the very same reading, however, **every quarterback** behaves just like an ordinary distributive quantifier phrase in its relation with **two new plays**: every quarterback learned two possibly different plays. That standard formalizations have difficulties with the interaction of distributive and 'cumulative' quantifiers had already been observed in Roberts 1997, 1990, who discussed sentence (3)[2]:

(3) **Five insurance associates gave a $25 donation to several charities**.

The problematic reading is one where taken together, the contributions of five insurance associates amounted to a gift of $25 to each of several charities. Let us explore the thorny issue of interacting cumulative and distributive quantifiers for the simpler sentence (1). The most straightforward formalization of the reading of (1) that we are interested in doesn't yield a satisfying result:

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credit' (in the sense of Lasersohn 1988, 1990, 1995) to the group of three copy editors. I do not think, however, that my attempt is fully successful. For the three copy editors to be considered a team, it is not necessary that they work in a coordinated fashion. Schein's own examples are constructed in such a way that a team credit interpretation is more clearly ruled out.

2. Cited from Roberts 1990, 86.

(4) $\exists x[\text{3 copy editors}(x)\ \&\ \forall y\ [\text{mistake}(y) \rightarrow \exists e[\ \text{catch}(y)(x)(e)]\ ]\ ]$

In (4) and subsequent logical-conceptual representations, variables from the end of the alphabet range over singular or plural individuals, construed as mereological sums. The variables 'e', 'e' ', 'e" ' range over singular or plural events, also construed as mereological sums, as proposed by Emmon Bach and many others since[3]. (4) says that each and every mistake was caught by some plurality of three copy editors, the same plurality for every mistake. This is not the reading we want. A formalization along the lines of (5) doesn't fare much better ('≤' stands for the mereological part relation):

(5) $\exists x\ [\text{3 copy editors}(x)\ \&\ \forall y\ [\text{mistake}(y) \rightarrow \exists e \exists z\ [z \leq x\ \&\ \text{catch}(y)(z)(e)\ ]\ ]\ ]$

(5) could be true in a situation where, say, a single copy editor found all the mistakes without any other copy editor having been involved in the project at all. Splitting off the agent argument gets us a bit closer to an acceptable reading:

(6) $\exists e \exists x\ [\text{3 copy editors}(x)\ \&\ \text{agent}(x)(e)\ \&\ \forall y\ [\text{mistake}(y) \rightarrow \exists e'\ [e' \leq e\ \&\ \text{catch}(y)(e')\ ]\ ]\ ]$

(6) says that three copy editors were the agents of an event in which every mistake was caught. The 3 copy editors are plural agents of a plural event. The paraphrase sounds good, but it is still not quite right. Suppose three copy

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[3]. Bach 1986, but without the bits of processes.

editors spent an afternoon together: Adam built a birdhouse, Bill ironed his shirts, and Chris caught all the mistakes in the manuscript. The sum of Adam, Bill, and Chris would be the plural agent of an event <u>in</u> which all the mistakes were caught. Intuitively, (1) wouldn't be true in such a situation. Maybe it would help to split off the theme argument as well, as in (7):

(7) $\exists e \exists x$ [3 copy editors(x) & agent(x)(e) & catch(e) & $\forall y$ [mistake(y) $\rightarrow$ $\exists e'$ [$e' \leq e$ & theme(y)(e')]]]

(7) is still wrong. As before, suppose that three copy editors spent an afternoon together. But this time, Adam caught fish, Bill caught rabbits, and Chris caught all the mistakes in the manuscript. The sum of Adam, Bill, and Chris is the plural agent of a catching event (a hunt, say) in which every mistake in the manuscript was caught, and this is what (7) requires to be true. Again, (1) wouldn't be true in such a situation. Maybe we should say that three copy editors were the agents of a minimal event in which every mistake was caught. Here is a try ('<' stands for the mereological proper part relation, and 'P' and 'Q' are variables that range over properties of events):

(8) $\exists e \exists x$ [3 copy editors(x) & agent(x)(e) & Min(P)(e)],
where P = $\lambda e \forall y$ [mistake(y) $\rightarrow$ $\exists e''$ [$e'' < e$ & catch(y)(e'')]], and
Min = $\lambda Q_{<se>} \lambda e$ [Q(e) & ~$\exists e'$ [$e' < e$ & Q(e')]][4].

