

Incremental *more**

Guillaume Thomas
Massachusetts Institute of Technology

Abstract In this paper, we argue that incremental *more* (*more_{inc}*) is a pluractional additive operator. *More_{inc}* combines with a relation *D* between degrees and eventualities, triggers a presupposition that a similar relation is satisfied by a pair of degree and eventuality (d_p, e_p) , asserts that *D* itself is satisfied by another pair of degrees and eventuality (d, e) , and asserts also that a similar relation is satisfied by the sum of the two pairs, $(d_p + d, e_p \oplus e)$. It is this last component of the meaning of *more_{inc}* that makes it a pluractional operator. Evidence for such a pluractional semantics comes from the analysis of some restrictions on the use of *more_{inc}* with stative predicates.

Keywords: additivity, degree semantics, event semantics, pluractionality

1 Introduction

The morpheme *more* has been mostly studied as a comparative operator. However, it appears that *more* can be used non-comparatively, as in (1):

- (1) It rained for three hours this morning, and it rained a little more in the afternoon.

There is an interpretation of (1) in which the second conjunct, *it rained a little more in the afternoon*, is an assertion that it rained in the afternoon, possibly less than three hours. In this reading, the second conjunct is not interpreted as an assertion that the duration of the rain in the afternoon was greater than some standard (the duration of the rain in the morning). Rather, this interpretation of (1) conveys that it rained for some short period of time in the afternoon, and that this event of raining is in some sense added to the event of raining that took place in the morning, the two events forming a larger eventuality of raining. We call this the incremental use of *more*.

More_{inc} is attested in some stative predications, c.f. (2), but not in others, c.f. (3):

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- (2) Michael owns two apartments in Boston and he owns one more apartment in New York.
- (3) This area was quite dangerous a few years ago. Now it is a little more dangerous.

(2) has an incremental reading according to which John owns (at least) three houses, two in Boston and one in New York. By contrast, the only available reading of *more* in (3) is comparative (this area is a little more dangerous now than it was before). We argue in section 5 that gradable stative predicates (like *dangerous*) denote relations between individuals, states and degrees. It is shown in section 6 that incremental *more* is ungrammatical in exactly those stative predications where *more* binds the degree argument of the stative predicate. This generalization correctly predicts that *more_{inc}* is unattested in sentences such as (3), where *more* binds the degree argument of *dangerous*, while it can occur in stative sentences such as (2), where the degree that it binds originates inside the DP *apartment*.

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Consider the following sentence:

- (4) There were five beers on the kitchen table. There are two more in the fridge.

In its incremental reading, the second sentence asserts that there are two beers in the fridge. It also seems to presuppose that there are/were some other beers, possibly somewhere else – in this case, the presupposition is satisfied by the fact that the context entails the proposition that there were five beers on the kitchen table. This division of labor between assertion and presupposition is supported by classical tests. The proposition that there are two beers in the fridge can be denied by the addressee:

- (5) A: There are two more beers in the fridge.
B: No, the only beers we had were on the kitchen table.

The proposition that there are/were some other beers somewhere (else) can be targeted by the ‘Hey, wait a minute!’ test, and projects from the antecedent of conditionals, among other environments:

- (6) A: There are two more beers in the fridge.
B: Hey, wait a minute, I didn’t know that we had any other beers!
- (7) A: If there are two more beers in the fridge, Chuck will drink them.
B: Hey, wait a minute, I didn’t know that we had any other beers!

More_{inc} appears to contribute yet another element of meaning to the utterance in (4) beyond the assertion and the presupposition we just mentioned. (4) means that the number of beers that there are in the fridge has to be added to the number of beers that there are/were somewhere else, the sum of the two numbers being the total number of beers available. This is shown by the fact that (4) is not felicitous in the following context. There were exactly five beers on the kitchen table, I drank three of them, and then I put the two that were left in the fridge. There are no other bottles of beer in the fridge. In sum, the second sentence in (4) asserts that there are two beers in the fridge, presupposes that there are/were other beers somewhere (else), in this case that there were five beers on the kitchen table, and asserts that there is a total of at least seven beers on the kitchen table and in the fridge. Consider now this other example of *more_{inc}*:

(8) I ran for two hours this morning and I ran for three more hours this afternoon.

Once again, the second sentence with *more_{inc}* conveys three different propositions: it asserts that the speaker ran for three hours in the afternoon, it presupposes that the speaker ran for some time on some other occasion, and it asserts that these two events of running can be summed to form a plural event whose duration is the sum of the duration of the two simple events.

3 A formal analysis of *more_{inc}*

3.1 *More_{inc}* as a pluractional additive operator

In order to analyze the meaning of *more_{inc}* in (4) and in (8) in a unified way, we hypothesize that *more_{inc}* is a function that applies to a relation between degrees and eventualities. In (4), the relation is between states *s* of being in the fridge and the cardinalities of the groups of beers (degrees *d*) as in (9). In (8), the relation is between events *e* of the speaker running and the durations $\tau(e) = d$ of these events as in (10):

$$(9) \quad \lambda d. \lambda s. \exists X [\text{beers}(X) \wedge |X| = d \wedge \text{in the fridge}(s)(X)]$$

$$(10) \quad \lambda d. \lambda e. [\text{run}(e) \wedge \text{agent}(e) = (\text{sp}_c) \wedge \tau(e) = d]$$

In both cases, *more_{inc}* contributes an assertion that this relation holds between some event *e* and some degree *d*, a presupposition that a similar relation holds between some salient event *e'* and some degree *d'*, and an assertion that these two events can be summed to form an eventuality $e \oplus e'$ that is realized to a degree $d + d'$.

