

# Additivity in the Domain of Eventualities (or: Oliver Twist's *more*)

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## Abstract

This paper examines the English additive particle *more* (*more<sub>add</sub>*), in both its 'nominal' and 'verbal' uses (as in *I read 3 more books* and *I ran 3 kilometers more*, respectively). It makes a number of novel observations, showing that 'nominal' *more<sub>add</sub>*, obeys constraints in both the nominal and the verbal domains and suggests that this particle denotes a derived additive measure function on eventualities, using a homomorphism from eventualities to their individual participants. The analysis can account for a number of distributional and interpretational constraints on nominal *more<sub>add</sub>*. The paper further shows how the analysis can be extended to verbal *more<sub>add</sub>* and proposes that it denotes an additive measure function too, which can be either *derived*, using a homomorphism (measuring the run time, or path of eventualities), or *non-derived*, (measuring the cardinality of eventualities directly). The analysis can account for a number of aspectual constraints on verbal *more<sub>add</sub>*.

## 1 Introduction

The English particle *more* is usually discussed in the semantic literature with respect to its comparative meaning as in (1), with adjectives, or as in (2), with NPs:

- (1) Mary is more intelligent than John (see e.g. Kennedy 1999, 2005)
- (2) Mary bought more books than John (see Hackl 2001)

But *more* has another, additive, use.<sup>1</sup> For example, when Charles Dickens' hero Oliver Twist says "Please sir, I want some more", he uses the additive, and not the comparative reading of *more*. I.e. he does not ask to get now more gruel than he got before, but rather to get some gruel now, in addition to what he got before. The difference between these readings can be seen clearly when we consider a sentence like (3), which is ambiguous between the comparative reading (today John interviewed more than 3 students (e.g. 4)), and an additive reading (today John interviewed additional students (perhaps only 1, or 2):

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1 Cf. Thomas 2009A and 2009B, who also analyzes this use of *more*, and calls it 'incremental'.

(3) Yesterday John interviewed three students. Today he interviewed more (students)

Other languages use a distinct lexical item for the additive reading. This is the case, for example, in French, Italian and Chinese (see Tovena & Donazzan 2008), German (see Umbach 2008) and Modern Hebrew (see Greenberg 2009C). In this paper, though, I concentrate on the additive use of the English *more* (*more<sub>add</sub>* henceforth).

In section 2 of this paper I examine some novel observations concerning the distribution and interpretation of *more<sub>add</sub>*, and show that, despite its apparent 'nominal' nature, this particle obey constraints in both the nominal and verbal domains. In section 3 I present an analysis of the data, suggesting that nominal *more<sub>add</sub>* denotes a derived additive measure function on eventualities (following ideas in Krifka (1989, 1998), Moltmann (2004), Nakanishi (2007)). That is, it expresses indirect measurement of the development and growth of the sum of eventualities (in the assertion and presupposition), by measuring the sum of individuals participating in these eventualities (using a homomorphism from events to individuals). In section 4 I examine how the analysis accounts for the observations in section 1. Section 5 extends the analysis to verbal *more<sub>add</sub>* as in *John slept some more* and proposes that it denotes an additive measure function too, which can be either *derived*, using a homomorphism (measuring the run time, or path of eventualities), or *non-derived*, (measuring the cardinality of eventualities directly). Finally, section 6 summarizes the main claims made in the paper and examines several directions for further research.

## 1 Some novel observations

Consider (3), repeated here as (4), focusing on the additive reading:

(4) (Yesterday John spoke with 3 students). Today he spoke with more (students)

Intuitively this sentence involves an assertion and a presupposition. It asserts that John spoke with some students today, and presupposes that there is another occasion where John interviewed students. This latter implication indeed survives under, e.g. questions and negations, as in (5):

- (5) a. Did John speak with more students today?  
b. It is not true that John spoke with more students today.

Notice that we get very similar assertion and presupposition with the much more well-studied additive particle *too*, as in (6):

(6) (Yesterday John interviewed three students). Today he interviewed students too.

But the rest of the observations I will examine now are only true of *more<sub>add</sub>*. Among other things, unlike *too*, nominal *more<sub>add</sub>* has a double nature, as both 'nominal' and 'verbal'. Thus, on the one hand, it seems indeed to be nominal, as it is associated with a nominal predicate (e.g. *students* in (4)). Moreover, it obeys three constraints in the nominal domain: First, the nominal predicate in the assertion should be present in the presupposition as well. For example, in the context of (7a), (7b) sounds infelicitous on the additive reading, and has a salient comparative reading (where I bought more than three carrots):

- (7) a. I bought 3 apples this morning.  
b. Later on I bought more carrots.