We are not there yet. Unfortunately, (8) excludes scenarios we do not want to exclude. Imagine that there were just two mistakes in the manuscript, call them 'Addition' and 'Omission'. One of the copy editors found Addition, but

4. See von Stechow 1996 for an analogous minimalization operator.

not Omission. The other two copy editors both found Omission, but not Addition. In such a situation, (1) is true, even though (8) winds up false. The three copy editors are not agents of any minimal event in which every mistake in the manuscript was caught. If there is an event in which every mistake was caught, and which has the plurality consisting of the three copy editors as agents, that event must include two sightings of Omission and one sighting of Addition. But this means that such an event is not a minimal event in which every mistake was caught. What we ultimately want to say is that the three copy editors were the agents of an event that was a completed event of catching every mistake in the manuscript. But what is an event that is a completed event of catching every mistake in the manuscript? It is an event in which every mistake in the manuscript was caught, and which does not contain anything that is irrelevant to the enterprise of catching mistakes in the manuscript. That in turn is an event in which every mistake in the manuscript was caught, and which is a catching of mistakes in the manuscript. This intuition is captured by (9):

(9) $\exists e \exists x$ [3 copy editors(x) & agent(x)(e) & $\forall y$ [mistake(y) $\rightarrow$ $\exists e'$ [$e' \leq e$ & catch(y)(e')]] & $\exists y$ [mistakes(y) & catch(y)(e)]].

In (9), the condition '$\exists y$ [mistakes(y) & catch(y)(e)]' guarantees that e is an event of catching mistakes, not merely an event <u>in</u> which mistakes are caught. This is just how event descriptions are understood in Davidsonian event semantics. 'Catch(y)(e)' says that e is a completed event of catching of y, not that e is an event <u>in</u> which y is caught[5].

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5 . See Kratzer 1990, 1998, 2002 for how to relate propositions to event descriptions in a situation semantics. Instead of the condition '$\exists y$ [mistakes(y) & catch(y)(e)]', we could also

Finding an appropriate logical representation for sentence (1) has been a laborious exercise, even without worrying about a compositional derivation. The most pressing question is, of course, whether there isn't an equally insightful formalization of (1) that does not require neo-Davidsonian association of the agent argument. There is much discussion of this point in Schein's work. To consider additional options, we might also try to follow Montague and assume that the direct object positions of verbs have the semantic type of generalized quantifiers. (1) could then be formalized as (10):

(10) $\exists x \exists e$ [3 copy editors(x) & catch($\lambda Q \lambda e \forall y$[mistake(y) $\rightarrow$ Q(y)(e)])(x)(e)]

In (10), the variable 'Q' ranges over (Schönfinkeled) relations between individuals and events. '$\lambda Q \lambda e \forall y$[mistake(y) $\rightarrow$ Q(y)(e)]' is the analogue of a generalized quantifier within an event semantics. It maps relations between individuals and events into properties of events. (10) is unsatisfactory as it stands, as long as we are not told what it means, quite generally, for a generalized quantifier, a plural individual, and an event to stand in the catching relation. What condition is it that the actual world has to satisfy for such a relation to hold? At this point, Schein's sentence (2) should be brought into the discussion as well.

(2) **Three video games taught every quarterback two new plays**.

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use Link's σ-operator and posit 'e = σe'$\exists$y [mistake (y) & catch(y)(e') & e' ≤ e]'. The event e would now be required to be identical to the sum of all its subevents that are catchings of a mistake (in the manuscript).

(2) has an additional quantifier phrase, and we want a scope relationship between **every quarterback** and **two new plays**. That is, we are interested in a reading where if there were, say, four quarterbacks, a total of eight new plays might have been taught. I do not see an analysis of the relevant reading of (2) that follows the model of (10) without seriously straining our assumptions about what logical representations are and can do. I am ready to conclude, then, that if agent arguments are neo-Davidsonian at logical-conceptual structure, an analysis of sentence (1) and its kin becomes available that does not seem to be straightforwardly available otherwise. What we have, then, is a first piece of support for neo-Davidsonian association of agent arguments of verbs at logical-conceptual structure.

It seems that Schein's argument can be extended to at least certain other kinds of external arguments:

(11) a. (**Between them**), **three real estate agents own every house in town**.
b. (**Between them**), **three high school students from Pelham won every scholarship there was this year**.