Therefore, we argue that the semantic type of *more_{inc}* is the same in nominal and in adverbial environments, and that in both cases, *more_{inc}* applies to a relation between degrees and eventualities. We claim that such a relation is built in the syntax, along the following lines:

- (11) Two more students passed the exam.
 (12) $[[[[\text{two } \textit{more}_{inc}] e_p] [1 [[[t_1 \text{ MANY }] \text{students}] [\text{passed the exam}]]]]]]$
 (13) It rained for two hours more.
 (14) $[[[[[\text{two hours}] \textit{more}_{inc}] e_p] [1 [\text{it} [\text{rained} [\text{for } t_1]]]]]]]$

Both nominal *more_{inc}* (cf. (11)) and adverbial *more_{inc}* (cf. (13)) originate inside a measure phrase. In the case of nominal *more_{inc}*, this measure phrase is created by a covert MANY operator, that applies to an NP and returns a parametrized generalized quantifier (Hackl 2001):

- (15) $[[\text{MANY}]] = \lambda d. \lambda P_{\langle e, t \rangle}. \lambda Q_{\langle v, \langle e, t \rangle \rangle}. \lambda e. \exists X [|X| = d \wedge P(X) \wedge Q(e)(X)]$

In the case of adverbial *more_{inc}*, we assume that a measure phrase relating to the verbal head as an adjunct is provided overtly (cf. the *for* phrase in (13)) or covertly. In both cases, *more_{inc}* originates in a position where an element of type *d* (for degrees) is expected. Since the type of *more_{inc}* does not fit the local requirements, *more_{inc}* raises to a position above the VP, leaving behind it a trace of type *d* that is abstracted over. This QR of *more_{inc}* creates an argument of type $\langle d, \langle v, t \rangle \rangle$ (a relation between degrees *d* and eventualities *v*) for *more_{inc}* to apply to at the level of the VP.

Let us now consider the meaning we hypothesize for *more_{inc}*. We assume a system of types including at least eventualities (type *v*), degrees (type *d*) and individuals (type *e*). We assume that the domain of eventualities and the domain of individuals come with part-whole structures (Krifka 1998), with operation of sum \oplus , and the relation part-of \leq . The following denotation for *more_{inc}* is temporary and will be revised later on (the presupposition of *more_{inc}* is underlined):

- (16) $[[\textit{more}_{inc}]]^g = \lambda d. \lambda e'. \lambda D_{\langle d, \langle v, t \rangle \rangle}. \lambda e. \underline{\exists d' [D(d')(e')] \wedge D(d)(e) \wedge D(d + \delta)(e \oplus e')}$
 where $\delta = \iota d' [D(d')(e')]$

Remember that in our analysis, *more_{inc}* contributes the assertion that some relation of type $\langle d, \langle v, t \rangle \rangle$ holds of a pair of degree and eventuality (*d, e*) (call them the asserted degree and eventuality) and triggers the presupposition that a similar relation holds of a degree *d'* and a contextually salient eventuality *e'*. As can be seen in the LF above,

we assume that *more_{inc}* first applies to the asserted degree. The resulting function then applies to the contextually salient eventuality mentioned in the presupposition. We represent it as e_p in our metalanguage. It is treated as a pronoun and is never bound in the semantic representation. The presupposed degree is existentially quantified in the presupposition of *more_{inc}* and referred back to in the assertion using a definite description δ . *More_{inc}* together with its two innermost arguments forms a constituent that denotes a degree quantifier of type $\langle\langle d, \langle v, t \rangle \rangle, \langle v, t \rangle\rangle$, labeled DegP in the LF. This DegP is then merged with an expression denoting a function that expects a degree argument (MANY in the LF above), and undergoes QR. The complete semantic derivation of the sentence is as follows (presuppositions are underlined):

$$\begin{aligned}
(17) \quad & 1. \llbracket \text{DegP} \rrbracket^g = \lambda D_{\langle d, \langle v, t \rangle \rangle} \cdot \lambda e. \exists d' \wedge [D(d')(e_p)] \wedge D(2)(e) \wedge D(2 + \delta)(e \oplus e_p) \\
& \quad \text{where } \delta = \iota d' [D(d')(e')] \\
& 2. \llbracket \text{MANY} \rrbracket^g(\llbracket t_1 \rrbracket^g) = \\
& \quad \lambda P_{\langle e, t \rangle} \cdot \lambda Q_{\langle v, \langle e, t \rangle \rangle} \cdot \lambda e. \exists X [|X| = g(t_1) \wedge P(X) \wedge Q(e)(X)] \\
& 3. \llbracket \text{MANY } t_1 \rrbracket^g(\llbracket \text{students} \rrbracket^g) = \\
& \quad \lambda Q_{\langle v, \langle e, t \rangle \rangle} \cdot \lambda e. \exists X [|X| = g(t_1) \wedge \text{students}(X) \wedge Q(e)(X)] \\
& 4. \llbracket \text{MANY } t_1 \text{ students} \rrbracket^g(\llbracket \text{passed the exam} \rrbracket^g) = \\
& \quad \lambda e. \exists X [|X| = g(t_1) \wedge \text{students}(X) \wedge \text{pass}(\text{the exam})(e) \wedge \text{agent}(e) = (X)] \\
& 5. \llbracket 1 \text{ MANY } t_1 \text{ students passed the exam} \rrbracket^g = \\
& \quad \lambda d. \lambda e. \exists X [|X| = d \wedge \text{students}(X) \wedge \text{pass}(\text{the exam})(e) \wedge \text{agent}(e) = (X)] \\
& 6. \llbracket \text{DegP} \rrbracket^g(\llbracket 1 \text{ MANY } t_1 \text{ students passed the exam} \rrbracket^g) = \\
& \quad \lambda e. \exists d' \exists X [|X| = d' \wedge \text{students}(X) \wedge \text{pass}(\text{the exam})(e_p) \wedge \text{agent}(e_p) = (X)] \wedge \\
& \quad \exists X [|X| = 2 \wedge \text{students}(X) \wedge \text{pass}(\text{the exam})(e) \wedge \text{agent}(e) = (X)] \wedge \\
& \quad \exists X [|X| = 2 + \delta \wedge \text{students}(X) \wedge \text{pass}(\text{the exam})(e \oplus e_p) \wedge \text{agent}(e \oplus e_p) = \\
& \quad (X)] \\
& \quad \text{where } \delta = \iota d' [D(d')(e')]
\end{aligned}$$