Notice that this constraint holds even if we do not explicitly mention the nominal predicate before. For example, a strong implication of (8) is that John is a teacher:

- (8) Mary spoke with John. Tomorrow she will speak with some more teachers

Unlike *more<sub>add</sub>*, *too* is not subject to this constraint. For example, (9b) is perfectly felicitous in the context of (9a), and (10) does not implicate that John is a teacher:

- (9) a. I bought three apples this morning.  
b. Later on I bought carrots too.

- (10) Mary spoke with John. Tomorrow she will speak with teachers too

The second 'nominal' constraint on nominal *more<sub>add</sub>* is that the individuals in the denotation of the nominal predicate in the assertion and presupposition should be different. For example, (11) implies that John and Mary spoke with different students. Again, we do not find this implication with *too*. For example, in (12), some, or even all students that Mary spoke with can be the same students John spoke with:

- (11) Yesterday John spoke with 4 students. Today Mary spoke with 4 more students  
(12) Yesterday John spoke with 4 students. Today Mary spoke with 4 students too

Finally, nominal *more<sub>add</sub>* can be modified by numerals or by other measure phrases (*2 liters, 2 kilos*), as in (13), respectively, but not by measure phrases like *12 carat, 10 degrees*, as in (14):

- (13) a. John drank 2 liters of water, and then one liter more.  
b. I've already bought 3 kilos of potatoes. I will buy 2 kilos more later on.  
(14) a. Yesterday John bought 10 carat gold. #Today he bought 12 carat more  
b. 30 degree Celsius water was spilled on the carpet. #10 degree Celsius more was spilled on the bed

Despite this 'nominal' nature of *more<sub>add</sub>*, however, it is also subject to three constraints in the *verbal* domain (the domain of eventualities). First, the eventuality in the presupposition should not occur later than the one in the assertion. For example, unlike (4), repeated here, which is ambiguous between the comparative and the additive readings, the minimally contrasting (15) has a comparative reading only. In contrast, *too* is not subject to this constraint, as can be seen from the felicity of (16):

- (4) (Yesterday John interviewed three students). Today he interviewed more (students)  
(comparative / additive)  
(15) Today John interviewed three students. Yesterday he interviewed more (students).  
(comparative / # additive)  
(16) Today John interviewed three students. Yesterday he interviewed students too.

Notice that the presupposed eventuality with *more<sub>add</sub>* need not be temporally *prior* to the

asserted one: It can also hold at the same time, e.g. unlike (4), (17) is felicitous under the additive reading:

- (17) This morning Danny interviewed 3 students in his office. At the same time Susan interviewed more students in the library (comparative / additive)

It seems, then, that *more<sub>add</sub>* requires that there is some eventuality, which is not later than the asserted eventuality, and which involves different members of the same nominal predicates.

Second, unlike the nominal predicates, the verbal predicates in the assertion and presupposition of *more<sub>add</sub>* can differ. But this can only happen if these predicates can be characterized by a common, 'superset' verb (see also Tovena & Donazzan (2008) for a similar observation). E.g. consider the contrast between (18) and (19):

- (18) a. John baked 3 cakes for the party. Mary will buy one more ('prepare cakes')  
 b. Today I found 4 coins. I received 2 more from my father. ('got coins')
- (19) a. John baked 3 cakes for the party. #Mary will eat one more  
 b. I found 4 coins on the ground. #Then I lost 2 more

Thomas 2009A attempts to explain this constraint by analyzing *more<sub>add</sub>* as focus sensitive, and by assuming that the verbal predicates the presupposition of *more<sub>add</sub>* should be a member of the set of contextually relevant alternatives which constitute the focus semantic value of the verbal predicate in the assertion. This suggestion, however, does not seem to work for at least two reasons. First, it predicts that the focused element in the sentence is the verbal predicate. Although we can get such a focus pattern when we intend to express contrast, in the more usual case we get a different focus pattern where *more<sub>add</sub>* itself is stressed, together with various other elements in the sentence (but not the verbal predicate), which get a (rise-)fall-rise intonation, i.e. a 'topic-focus'-like intonation:<sup>2</sup>

- (20) a. John spoke with 3 students [Sara]<sub>TF</sub> interviewed some [more]<sub>F</sub>  
 b. Today I spoke with 3 students. [Tomorrow]<sub>TF</sub> I will interview some [more]<sub>F</sub>  
 c. In the box there are 10 cookies. [In the oven]<sub>TF</sub> there are 4 [more]<sub>F</sub>

In addition, even if the non-stressed verbal predicates are considered focused, thus triggering a set of alternatives, this cannot explain the infelicity in (19). This is because the constraints on *more<sub>add</sub>* are much stricter than what we usually find with focused predicates. In the latter case the alternatives in the focus semantic value are only required to belong to a contextually relevant set, and not necessarily to be subsumed under a 'superset' predicates. Thus, *lost* and *found*, or *bake cakes* and *eat cakes*, for example, can be easily considered

<sup>2</sup> This makes the focus pattern of sentences with nominal additivity similar to that of sentences with involving contrastive topics, e.g. with *too* as in (i) (see e.g. Krifka 1999)

- (i) a. Today Danny bought books. [Tomorrow]<sub>TF</sub> he will buy books [too]<sub>F</sub>.  
 b. Today Danny bought books. [Mary]<sub>TF</sub> will buy books [too]<sub>F</sub>.