Both 11(a) and (b) have the 'cumulative' interpretation we are after. In 11(a), the external argument denotes the possessor of a state, in 11(b) the patient of an event. What about internal arguments, theme arguments, for example? The question is not pursued in Schein's book. In a footnote he notes, however, that for his purposes, it is not necessary to separate off the theme argument in the logical form of the sentence **Brutus stabbed Caesar**. He considers '∃e[agent(Brutus)(e) & stab(Caesar)(e)]' an acceptable formalization of that sentence. Can we construct a sentence modeled after (1) or (2) that would force us to sever the theme argument from its verb in the syntax? It seems that we can't. Take (12):

(12) **Every copy editor caught 500 mistakes in the manuscript**.

(12) is like (1), but this time, the distributive quantifier **every** is part of the subject, not the object. (12) does not have a cumulative reading saying that between them, the copy editors caught a total of 500 mistakes in the manuscript. Let's passivize (12) so as to place the theme argument in subject position. (13) still doesn't have the reading we are after.

(13) **500 mistakes in the manuscript were caught by every copy editor**.

Following the spirit of Schein, the non-existent cumulative reading for (12) or (13) would correspond to (14), neglecting the complications relating to minimality that we went through above:

(14) $\exists e \exists x[\text{500 mistakes}(x) \ \& \ \text{theme}(x)(e) \ \& \ \forall y \ [\text{copy editor}(y) \rightarrow \exists e'[e' < e \ \& \ \text{agent}(y)(e') \ \& \ \text{catch}(e')] \ ] \ ]$

(14) says that 500 mistakes were the plural theme of an event in which every copy editor was a catcher. The paraphrase I just gave doesn't sound optimal, and there may be good reasons why, but within those limitations, (14) captures the non-existing reading of (12) or (13) that we are interested in. That (12) and (13) do not have the reading represented by (14) tells us that we cannot rely on representations like (14) to extend Schein's reasoning to theme arguments. That we can't seem to come up with cases that would <u>force</u>

neo-Davidsonian theme arguments doesn't mean that neo-Davidsonian themes are not an option, of course. Both 15(a) and (b) correctly represent one of the readings of (12) and (13), for example, and both 16(a) and (b) correctly represent the other.

(15) a. $\exists x$ [500 mistakes(x) & $\forall y$ [copy editor(y) $\rightarrow$ $\exists e$ [theme(x)(e) & agent(y)(e) & catch(e)]]]

b. $\exists x$ [500 mistakes(x) & $\forall y$ [copy editor(y) $\rightarrow$ $\exists e$ [catch(x)(y)(e)]]]

(16) a. $\forall y$ [copy editor(y) $\rightarrow$ $\exists x$ [500 mistakes(x) & $\exists e$ [theme(x)(e) & agent(y)(e) & catch(e)]]]

b. $\forall y$ [copy editor(y) $\rightarrow$ $\exists x$ [500 mistakes(x) & $\exists e$ [catch(x)(y)(e)]]]

15(a) and 16(a) use the neo-Davidsonian method, 15(b) and 16(b) have ordered argument association for the verb's arguments, including the theme argument. The main difference between the logical-conceptual representation (14) on the one hand, and the representations in (15) and (16) on the other, is the scope of the event quantifier. As long as the event quantifier has narrow scope with respect to the other two quantifiers, the mode of argument association does not matter. We can conclude at this point that the fact that (12) and (13) lack the reading (14) doesn't show that theme arguments are <u>not</u> neo-Davidsonian. However, we also have not yet found any evidence that they <u>are</u>. The kind of argument Schein presented for neo-Davidsonian association of external arguments, then, can't be extended to theme arguments. Moreover, Schein's argument only seems to bear on the issue of argument association in logical-conceptual structure. So far, nothing at all is implied about argument association in the syntax.

To use the properties of sentences like (1) as support for neo-Davidsonian association of agent arguments in the syntax, we have to look at the mapping from syntactic structures to logical-conceptual structures, and show that the kind of logical representations needed for such sentences can only be derived in an empirically plausible way by assuming that neo-Davidsonian association of agent arguments is already present in the syntax. In any such demonstration, a lot depends on what is considered to be 'empirically plausible'. It is not too difficult to come up with some way of deriving the intended logical representation for sentence (1), while still associating agent arguments via the ordered argument method in the syntax. Here is a proposal deriving the logical representation (6) (just to keep things simple). The proposal also serves as an introduction to the formal framework I will be using in this study. To understand all the technical details of those computations is not essential for understanding the story I will tell, so they may be skipped by readers who don't worry that the proposals made might not do what they are claimed to do.