The interpretation of a sentence with adverbial *more_{inc}* is similar, and we leave it to the reader.

The semantics we have given to *more_{inc}* requires the asserted relation and the presupposed relation to be identical. This is clearly too restrictive. The relations between degrees and eventualities that are mentioned in the presupposition and the assertion of *more_{inc}* are obviously allowed to differ, as illustrated in the following examples, with nominal and adverbial *more_{inc}*:

- (18) A: How much did you exercise last week?
 B: I ran for two hours and I biked for three more hours.

- (19) A: How many students are asking for a grant this year?
 B: Five students submitted a proposal to the NSF and three more to the ELF.

In (18), the presupposed and asserted relation are as in (20) and (21) respectively:

$$(20) \quad \lambda d. \lambda e. \text{run}(e) \wedge \text{agent}(e) = (\text{sp}_c) \wedge \tau(e) = d$$

$$(21) \quad \lambda d. \lambda e. \text{bike}(e) \wedge \text{agent}(e) = (\text{sp}_c) \wedge \tau(e) = d$$

In order to make the semantics of *more_{inc}* flexible enough to be consistent with such variation, we assume that a function *alt* is available, that generates the set of alternatives of an expression α . We assume that this set is a contextually restricted subset of the set of expressions of the same type as α . The revised semantics of *more_{inc}* is:

$$(22) \quad \llbracket \text{more}_{inc} \rrbracket^{g,c} = \lambda d. \lambda e'. \lambda D_{\langle d, \langle v, t \rangle \rangle}. \lambda e. \\ \exists d' \exists D' \in \text{alt}(D) [D'(d')(e')] \wedge D(d)(e) \wedge \exists D'' \in \text{alt}(D) [D''(d + \delta)(e \oplus e')] \\ \text{where } \delta = \iota d' [\exists D' \in \text{alt}(D) [D'(d')(e')]]$$

This allows us to predict the following truth conditions for the second conjunct of (18):

$$(23) \quad \exists d' \exists D' \in \text{alt} D [D'(d')(e')] \wedge \exists D(d)(e) \wedge \exists D'' \in \text{alt}(D) [D''(d + \delta)(e \oplus e')] \\ \text{where } \delta = \iota d' [\exists D' \in \text{alt}(D) [D'(d')(e')]] \\ \text{and } D = \lambda d. \lambda e. \text{run}(e) \wedge \text{agent}(e) = (\text{sp}_c) \wedge \tau(e) = d$$

The set of alternatives to a given relation between eventualities and degrees must of course be constrained in several respects. One that seems to be of theoretical interest is that in some sense, the degree arguments of the asserted relation and of the presupposed relation must stand for measures of the same kind of entity. Consider for instance (24):

$$(24) \quad ?\text{I met two boys yesterday and I met two more girls today.}$$

(24) sounds odd, unless we are able to accommodate the information that I had met other girls before today, i.e., we are aware that there is a particular event of me meeting some girls that is relevant to the conversation at the point when I utter (24). This suggests that the presupposed eventuality to which *more_{inc}* relates in (24) must be an event of interacting in some way with some girls. Why is that? The relational argument of *more_{inc}* in (24) is:

$$(25) \quad \lambda d. \lambda e. \exists X [\text{girl}(X) \wedge \text{meet}(e)(X) \wedge \text{agent}(e) = (\text{sp}_c) \wedge |X| = d]$$

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We have seen that the alternatives to (25) might be as (26), but cannot be as (27); else, the oddity of (24) would be unexpected:

- (26) $\lambda d.\lambda e.\exists X[\text{girl}(X) \wedge P(e)(X) \wedge |X| = d$
 where $P \in \text{alt}(\lambda e.\lambda x.\text{meet}(e)(x) \wedge \text{agent}(e) = (sp_c))$
- (27) $\lambda d.\lambda e.\exists X[P(X) \wedge \text{met}(e)(X) \wedge \text{agent}(e) = (sp_c) \wedge |X| = d$
 where $P \in \text{alt}(\lambda x.\text{girl}(x))$

We suggest that (27) is not a good alternative to (25) because the degrees in both relations are measures of potentially different kinds of entities. In (25), the degrees are cardinalities of groups of girls. In (17) on the other hand, the degrees are cardinalities of groups of individuals having the property P , where P is an alternative to $\lambda x.\text{girl}(x)$.