Notice, however, that Umbach 2008 claims that German correlate of *more<sub>add</sub>*, *noch*, can come with another focus pattern: where *noch* is not focused, and the nominal predicate in the assertion is focused, and differs from the one in the presupposition, unlike what seen in (7) and (8) above. In English such a focus pattern seems possible as well:

- (ii) "Danny spoke with a few teachers. [Laer on]<sub>F</sub> he spoke with some more [students]<sub>F</sub>"

Further research should examine how the analysis proposed below for *more<sub>add</sub>* can be applied to both focus patterns.

members of the same focus semantic value. Indeed, such predicates can naturally appear in the assertion and presupposition of real focus sensitive particles, like *only* as in (21):

- (21) a. John baked the cakes. I only ate them  
 b. John finds money. I only lose money

The contrast on the variability of the verbal predicates with *more<sub>add</sub>*, then, cannot be derived from its focus sensitivity. Instead I propose that it results from the fact that the operation of nominal *more<sub>add</sub>* is not only to add or sum individuals (e.g. the students spoken to in (4)), but also to add and sum the *eventualities* in the assertion and presupposition. In the case of e.g. (18a) and (18b), the eventualities can be summed, although they are in the denotation of two different verbal predicates, since they can be also thought of as being in the denotation of a single ('superset') verbal predicate (e.g. 'prepare cake' and 'got coins', respectively). But when no such common predicate can be found, (as in (19a) and (19b)), the presupposed and asserted eventualities cannot be summed, and we get infelicity.

Finally, notice that sentences like (22a) and (22b) are infelicitous on the additive reading, although the verbal predicates in the assertion and the presuppositions are the same:

- (22) a. I have many friends who are busy writing papers. John has written 5 papers.  
 Mary has written more (papers) (comparative / # additive)  
 b. I baked 3 cakes for my son's birthday party. A woman I know in New York  
 baked more (cakes) for her son's birthday party (comparative / # additive)

In contrast, minimally contrasting sentences with *too* are perfectly felicitous:

- (23) a. I have many friends who are busy writing papers. John has written 5 papers.  
 Mary has written papers too  
 b. I baked three cakes for my son's birthday party. A woman I know in New  
 York baked cakes for her son's party too

Why is *more<sub>add</sub>* infelicitous in (22)? It seems that the presupposed and asserted eventualities particle cannot be too 'unrelated'. In particular, they need to be summed together not only to yield a plural eventuality, but also to one which can be intuitively considered 'more developed'. This does not seem to happen in (22a,b): Two eventualities of writing papers by two unrelated individuals, or baking cakes by different people, in different places, for different parties, are not perceived as leading to some more developed eventualities, only to plural ones with more participants (more papers, more cakes). Indeed, in the following contexts, where the summed eventuality *can* be considered 'more developed' the additive reading is much better:

- (24) a. (Context: John and Mary work in the same research project, and they are supposed to write the annual report. John has written 5 papers. Mary has written more (papers) (additive reading possible)  
 b. (Context: Some rich man suggests donating a certain sum of money for poor children for every birthday cake baked in the world) I baked three cakes for my son's birthday party. A woman I know in New York will bake more (cakes) for her son's party (additive reading possible)

To summarize, we observed that the additivity expressed by *more<sub>add</sub>* differs from that of *too*. More importantly, we saw that nominal *more<sub>add</sub>* has a double nature: it is subjects to

constraints in both the nominal and the verbal domains, and it seems to express summing of both individuals and eventualities in the assertion and presupposition. In addition to capture each of the constraints above, then, the main challenge we are facing is to find a way to capture this double nature.

## 2 An analysis in terms of a derived measure function on eventualities

I suggest that through the addition and growth of the nominal set (the set of individuals) nominal *more<sub>add</sub>* expresses addition, development and growth in the domain of eventualities. More precisely, it denotes a *derived additive measure function* on eventualities (for a similar measurement-based analysis of *more<sub>add</sub>*, see Thomas (2009A) and (2009B)).