(17) a. English sentence:
Three copy editors caught every mistake (**in the manuscript**).

b. Logical representation to be derived compositionally:
$\exists e \exists x$ [3 copy editors(x) & agent(x)(e) & $\forall y$ [mistake(y) $\rightarrow$ $\exists e'$ [e' $\leq$ e & catch(y)(e')]]]

<u>Derivation 1</u>:

1. T(**every mistake**) = $\lambda R_{<e<st>>} \lambda e \forall y$ [mistake(y) $\rightarrow$ $\exists e'$[e' $\leq$ e & R(y)(e')]]
2. T(**catch**) = $\lambda Q_{<<e<st>><st>>} \lambda x \lambda e$ [agent(x)(e) & Q($catch_{<e<st>>}$)(e)]

3. T(**catch** (**every mistake**)) =

$\lambda x \lambda e$ [agent(x)(e) & T(**every mistake**) (catch)(e)] =

$\lambda x \lambda e$ [agent(x)(e) & $\forall y$ [mistake(y) $\rightarrow$ $\exists e'$[$e' \leq e$ & catch(y)(e')]]]

From (1), (2), by Functional Application.

4. T(**3 copy editors**) = $\lambda R_{<e<st>>}$ $\lambda e \exists x$ [3 copy editors(x) & R(x)(e)]

5. T(**3 copy editors** (**catch** (**every mistake**))) =

T(**3 copy editors**) ($\lambda x \lambda e$ [agent(x)(e) & $\forall y$ [mistake(y) $\rightarrow$ $\exists e'$[$e' \leq e$ & catch(y)(e')]]]) =

$\lambda e \exists x$ [3 copy editors(x) & agent(x)(e) & $\forall y$ [mistake(y) $\rightarrow$ $\exists e'$[$e' \leq e$ & catch(y)(e')]]]

From (3), (4), by Functional Application.

6. $\exists e \exists x$ [3 copy editors(x) & agent(x)(e) & $\forall y$ [mistake(y) $\rightarrow$ $\exists e'$ [$e' \leq e$ & catch(y)(e')]]]

From (5), by Existential Closure.

The computation just given is a derivation of the denotation of sentence 17(a) (= (1)) on the intended reading, leaving out some complications. The interpretation process assigns denotations to bracketed strings of lexical items in a type-driven fashion[6]. The interpretation procedure does not need to see syntactic category labels, nor does it care about linear order. For any string α, T(α) is the denotation of α. Denotations are given through translations into expressions of an extensional type logic. For the time being, we might think of those expressions as logical-conceptual representations, and this is what I will tentatively do in what follows. The type logic assumed here has three basic types: Type e (individuals), type s (events or states, that is, eventualities in the terminology of Bach 1977), and type t (truth-values).

6. Klein and Sag 1985. See also Bittner 1994 and Heim & Kratzer 1998.

When necessary, we will occasionally switch to an intensional semantics that has quantification over possible worlds, and we'll then add a separate type of possible worlds and a corresponding interpretation domain. If not obvious, I indicate the semantic types of variables and constants by subscripts on the first occurrence of the expression. The variable 'R' and the constant 'catch', for example, are both expressions of type <e<st>>, that is, they denote (Schönfinkeled) relations between individuals and events. The variable 'Q' is of type <<e<st>><st>>, which is the type of quantifier phrases. As before the variables 'e', 'e' ', 'e" ', etc. range over (possibly plural) events, and variables from the end of the alphabet range over (possibly plural) individuals. The denotations of lexical items are specified as part of their lexical information. To calculate the denotations of complex expressions, there are a handful of composition principles that apply freely whenever they can. In this particular example, the only composition principles used were Functional Application and Existential Closure.

Derivation 1 establishes that examples like (1) do not force us to assume that agent arguments must be associated via the neo-Davidsonian method in the syntax. As we see in step 2 of the computation, all arguments of **catch** are associated via the ordered argument method. Derivation 1 also informs us about the price we have to be willing to pay if we hold on to ordered argument association when facing Schein's examples. We need a complicated semantic type for the direct object position of **catch** and we have to posit different argument structures for **catch** and 'catch'. Let us now compare derivation 1 with one that relies on neo-Davidsonian association of the agent argument in the syntax.