In short, we suggest that the degree argument of the relational argument of *more_{inc}* and the degree argument of its alternatives must stand for measures of the same kind of entity. How this constraint is to be implemented compositionally is left for further research.

4 Some welcome consequences of this analysis

Consider the denotation of *more_{inc}* again:

- (28) $\llbracket \text{more}_{inc} \rrbracket^{g,c} = \lambda d.\lambda e'.\lambda D_{\langle d, \iota d \rangle}.\lambda e.$
 $\frac{\exists d'\exists D' \in \text{alt}(D)[D'(d')(e')]}{\exists D'' \in \text{alt}(D)[D''(d + \delta)(e \oplus e')]} \wedge D(d)(e) \wedge \exists D'' \in \text{alt}(D)[D''(d + \delta)(e \oplus e')]$
 where $\delta = \iota d'[\exists D' \in \text{alt}(D)[D'(d')(e')]]$

The assertive component of *more_{inc}* contains two clauses. The first one ($D(d)(e)$) asserts that the relational argument of *more_{inc}* is satisfied by a pair of eventuality and degree (d, e) . The second one asserts that some relation $D'' \in \text{alt}(D)$ is satisfied by the sum of the pair (d, e) with a contextually salient pair of degree and eventuality (d', e') . Let us call the first clause the subjacent, and let us call the second clause the incremental clause. In this section, we present some consequences of our analysis of the incremental clause, and give arguments for its assertoric rather than presuppositional status.

As we argued in section 2, the incrementality of *more_{inc}* can be easily demonstrated with nominal *more_{inc}*. Consider (29):

- (29) Two customers bought a laptop yesterday, and one more bought a desktop today.

(29) is infelicitous in a context in which the customer who bought a desktop is one of the two customers who bought a laptop. In order for (29) to be felicitous, there must be three customers buying a computer. The following example shows that adverbial *more_{inc}* is also incremental:

(30) It rained for two hours in Cambridge. (# In the same time span), it rained for two more hours in Somerville.

Sentence (30) is infelicitous with the adverbial *in the same time span*. This is expected if we require the two hours of raining in Cambridge to be added to the two hours of raining in Somerville to form the duration of a larger event of raining: if two raining events overlap in time, the duration of their sum cannot be equal to the sum of their durations. These facts are predicted by our analysis of *more_{inc}*. (29) is predicted to be false in a context in which only two customers bought computers. As for (30), the use of the adverbial *at the same time* makes the sentence contradictory: the adverbial entails that the event of raining in Somerville was simultaneous to a salient event, while the semantics of *more_{inc}* requires that this salient event must not temporally overlap with the asserted event. We might then argue that (30) is infelicitous because it is necessarily false.

Since the incremental clause is part of the assertoric components of *more_{inc}*, it can be negated. This allows us to account for the behavior of *more_{inc}* under negation. Nominal *more_{inc}* can be negated as *no more*, c.f. (31). Both adverbial and nominal *more_{inc}* can take the form *any more* when they are realized in the scope of negation, c.f. (32) and (33):

(31) No more students arrived.

(32) I didn't see any more students.

(33) It didn't rain any more.

(31) presupposes that some students arrived at a previous occasion, and asserts that no students arrived afterward. (32) presupposes that the speaker had previously seen some students, and asserts that she didn't see any students afterward. (33) presupposes that it was raining at a previous occasion, and asserts that it is not raining at the time of utterance. Note that in the three cases, the negated incremental clause can be directly denied and does not project from the antecedent of conditionals, showing that it is not a presupposition:

(34) A: No more students arrived.

B: It's false, Bill just arrived.

(35) If no more students had arrived, the class room should have been half empty.

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But it is full.

- (36) A: I did not see anymore students.
B: It's false, you're talking to one right now.
- (37) If I had not seen anymore students, I would have left. But I saw Jane and Michael in the hall.
- (38) A: It is not raining anymore.
B: It's false, it's pouring right now.
- (39) If it were not raining anymore, I would go to the grocery store. But it is still pouring.

The possibility to negate the incremental clause is expected in our analysis. The truth conditions we predict for (31), (32) and (33) respectively are as follows, were the subjacent and the incremental clause are conjoined and the conjunction is in the scope of a negation:

- (40)
$$\frac{\exists d' \exists D' \in \text{alt}(D)[D'(d')(e_p)] \wedge \neg \exists d \exists e \exists X [\text{students}(X) \wedge |X| = d \wedge \text{arrived}(e)(X) \wedge \exists D'' \in \text{alt}(D)[D''(e \oplus e_p)(X \oplus \delta)]]}{\text{where } \delta = \iota d' [\exists D' \in \text{alt}(D)[D'(d')(e_p)] \text{ and } D = \lambda d. \lambda e. \exists X [\text{students}(X) \wedge |X| = d \wedge \text{arrived}(e)(X)]}$$
- (41)
$$\frac{\exists d' \exists D' \in \text{alt}(D)[D'(d')(e_p)] \wedge \neg \exists d \exists e \exists X [\text{students}(X) \wedge |X| = d \wedge \text{see}(e)(X) \wedge \text{agent}(e) = (\text{sp}_c) \wedge \exists D'' \in \text{alt}(D)[D''(e \oplus e_p)(d \oplus \delta)]]}{\text{where } \delta = \iota d' [\exists D' \in \text{alt}(D)[D'(d')(e_p)] \text{ and } D = \lambda d. \lambda e. \exists X [\text{students}(X) \wedge |X| = d \wedge \text{see}(e)(X) \wedge \text{agent}(e) = (\text{sp}_c)]}$$
- (42)
$$\frac{\exists d' \exists D' \in \text{alt}(D)[D'(d')(e_p)] \wedge \neg \exists d \exists e [\text{rain}(e) \wedge \tau(e) = d \wedge \exists D'' \in \text{alt}(D)[D''(d + \delta)(e \oplus e_p)]]}{\text{where } \delta = \iota d' [\exists D' \in \text{alt}(D)[D'(d')(e_p)] \text{ and } D = \lambda d. \lambda e. \text{rain}(e) \wedge \tau(e) = d}$$