Let me start with some background terminology. First, following Schwarzschild (2002) and Nakanishi (2007) I take a measure function ( $\mu$ ) to be a nonevent measurement scheme, like  $\mu$ :cardinality,  $\mu$ : spatial length,  $\mu$ :volume, etc. Such a function is used, for example, in Nakanishi's 2007 interpretation of (25) in (26) (with  $\mu$ :spatial length):

- (25) Two meters of rope  
 (26)  $\lambda_{x_e} \text{ rope}(x) \wedge \mu(x) = 2 \text{ meters } (\mu:\text{spatial length})$

An *additive* or a *monotonic* measure function (to use Krifka's (1998) and Schwarzschild's (2002), respectively) is such that if  $f(x)=d_1$  and  $f(y)=d_2$  then  $f(x+y)=d_1+d_2$ . Nonadditive (or nonmonotonic) measure functions are those where this condition does not hold. Intuitively, nominal *more<sub>add</sub>* has an additive component, e.g. (27a) says that the cardinality of the cookies that John ate is altogether  $4+3=7$ , and (27b) says that the weight of the potatoes that John bought is altogether 5 kilos:

- (27) a. John ate 4 cookies in the morning, and 3 more in the afternoon  
 b. John bought 3 kilos of potatoes in the morning, and 2 more in the afternoon

This additivity component, however, is not enough to capture the fact observed above, that *more<sub>add</sub>* is subject to constraints in the eventuality domain, and seems to sum eventualities as well. To capture that we look at the notion of *derived measure functions* ( $\mu'$ ) (Krifka 1998, Nakanishi 2007), namely those functions which indirectly measure elements in a certain domain by measuring elements in another domain, homomorphically related to the first domain. Such functions are expressed, for example, by adverbial measure phrases as in (28) and (29):

- (28) John walked **two meters**.  
 (29) John walked **for 10 minutes**

Krifka (1989, 1998) claims that such expressions do not measure the events directly. This is because events themselves do not have spatial or temporal length, only their spatial paths and run times do. To get from events to run time or from events to paths. We use a *homomorphism*,  $h$ . Thus, derived measure functions -  $\mu'$  - indirectly measure events by measuring the range of a homomorphism on events :  $\mu(h(e))$ . For example, in (28) and (29)

the measure functions measure the ranges of the homomorphisms from events to their spatial path and their run time, respectively.

Nakanishi (2007), claims that derived measure functions are also relevant for the interpretation of split measure phrases in Japanese, which measure individuals, but are subject to constraints in the domain of eventualities (similarly to what observed with the nominal *more<sub>add</sub>*). Hence, such measure phrases also involve *derived* measure functions: They indirectly measure eventualities, by measuring the range of a homomorphism from events to their individual participants. E.g. the interpretation of the Japanese split measure construction in (30) would be (31):

(30) Gakusei-ga ie-ni san-nin kaet-ta (koto)  
student-NOM home-to three-CL go-PAST  
"Three students went home"

(31)  $\exists e \exists x [*boy(x) \wedge Ag(e)=x \wedge *went\ home\ (e) \wedge \mu(h(e))=2\ individuals]$   
"There is a (plural) walking home eventuality, whose agent is boys, and the cardinality of the individuals participating in this eventuality is 3 individuals".

I will now integrate the idea of an additive measure function, and a derived measure function, and suggest that nominal *more<sub>add</sub>* involves a DERIVED ADDITIVE measure function. More specifically, following ideas about the syntax and semantic type of nonovert measure functions in Schwarzschild (2002) and Nakanishi (2007), I propose that nominal *more<sub>add</sub>* is an overt lexicalization of a derived additive measure function  $\mu'$  which first combines with a degree phrase, type  $d$  (e.g. 3 or 3 *kilos*), then with a nominal predicate, type  $\langle e, t \rangle$  (e.g. *boys / potatoes*), and then with a verbal relation (type  $\langle e, \langle v, t \rangle \rangle$ , where  $v$  is the type of eventualities). Hence the type of nominal *more<sub>add</sub>* is  $\langle d, \langle \langle e, t \rangle, \langle \langle e, \langle v, t \rangle \rangle \rangle \rangle$ , and its denotation is as in (32):

(32) **Nominal *more<sub>add</sub>***  $\lambda d_1. \lambda Q_{\langle e, t \rangle}. \lambda P_{1 \langle e, \langle v, t \rangle \rangle}. \lambda e_{1v}. [\exists x [Q(x) \wedge P_1(x)(e_1) \wedge \mu(h(e_1)) = d_1 \wedge \underline{\exists e_2, P_2, d_2, y [P_2(y)(e_2) \wedge Q(y) \wedge \mu(h(e_2)) = d_2 \wedge \tau(e_2) \leq \tau(e_1)} \wedge \underline{\exists e_3, P_3 z *P_3(z)(e_3) \wedge e_3 = e_1 + e_2 \wedge Q(z) \wedge z=x+y \wedge \mu(h(e_3)) = d_1 + d_2 \wedge e_3 \geq_{developed} e_2}] ]$

In (32)  $h$  is a homomorphism from eventualities to individuals, the asserted eventuality is  $e_1$ , and there are two presuppositions (underlined): the first concerns the presupposed eventuality,  $e_2$ , and the second concerns the sum of  $e_1$  and  $e_2$  ( $e_1 + e_2$ ), i.e.  $e_3$ . To illustrate how this definition works, consider the compositional derivation of (33), in (34) (to simplify the derivation I add the presupposition at the beginning and the end of the derivation only):

(33) 4 children sang. 3 more children danced.