Derivation 2:

1. T(**every mistake**) = $\lambda R_{<e<st>>} \lambda e \forall y\ [\text{mistake}(y) \rightarrow \exists e'[e' \leq e\ \&\ R(y)(e')]\ ]$
2. T(**catch**) = $\lambda x \lambda e\ \text{catch}_{<e<st>>}(x)(e)$
3. T(**catch (every mistake)**) = $\lambda e \forall y[\text{mistake}(y) \rightarrow \exists e'[\ e' \leq e\ \&\ \text{catch}(y)(e')\ ]\ ]$

   From (1), (2), by Functional Application.
4. T(**3 copy editors**) = $\lambda R_{<e<st>>} \lambda e \exists x\ [3\ \text{copy editors}(x)\ \&\ R(x)(e)\ ]$

We are stuck. The denotations of the subject and the VP cannot be combined. Since the verb lacks an agent argument, the VP does, too. If the association of agent arguments is neo-Davidsonian in the syntax, there must be something that introduces agent arguments in the course of a syntactic derivation. Schein assumes that INFL, the carrier of verbal inflection, introduces external arguments, without being clear, however, about how INFL is able to do so. Suppose there is an inflectional feature **[active]** that is responsible for the introduction of external arguments. For the time being, let us assume that agent arguments are the only kind of external arguments. We'll worry about other types of external arguments later. Following much recent work in syntactic theory, let us assume furthermore that inflectional features may head their own projections. Derivation 2 can now continue as follows:

5. T(**[active]**) = $\lambda x \lambda e$ agent(x)(e)

6. T(**[active]** (catch (**every mistake**))) =

$\lambda x \lambda e$ [agent(x)(e) & $\forall y$ [mistake(y) $\rightarrow$ $\exists e'$[$e' \leq e$ & catch(y)(e')]]]

From (3), (5) by Event Identification.

7. T(**3 copy editors** (**[active]** (**catch** (**every mistake**)))) =

$\lambda e \exists x$ [3 copy editors(x) & agent(x)(e) & $\forall y$ [mistake(y) $\rightarrow$ $\exists e'$[$e' \leq e$ & catch(y)(e')]]]

From (4), (6) by Functional Application.

8. $\exists e \exists x$ [3 copy editors(x) & agent(x)(e) & $\forall y$ [mistake(y) $\rightarrow$ $\exists e'$[$e' \leq e$ & catch(y)(e')]]]

From (7), by Existential Closure.

Derivations 1 and 2 yield the same result. They both correctly predict the truth-conditions of sentence (1) = (17). The prettiest aspect of derivation 2 is that English **catch** and logical-conceptual 'catch' have matching argument structures. No higher type has to be assumed for the object position of **catch**. Derivation 2, unlike derivation 1, is compatible with a possible constraint that might require a tight match between the syntactic structure projected by lexical items and their logical-conceptual counterparts. Some such constraint would help a child learn the words of her language. However, derivation 2 comes with a price tag as well. It needs to assume that there is something in the grammar that introduces the right kind of external arguments in just the right kind of places. Derivation 2 also needs an additional composition principle, Event Identification[7]. Event Identification is really just a special type of a conjunction operation that makes it possible to chain together

7. The term 'Event Identification' is inspired by Higginbotham's term 'Theta Identification' (Higginbotham 1985).

various conditions for the event described by a sentence. The operation is independently needed for adverbial modification, for example. Event Identification, then, is not part of the cost accrued by derivation 2. The main cost for derivation 2 is the assumption about the introduction of the external argument it has to rely on. I conclude that the comparison between derivation 1 and 2 has not yet produced a winner. I will eventually plead for derivation 2. But Schein's examples all by themselves do not settle the case about argument association in the syntax. In fact, the obstacles derivation 2 has to overcome look more serious at this point.

Let me review where we are. I considered two modes of argument association, the neo-Davidsonian method, and the ordered argument method. This distinction opened up a number of possibilities for the association of different kinds of verb arguments at different levels of representation. I critically examined a piece of evidence brought forward by Barry Schein in support of neo-Davidsonian argument association. I explored the consequences of Schein's case for argument association at logical-conceptual structure and in the syntax. Schein's case came out strongest with respect to neo-Davidsonian association of external arguments of verbs at logical-conceptual structure. An equally strong case could not be made for theme arguments, nor for argument association in the syntax.

In the following chapter, I will take up the status of theme arguments. I will argue that if there was a general thematic role predicate 'theme' that introduced theme arguments in a neo-Davidsonian way, this predicate would lack cumulativity, a property that other basic lexical items expressing relations between individuals and events seem to have. Accepting a thematic role predicate 'theme' at logical-conceptual structure, then, would mean loss of a promising candidate for a semantic universal.