Note that if the incremental clause were part of the presupposition triggered by *more_{inc}*, we would predict its projection under negation. It is not clear what the truth condition of (31)-(33) would then be. Furthermore, classical tests show that the incremental clause does not project, contrary to what we would expect if it were a presupposition:

- (43) We only had two beers. They were on the kitchen table and Chuck drank them both. If there were two more beers in the fridge, Chuck would drink them both.

The incremental clause in (43) is plausibly understood as the proposition that there have been four beers in our possession, two on the kitchen table and two in the fridge. If this proposition projected out of the antecedent of the conditional, we would expect (43) to be contradictory. The absence of contradiction shows that the incremental clause does not project, and hence is probably not a presupposition, *pace* Greenberg (2009, 2010).

5 Background assumptions on event semantics and measurement

The last section of the paper will be concerned with the analysis of the incompatibility of *more_{inc}* with stative predicates. This section will rely heavily on assumptions about event semantics and measurement in natural language that we introduce in this section.

5.1 Plurality and events

Sentences with multiple plural DPs are often ambiguous. (44), for instance, (from Kratzer 2007) has at least three readings: cumulative, collective and subject distributive:

(44) Two children lifted two boxes.

Kratzer suggests that these three readings are not necessarily distinguished in logical form. The source of these plural ambiguities, Kratzer argues, should rather be traced to differences in the possible extensions of the VPs. In order to understand Kratzer's analysis of the plural ambiguities, we must therefore understand her analysis of the denotation of verbs and verb phrases. Two elements are crucial in this analysis. Firstly, Kratzer argues that the internal arguments of verbs are always introduced by the verbs themselves. By this, we mean that transitive and unaccusative verb heads denote relations between eventualities and individuals, where the individual position is reserved for the individual argument of the verb. External arguments of verbs are introduced by separate functional heads. Secondly, Kratzer argues that verbs are inherently cumulative. That is, their extensions are closed under mereological summation. Given these assumptions, the cumulative and the collective readings of a sentence such as (44) can be identified as the result of assigning different extensions to the VP *lift two boxes*. Let us assume that there are two boxes in our universe of discourse, b_1 and b_2 . The extension of *lift two boxes* might be as follows:

$$(45) \quad \llbracket \text{lift two boxes} \rrbracket^g = \{ \langle e_1, b_1 \rangle, \langle e_2, b_2 \rangle, \langle e_1 \oplus e_2, b_1 \oplus b_2 \rangle \}$$

$$(46) \quad \llbracket \text{lift two boxes} \rrbracket^g = \{ \langle e_3, b_1 \oplus b_2 \rangle \}$$

$$(47) \quad \llbracket \text{lift two boxes} \rrbracket^g = \{ \langle e_1, b_1 \rangle, \langle e_2, b_2 \rangle, \langle e_3, b_1 \oplus b_2 \rangle, \langle e_1 \oplus e_2, b_1 \oplus b_2 \rangle, \langle e_1 \oplus e_3, b_1 \oplus b_2 \rangle, \langle e_2 \oplus e_3, b_1 \oplus b_2 \rangle, \langle e_1 \oplus e_2 \oplus e_3, b_1 \oplus b_2 \rangle \}$$

If the extension of the VP happens to be as in (45), the only event of lifting two boxes that is available is a plural event consisting of the sum of two events of lifting a box. Asserting that two children are the agent of such an event can be understood in two ways. It might be the case that the children are agents both of e_1 and e_2 , in which case they are agents of $e_1 \oplus e_2$ by virtue of the cumulativeness of the relation *agent*. We get a collective reading in which the two boxes were lifted one by one but collectively by the two children. It might also be the case that each child was the agent of one of these events, i.e. the first child was an agent of e_1 and the second the agent of e_2 , in which case the two children are still agents of $e_1 \oplus e_2$ by virtue of the cumulativeness of the relation *agent*. In this case we get a cumulative reading, since no child lifted two boxes on its own but two boxes were lifted in total, and a total of two children lifted boxes. If the extension of the VP happens to be as in (46), the only possible reading is a collective one, according to which the two children lifted the two boxes collectively and at the same time. If the denotation of the VP is as in (47), all of these readings are possible. In all cases, the logical form of (44) is as follows¹:

$$(48) \quad \exists e \exists x \exists y [\text{children}(x) \wedge \text{boxes}(y) \wedge |x| = 2 \wedge |y| = 2 \wedge \text{lifted}(e)(y) \wedge \text{agent}(e)(x)]$$