(34) Derivation of *Three more<sub>add</sub> boys danced*:

$3_d \rightarrow 3$  individuals

*more* $_{\langle d, \langle \langle e, t \rangle, \langle \langle e, \langle v, t \rangle \rangle, \langle v, t \rangle \rangle \rangle}$   $\rightarrow \lambda d_1. \lambda Q_{\langle e, t \rangle}. \lambda P_{1 \langle e, \langle v, t \rangle \rangle}. \lambda e_{1v}. [\exists x [Q(x) \wedge P_1(x)(e_1) \wedge \mu(h(e_1)) = d \wedge \underline{\exists e_2, P_2, d_2, y [P_2(y)(e_2) \wedge Q(y) \wedge \mu(h(e_2)) = d_2 \wedge \tau(e_2) \leq \tau(e_1)} \wedge \underline{\exists e_3, P_3 z *P_3(z)(e_3) \wedge e_3 = e_1 + e_2 \wedge Q(z) \wedge z=x+y \wedge \mu(h(e_3)) = d_1 + d_2 \wedge e_3 \geq_{developed} e_2}] ]$

**3 more** $_{\langle \langle e, t \rangle, \langle \langle e, \langle v, t \rangle \rangle, \langle v, t \rangle \rangle}$   $\rightarrow \lambda Q_{\langle e, t \rangle}. \lambda P_{1 \langle e, \langle v, t \rangle \rangle}. \lambda e_{1v}. [\exists x [Q(x) \wedge P_1(x)(e_1) \wedge \mu(h(e_1)) = 3$  individuals]]

**3 more boys** $_{\langle \langle e, \langle v, t \rangle \rangle, \langle v, t \rangle \rangle}$   $\rightarrow \lambda P_{1 \langle e, \langle v, t \rangle \rangle}. \lambda e_{1v}. [\exists x [*boy(x) \wedge P_1(x)(e_1) \wedge \mu(h(e_1)) = 3$  individuals]]

*dance*<sub><v,f></sub> → λe. dance(e) ∧ Agent (e) = x

*dance*<sub><e,<v,f></sub> → λx.λe. dance(e) ∧ Agent (e) = x (**by predicate formation** (Rothstein 2001))

*3 more boys danced*<sub><v,f></sub> → λe<sub>1v</sub>. [∃x [\*boy (x) ∧ dance(e<sub>1</sub>) ∧ Agent (e<sub>1</sub>) = x ∧ μ(h(e<sub>1</sub>)) = 3 individuals]]

*3 more boys danced*<sub>t</sub> → ∃e<sub>1</sub>∃x [student(x) ∧ dance(e<sub>1</sub>) ∧ Agent (e<sub>1</sub>) = x ∧ μ(h(e<sub>1</sub>)) = 3 individuals ∧ ∃ e<sub>2</sub>, P<sub>2</sub>, d<sub>2</sub>, y [P<sub>2</sub>(y) (e<sub>2</sub>) ∧ \*boy(y) ∧ μ(h(e<sub>2</sub>)) = d<sub>2</sub> ∧ τ(e<sub>2</sub>) ≤ τ(e<sub>1</sub>) ∧ ∃ e<sub>3</sub>, P<sub>3</sub> z \*P<sub>3</sub> (z) (e<sub>3</sub>) ∧ e<sub>3</sub> = e<sub>1</sub> + e<sub>2</sub> ∧ \*boy(z) ∧ z=x+y ∧ μ(h(e<sub>3</sub>))= 3 individuals + d<sub>2</sub> ∧ e<sub>3</sub> ><sub>developed</sub> e<sub>2</sub>] ]

In prose: (34) asserts that there is a dancing eventuality, e<sub>1</sub>, whose agent is a plural individual boy, and the cardinality of this agent of e<sub>1</sub> is 3 individuals. It has the following two presuppositions: **(A)** There is an eventuality e<sub>2</sub>, in the denotation of a verbal predicate P<sub>2</sub> (not necessarily 'dancing'), whose run time is prior or equal to that of e<sub>1</sub>, and it has a plural individual boy as an agent. The cardinality of this e<sub>2</sub> event is some degree d<sub>2</sub>, i.e. some number of individuals. **(B)** There is an eventuality e<sub>3</sub>, which is the sum of e<sub>1</sub> and e<sub>2</sub>, in the denotation of a verbal predicate P<sub>3</sub> (e.g. perform), the agent of e<sub>3</sub> is the sum of the agents of e<sub>1</sub> and e<sub>2</sub> in the denotation of *boy*. The cardinality of the agent of e<sub>3</sub> is the sum of the cardinality of the agent of e<sub>1</sub>, plus the cardinality of the agent of e<sub>2</sub>, i.e. 2 individuals+d<sub>2</sub>. And e<sub>3</sub> is more developed than e<sub>2</sub>.