We still have to explain how the subject distributive reading of (44) can be generated. This reading is inconsistent with the LF in (48). Indeed, this LF imposes that the two children be agents of a single event of lifting two boxes, which is inconsistent with the subject distributive reading according to which the children could have lifted up to four boxes, i.e. two boxes each. In order to generate this reading, we need to pluralize the VP which is the sister constituent of the plural subject. Kratzer argues that plural DPs can pluralize their sister constituents, which accounts for the availability of subject distributive reading. We introduce a pluralization operator PL, in (49), from Beck 2001:

$$(49) \quad \text{PL is the function: } D_{\langle e,t \rangle} \rightarrow D_{\langle e,t \rangle} \text{ such that for any } f \text{ in } D_{\langle e,t \rangle} \text{ and any } x \text{ in } D_e, :$$

$$[\text{PL}f](x) = 1 \text{ iff } f(x) = 1 \text{ or } \exists u, v [x = u \oplus v \wedge [\text{PL}f](u) \wedge [\text{PL}f](v)]$$

Now, compare the unpluralized VP in (50) and the pluralized VP in (51):

$$(50) \quad \lambda x. \lambda e. \exists y [\text{children}(x) \wedge \text{boxes}(y) \wedge |x| = 2 \wedge |y| = 2 \wedge \text{lifted}(e)(y) \wedge \text{agent}(e)(x)]$$

$$(51) \quad \text{PL}(\lambda x. \lambda e. \exists y [\text{children}(x) \wedge \text{boxes}(y) \wedge |x| = 2 \wedge |y| = 2 \wedge \text{lifted}(e)(y) \wedge$$

¹ It is assumed that the predicates *children*, *boxes* and *agent* are inherently cumulative, i.e. are closed under mereological sum formation.

$\text{agent}(e)(x)]]$

(50) is a relation between events and individuals that holds of an individual i and an event e only if i is the agent of e and e is an event of lifting two boxes. Therefore, the subject distributive reading is impossible to generate. (51) on the other hand can hold of an individual i and an event e in case i is the sum of two individuals u and v , and e is the sum of two events e_1 and e_2 , such that u is the agent of e_1 , v is the agent of e_2 , and e_1 and e_2 each are events of lifting two boxes. Since no constraints in (51) state that e_1 and e_2 should be events of lifting the same boxes, we get a reading in which two children have lifted two possibly different boxes each, which is the desired subject distributive reading. This closes our summary of Kratzer's treatment of plural ambiguities with event semantics.

5.2 Adjectives, degrees and states

Kratzer (2004) proposes to extend her analysis of plural ambiguities using events to the ambiguity of stative sentences such as (52). This part of Kratzer's analysis is going to be of primary importance to our analysis of *more_{inc.}*. Consider then (52) uttered in a context where I am pointing to a pile of 100 plates:

(52) These 100 plates are light.

In its distributive reading, (52) is an assertion that each of the 100 plates is light. In its collective reading, it is an assertion that the pile of plate is light. Once again, Kratzer argues that this ambiguity is not rooted in the availability of two logical forms for (52), but that each reading corresponds to a different extension of the predicate *light*. Kratzer assumes that gradable adjectives such as *light* are relations between states and individuals who find themselves in these states; *light* for instance is a relation between an individual and its state of lightness. Kratzer furthermore seems to assume that (what I will call) dimension states, e.g. states of lightness, are values on a scale and therefore can play the role of degrees in our ontology. That is, Kratzer presumably assumes that the denotation of *light* is:

(53) $\llbracket \text{light} \rrbracket = \lambda s. \lambda x. \text{light}(s)(x)$

I will not adopt the latter part of Kratzer's proposal, and I will instead assume that gradable adjectives are relations between states, individuals and degrees, where the degree argument is identified as the result of measuring the state s with an appropriate measure function μ , c.f. (54). The reason for this minor modification to Kratzer's proposal is that it seems to make the analysis of measure phrases with adjective somehow easier, c.f. (55) and (56):

Incremental *more*

$$(54) \quad \llbracket \text{light} \rrbracket = \lambda d. \lambda x. \lambda s. \text{light}(s)(x) \wedge \mu(s) \leq d$$

$$(55) \quad \llbracket \text{long} \rrbracket = \lambda d. \lambda x. \lambda s. \text{long}(s)(x) \wedge \mu(s) \geq d$$

$$(56) \quad \llbracket \text{2 meters long} \rrbracket = \lambda x. \lambda s. \text{long}(s)(x) \wedge \mu_{\text{meters}}(s) \geq 2$$

Before we can understand Kratzer's explanation of the ambiguity of (52), we need to introduce additional concepts in the discussion. As we saw earlier, Kratzer accounts for the contrast between collective and cumulative readings of VPs by reducing these readings to different kinds of relations between eventualities and individuals. An event of two boys collectively lifting two boxes is an event that has two boys as its agent and two boxes as its internal argument, and that has no subevent that has only one of the boys as an agent. On the other hand, an event of two boys cumulatively lifting two boxes is an event that has two boys as its agent and two boxes as its internal argument, and that has two subevents in which only one of the boys is lifting a single box. What distinguishes one reading from the other is not what kind of individuals are its agent, but how an event relates to a pair of a plural individual (two boys) and a plural object (two boxes). Kratzer suggests to extend this relational theory of collectivity and cumulativity to the analysis of collective nouns, such as *choir*. What distinguishes a choir of boy, as a collective entity, from the plurality of boys that compose it is that in the first case the boys are the possessor of (i.e., find themselves in) a state of being in a choir. The denotation of the noun 'choir' is therefore as in (57), and its extension might be as in (58), where s_1 is a choir of three boys, s_2 is a choir of three girls, and $s_1 \oplus s_2$ is a plural individual consisting of the two choirs. On the other hand, the non-collective noun *boy* might have the denotation in (59) and the extension in (60). Note that $s_3 \oplus s_4 \oplus s_5$ is not a collective group of boys, but just a scattered plurality, since the plural possessor of $s_3 \oplus s_4 \oplus s_5$ ² is not also the possessor of each state that is a part of $s_3 \oplus s_4 \oplus s_5$. We can then give the following definition of a group or cohesive collection of individuals³: a plural individual forms a group with respect to a state s if and only if it is the single possessor of s . (61) defines single possessor of states⁴.

$$(57) \quad \llbracket \text{choir} \rrbracket = \lambda x. \lambda s. \text{choir}(s)(x)$$

$$(58) \quad \{ \langle s_1, b_1 \oplus b_2, \oplus b_3 \rangle, \langle s_2, g_1 \oplus g_2, \oplus g_3 \rangle, \langle s_1 \oplus s_2, b_1 \oplus b_2, \oplus b_3 \oplus g_1 \oplus g_2, \oplus g_3 \rangle \}$$

$$(59) \quad \llbracket \text{boy} \rrbracket = \lambda x. \lambda s. \text{boy}(s)(x)$$

$$(60) \quad \{ \langle s_3, b_1 \rangle, \langle s_4, b_2 \rangle, \langle s_5, b_3 \rangle, \langle s_3 \oplus s_4, b_1 \oplus b_2 \rangle, \langle s_3 \oplus s_5, b_1 \oplus b_3 \rangle, \langle s_5 \oplus s_6, b_2 \oplus b_3 \rangle, \langle s_3 \oplus s_4 \oplus s_5, b_1 \oplus b_2 \oplus b_3 \rangle \}$$

2 I.e. $b_1 \oplus b_2 \oplus b_3$

3 Neither this definition nor the examples in (57) to (60) are quoted from Kratzer 2004, although they follow Kratzer's presentation of these notions in this book.

4 Extrapolating on Kratzer's explicit definition of single agent, c.f. Kratzer 2004: chapter 4

- (61) *Single possessor constraint*
 If s is a state, and x is the possessor of s , then x is the possessor of any substate of s .

How does this apply to the stative predication in (52)? Kratzer's logical form for (52) is given in (62)⁵. Taking our modifications into account, (62) translates as (63), which asserts that the 100 plates are in the state of lightness s and that this state has a weight less than a contextual standard **pos**:

- (62) $\text{light}(\text{the 100 plates})(s)$
 (63) $\text{light}(\text{the 100 plates})(s) \wedge \mu(s) \leq \mathbf{pos}$

Kratzer's analysis applies in both cases. The variable s is left free in (62) and (63). It might then take different values depending on what assignment function is used. In one possible assignment, the 100 plates are the single possessors of s , according to the definition in (61). This assignment produces the collective reading of (52). An extension of *light* that makes this reading true is given in (64). Under another assignment, the 100 plates are the possessor of the state of lightness $s_1 \oplus \dots \oplus s_{100}$, but this state is the sum of 100 substates of lightness that each have one of the different plates as their possessor. This accounts for the distributive reading of (52). An extension of *light* that makes this reading true is given in (65).

- (64) $\{ \langle s, p_1 \oplus \dots \oplus p_{100} \rangle \}$
 (65) $\{ \langle s_1, p_1 \rangle, \dots, \langle s_{100}, p_{100} \rangle, \dots, \langle s_1 \oplus \dots \oplus s_{100}, p_1 \oplus p_{100} \rangle \}$

Note that in our revision of the denotation of the adjective *light*, the extension in (65) entails that the measure function introduced by the adjective is applied to the sum of 100 different states. What is measured then? Not the sum of the weight of each plate, since this would then generate a collective reading. We assume that the output of the measure function is the measure of the heaviest weight among the 100 states:

- (66) $\text{light}(\text{the 100 plates})(s_1 \oplus \dots \oplus s_{100}) \wedge \mu(s_1 \oplus \dots \oplus s_{100}) \leq \mathbf{pos}$
 (67) $\mu(s_1 \oplus \dots \oplus s_{100}) = \max(\{ \mu(s_1), \dots, \mu(s_{100}) \})$

Note that the measure function must output the maximal weight because *light*, being a negative adjective, is upward entailing: if an object x weighs less than a weight w_1 , and another weight w_2 is greater than w_1 , then x weighs less than w_2 . With a downward entailing positive gradable adjective such as *long*, the measure function introduced by the adjective would have to select the smallest value among

⁵ Kratzer actually uses a symbol to indicate that the predicate *light* is pluralized, although this symbol is redundant in her theory and shown purely for extra explicitness.

the measures of each state. Take as an example the sentence (68), whose distributive reading can be represented by the formula in (69):

(68) These 2 ropes are 2 meters long.

(69) $\text{long}(\text{the 2 ropes})(s_1 \oplus s_2) \wedge \mu_{\text{meters}}(s_1 \oplus s_2) \geq 2$

(70) $\mu_{\text{meters}}(s_1 \oplus s_2) = \min(\{\mu(s_1), \mu(s_2)\})$

We have made two claims about measurement and gradable adjectives. The first one is that gradable adjectives introduce a measure function that takes the state argument of the adjective as input and outputs a degree, which is the measure of the state. The second one is that measure functions applied to plural states output the smallest or greatest value (depending on the monotonicity of the adjective) among the set of measures of each of its substates with a unique possessor. These claims will be used in our account of the incompatibility of *more_{inc}* with stative predicates.