A direction for defining the last component (e<sub>3</sub> ><sub>developed</sub> e<sub>2</sub>) is based on the observation that the distinction between felicitous and infelicitous sentences with *more<sub>add</sub>*, as in (22) vs. (24) correlates with the possibility to paraphrase these sentences using a 'comparative correlative' (or 'conditional comparative') construction. In the infelicitous (22a,b) above, such paraphrases cannot be naturally made. In contrast, in the contexts in (24) these sentences can be paraphrased with comparative correlatives like (35) and (36):

(35) The more papers are written (for the research project), the more funding we get / the better the Dean thinks of the projects, etc.

(36) The more cakes are baked, the more money we have for poor children.

Based on Beck's (1997) modalized approach to conditional comparatives, we take an event e to be more developed than e' if (a) the number of participants of e in w<sub>0</sub> is higher than the number of participants in e', and (b) this higher number of participants leads to, or correlates with a change on a scale measuring another event or entity. More precisely, the following characterization of 'a more developed' eventuality is suggested:<sup>3</sup>

(37) An event e is 'more developed' than an event e' ( e ><sub>developed</sub> e' ), iff  
In w<sub>0</sub> e has a higher number of participants than e', and in all accessible worlds w', and w'', if the number of participants of e<sub>3</sub> in w' is higher than the number of participants of e<sub>3</sub> in w'', then there is another measure function, μ', measuring another entity (eventuality or individual) x, such that μ'(x) in w' > μ(x) in w''

3 This is in contrast to the characterization given in Greenberg (2009B), in terms of the 'stage-of' relation.



### 3 Some Consequences of the analysis

The analysis of nominal *more<sub>add</sub>* above can directly account for some of the observations made in section 1, including the invariability of the nominal predicate in the assertion and presupposition (Q in (32)), the potential variability of the verbal predicates ( $P_1$  and  $P_2$  in (32)), the temporal constraint on the asserted and presupposed eventualities ( $\tau(e_2) \leq \tau(e_1)$ ), and the 'more developed' constraint on the summed eventuality (written as  $e_3 >_{\text{developed}} e_2$ ).

In addition, the analysis can more indirectly account for other observations. First, we can now explain the contrast in measure phrases compatible with *more<sub>add</sub>*, illustrated again in (38):

- (38) a. 3 Liters of water spilled on the carpet. 2 liters more was spilled on the bed.  
 b. 30 degree Celsius water was spilled on the carpet. #10 degree Celsius more was spilled on the bed

The distinction between measure phrases like *3 kilos / 3 liters* as opposed to *12 carat / 10 degrees Celsius* has already been shown to play a role in the felicity of pseudo-partitive constructions (Krifka 1989, 1998 Schwartzschild 2002), as in (39):

- (39) a. 3 liters of water / 3 kilos of potatoes  
 b. #30 degree Celsius of water / # 12 carat of gold

According to Krifka (1989, 1998) *3 liters* is an *additive* measure phrase, whereas *20 degree Celsius* is not additive: 3 liters of water + 2 liters of water = 5 liters of water, but 20 degree water + 10 degree water  $\neq$  30 degree water. Given this distinction we can attribute the infelicity of (39b) to the fact that the additivity requirement in the presupposition of *more<sub>add</sub>* ( $\mu(h(e_3)) = d_1 + d_2$ ) cannot be met with nonadditive measure phrases.

A second consequence of the definition above concerns the observation above, that an implication of a sentence like (40) is that Mary spoke with different students:

- (40) Yesterday John spoke with 4 students. Today Mary spoke with 3 more students

This implication follows from the additivity component too. Krifka (1998) and Moltmann (2004) already took nonoverlap as a precondition on additivity. In our case, for example, if even one of the students that Mary spoke with was also a student that John spoke with, then the number of students participating in  $e_3$  is not  $4+3=7$ . I.e. the additivity presupposition fails.

Finally, the claim that *more<sub>add</sub>* always denotes a (derived and additive) measure function, and combines with a degree phrase seems problematic when we consider sentences like (41), where there is no measure phrase, and we don't know anything about the precise degree measuring the number of individuals participating in the interviewing eventuality:

- (41) Yesterday John interviewed some students. Today he interviewed (some) more

I suggest that in such cases the degree argument that *more<sub>add</sub>* combines with is bound by existential closure, or by *some*. That is, (41) asserts that there is an eventuality,  $e_1$  where John spoke with a certain,  $d_1$  number of students, and presupposes (roughly) that there is another eventuality,  $e_2$ , involving a certain,  $d_2$ , number of students, and that the number of students

involved in the summed (and more developed) eventuality  $e_3$  is the sum of  $d_1$  and  $d_2$ .

The general lesson to learn from such cases is that the goal of nominal *more<sub>add</sub>* is to indicate that the development of the summed eventuality depends on the sum of degrees measuring the participants in its subevents. Crucially, this goal is achieved even if we do not know what the actual summed degree is, i.e. even if we do not know what the exact value of the additive measure function is. The main thing is the dependency on the sum of degrees.

#### 4 Extending the analysis to verbal *more<sub>add</sub>*

Above we analyzed nominal *more<sub>add</sub>* as denoting a derived additive measure function on eventualities. We now want to try and extend this analysis to cases of verbal *more<sub>add</sub>*, as in (42a-b):

- (42) a. John ran 2 miles in the morning. In the afternoon he ran some more.  
 b. Mary slept 20 minutes in the morning. In the afternoon she slept some more

Notice that in (42) the meaning of *more* is indeed additive, and not comparative: For example, the second sentence in (42a) is perfectly felicitous if in the afternoon John ran less than 2 miles.

As with nominal *more<sub>add</sub>*, here too we seem to have an assertion and a presupposition, and here too, I propose, the use of *more<sub>add</sub>* indicates measurement of the sum of presupposed and asserted eventualities, which obeys very similar constraints to the ones found with nominal *more<sub>add</sub>*. First, as with nominal *more<sub>add</sub>*, the presupposed eventuality should not be temporally later than the asserted one, as can be seen from the infelicity of (43):

- (43) # John worked on his paper today. Yesterday he worked on it some more

Second, here too the verbal predicates in the assertion and presupposition can differ, as long as they can be subsumed under a single 'superset' predicate:

- (44) a. Mary ran for a little while. Then she walked some more ('progressed')  
 b. # Mary ran for a little while. Then she slept some more.

Third, here too the asserted and presupposed eventualities should be summed into an eventuality which can be reasonably perceived as 'more developed' than its subevents. Consider (45)-(47):

- (45) In the morning Mary slept a bit. In the evening she slept some more  
 (46) #In the morning Mary slept a bit. In the evening Sara slept a bit more  
 (47) Mary ran for 10 minutes. Then Sara ran some more.

(45) is fine, since intuitively summing Mary's two sleeping eventualities leads to an eventuality which can be considered more developed. For example, we can say that the longer Mary sleeps, the better she feels later on. On the other hand, (46), which differs from (45) only in that the agents of the presupposed and asserted eventualities are not the same, is infelicitous. This is presumably due to the fact that summing Mary's and Sara's sleeping

eventualities, and their running times, only leads to a plural sleeping eventuality, which cannot be considered more developed, from any reasonable perspective. Finally, (47) is again felicitous, although we have two different agents. This is presumably since the summed eventuality can be reasonably considered again more developed. For example, we can imagine a situation, during a relay race, where summing Mary's and Sara's running times and comparing these with the running times of another group can make Mary's and Sara's group win. In contrast, in a context where Mary and Sara do not know each other and run in two distinct, unrelated settings so their summed running eventuality *cannot* be reasonably considered 'more developed', the sentence becomes infelicitous, like (46).

Just like nominal *more<sub>add</sub>*, then, I will assume that verbal *more<sub>add</sub>* denotes an operation which measures a sum of two eventualities, in the assertion and presupposition, and that this summed eventuality should be also 'more developed' than its subevents. However whereas with nominal *more<sub>add</sub>* the summed eventuality is indirectly measured by measuring the sum of individuals (in the denotation of the nominal predicate) participating in it, in (42a) this is done by measuring the spatial length of the spatial path of the summed running eventuality, and in (42b) this is done by measuring the temporal length of the run time of the summed sleeping eventuality. In addition, verbal *more<sub>add</sub>* can also *directly* measure the cardinality of the summed eventuality, and hence denote a non-derived measure function, without using any homomorphism, as in (48):<sup>4</sup>

(48) In the morning John ran 3 times. In the afternoon he ran twice more

We can now give the denotation of verbal *more<sub>add</sub>*. Unlike nominal *more<sub>add</sub>*, which has to combine with a nominal,  $\langle e, t \rangle$  type, verbal *more<sub>add</sub>* (+ the degree phrase) directly combines with the verbal predicate, type  $\langle v, t \rangle$ . Hence its type is  $\langle d, \langle \langle v, t \rangle, \langle v, t \rangle \rangle \rangle$ , and its denotation is as in (49):