6 On the incompatibility of *more_{inc}* with stative predicates

More_{inc} is not attested in predicative position with some stative predicates, as can be seen in (71) and (72). Although (71) and (72) are grammatical, their only attested interpretation is comparative. They have no attested incremental interpretation. These examples contrast with similar sentences in which an incremental reading is attested, as in (73):

(71) This rope is two meters longer.

(72) This rope measures two more meters.

(73) There are two more meters of rope in the garage.

What is it that explains the incompatibility of *more_{inc}* with the relations between degrees and eventuality in (71) and (72)? In order to answer this question, it will help us to compare the relations between degrees and eventualities that are formed by QRing *more_{inc}* in (71) and (72), with the one that is formed by QRing *more_{inc}* in (73). The logical forms of sentences (71) to (73) are represented in (74) to (76), respectively. We adopt the syntactic analysis of pseudo-partitive constructions of Schwarzschild (2006), according to which measure phrases occupy the specifier position of a functional projection headed by the preposition *of*.

(74) [[*DegP* [[two meters] *more*] *e_p*] [1 [[This rope] [is [long *t*₁]]]]]]

(75) [[*DegP* [[two meters] *more*] *e_p*] [1 [[This rope] [measures *t*₁]]]]]

(76) [[*DegP* [[two meters] *more*] *e_p*] [1 [There [are [_{*vP*} [*MonP* *t*₁ [*Mon'* [*Mon* of

Indeed, measure functions applied to non-collective states (i.e., states that do not satisfy the single possessor constraint) always distribute over their collective members (those substates that satisfy the single possessor constraints). Hence, $\mu_{meters}(s \oplus s_p)$ in (80) always equals the greatest member of $\{\mu_{meters}(s), \mu_{meters}(s_p)\}$ i.e. the greatest member of $\{\delta, 2\}$. Their incremental clause being necessarily false, (71) and (72) themselves are contradictory and thus judged unacceptable⁶.

(73) on the other hand is not predicted to be contradictory. The truth conditions of (73) are:

$$(81) \quad \frac{\exists d' \exists D' \in alt(D)[D'(d')(s_p)] \wedge \exists s \exists x[\text{rope}(x) \wedge \text{in the garage}(s)(x) \wedge \mu_{meters}(x) = 2 \wedge \exists D'' \in alt(D)[D''(\delta + 2)(s_p \oplus s)]]}{\text{where } D = \lambda d. \lambda s. \exists x[\text{rope}(x) \wedge \mu_{meters}(x) \geq 2 \wedge \text{in the garage}(s)(x)] \text{ and } \delta = \iota d' \exists D' \in alt(D)[D'(d')(s_p)]}$$

Let us assume that s_p is a salient state of some rope being in the garden. Then the presupposition of (73) is the proposition that there is some rope x such that s_p is a state of x being in the garden, and x is δ meters long. The incremental clause of (73) is the proposition that there is some rope z such that $s \oplus s_p$ is a state of z being in the garage and in the garden, and z is $2 + \delta$ meters long. This is true if we take z to be the concatenation of the rope in the garage and the rope in the garden.

Summing up, *more_{inc}* is unacceptable when it is generated in the position of the degree argument of a stative predicate. In these cases, the VP argument of *more_{inc}* ends up denoting a relation between states of dimension and their measure, and the distributivity of the measure function built in the relational argument of *more_{inc}* is inconsistent with its additive semantics. This analysis, if it is right, brings support to the theory of plural ambiguities developed by Kratzer, on which it is built. We rely in particular on Kratzer's distinction between collective states and (non-collective) plural states, a distinction that stems from the single possessor constraint.

7 Conclusion

I have presented an analysis of *more_{inc}* as a pluractional additive operator. We have seen that the analysis of this expression is a fertile ground for the application of theories of plurality that make use of events, such as Kratzer's (2004), thus bringing indirect support to these analyses. This analysis also lays the ground for future research on different aspects of the semantics of *more_{inc}* and similar pluractional or

⁶ Their negation, being tautological, is no better

additive constructions.

References

- Beck, Sigrid. 2001. Reciprocals are definites. *Natural Language Semantics* 9(1). 69–138. doi:10.1023/A:1012203407127.
- Greenberg, Yael. 2009. Additivity in the domain of eventualities. Paper presented at Sinn und Bedeutung 14.
- Greenberg, Yael. 2010. Aspectual and pragmatic constraints on the verbal additive particle *more*. Manuscript, www.semanticsarchive.net.
- Hackl, Martin. 2001. *Comparative quantifiers*: MIT dissertation.
- Kratzer, Angelika. 2004. The event argument. Book manuscript, www.semanticsarchive.net.
- Kratzer, Angelika. 2007. On the plurality of verbs. In T. Heyde-Zybatow J. Dölling (ed.), *Event structures in linguistic form and interpretation*, 269–299. Mouton Walter de Gruyter.
- Krifka, Manfred. 1998. The origins of telicity. In Susan Rothstein (ed.), *Events and grammar*, Kluwer.
- Schwarzschild, Roger. 2006. The role of dimensions in the syntax of noun phrases. *Syntax* 6(1). 67–110. doi:10.1111/j.1467-9612.2006.00083.x.

Guillaume Thomas
MIT Linguistics and Philosophy
77 Massachusetts Avenue
Bldg. 32-D808
Cambridge, MA 02139 USA
gthomas@mit.edu