(49) **Verbal** *more<sub>add</sub>* :  $\lambda d_1. \lambda P_{1 \langle v, t \rangle}. \lambda e_{1v}. [P_1(e_1) \wedge \mu(e_1) = d_1 \wedge \exists e_2. P_2. d_2 [P_2(e_2) \wedge \mu(e_2) = d_2 \wedge \tau(e_2) \leq \tau(e_1) \wedge \exists e_3. P_3 * P_3(e_3) \wedge e_3 = e_1 + e_2 \wedge e_3 \text{ >developed } e_2 \wedge \mu(e_3) = d_1 + d_2] ]^5$   
(Where  $\mu$  can be a **derived** measure function, i.e.  $\mu'(h(e))$ , or a **non-derived** function)

To illustrate how this definition works consider the derivation of (50) in (51):

(50) John ran 3 kilometers more

(51) **3 kilometers<sub>d</sub>**  $\rightarrow$  3 kilometers

**more<sub>add</sub>** $\langle d, \langle \langle v, t \rangle, \langle v, t \rangle \rangle \rangle \rightarrow \lambda d_1. \lambda P_{1 \langle v, t \rangle}. \lambda e_{1v}. [P_1(e_1) \wedge \mu(h(e_1)) = d_1 \wedge \exists e_2. P_2. d_2 [P_2(e_2) \wedge \mu(h(e_2)) = d_2 \wedge \tau(e_2) \leq \tau(e_1) \wedge \exists e_3. P_3 * P_3(e_3) \wedge e_3 = e_1 + e_2 \wedge e_3 \text{ >developed } e_2 \wedge \mu(h(e_3)) = d_1 + d_2] ]$   
**3 kilometers more**  $\rightarrow \lambda P_{1 \langle v, t \rangle}. \lambda e_{1v}. [P_1(e_1) \wedge \text{spatial length (spatial path } (e_1)) = 3 \text{ kilometers}]$

4 Cf. Nakanishi's (2004) analysis of the Japanese particle *sugiru* (which can be roughly translated as *too much*), which involves similar types of indirect and direct measure functions over eventualities.

5 To capture the condition that  $e_3 \text{ >developed } e_2$  in a way which covers 'development' with both nominal and verbal *more<sub>add</sub>*, we change the characterization in (37) above to (i)

(i)  $e_3 \text{ > developed } e_2$  if for any measure function  $\mu$  measuring  $e_3$  and  $e_2$  it holds that  $\text{In } w_0 \mu(e_3) > \mu(e_2)$  and that in all accessible worlds  $w'$ , and  $w''$ , if  $\mu(e_3)$  in  $w' > \mu(e_3)$  in  $w''$ , then there is another measure function,  $\mu'$ , measuring another entity (eventuality or individual)  $x$ , such that  $\mu'(x)$  in  $w' > \mu'(x)$  in  $w''$

**Ran**  $\langle v, f \rangle \rightarrow \lambda e. \text{ran}(e) \wedge \text{Agent}(e) = x$   
**ran 3 kilometers more**  $\langle v, f \rangle \rightarrow \lambda e_{1v}. [\text{ran}(e_1) \wedge \text{spatial length}(\text{spatial path}(e_1)) = 3 \text{ kilometers}]$   
**Ran 3 kilometers more**  $\langle e, \langle v, f \rangle \rangle \rightarrow \lambda x. \lambda e_{1v}. [\text{ran}(e_1) \wedge \text{spatial length}(\text{spatial path}(e_1)) = 3 \text{ kilometers} \wedge \text{Ag}(e_1) = x]$   
**John ran 3 kilometers more**  $\langle v, f \rangle \rightarrow \lambda e_{1v}. [\text{ran}(e_1) \wedge \text{spatial length}(\text{spatial path}(e_1)) = 3 \text{ kilometers} \wedge \text{Ag}(e_1) = \text{john}]$   
**John ran 3 kilometers more**  $t \rightarrow \exists e_{1v}. [\text{ran}(e_1) \wedge \text{spatial length}(\text{spatial path}(e_1)) = 3 \text{ kilometers} \wedge \text{Ag}(e_1) = \text{john} \wedge$   
 $\wedge \exists e_2, P_2, d_2 [P_2(e_2) \wedge \text{spatial length}(\text{spatial path}(e_2)) = d_2 \wedge \tau(e_2) \leq \tau(e_1) \wedge \exists e_3, P_3$   
 $*P_3(e_3) \wedge e_3 = e_1 + e_2 \wedge e_3 \text{ >developed } e_2 \wedge \text{spatial length}(\text{spatial path}(e_3)) = 3$   
 $\text{kilometers} + d_2]$  ].

The  $e_3 \text{ >developed } e_2$  component (50) and (51) should be now defined in a way appropriate for verbal *more<sub>add</sub>*, so contrasts as in (45-47) above can be accounted for. Thus, we cannot define the development of the summed eventuality  $e_3$  in terms of a higher number of *participants* involved only, as in (37) above. Rather, we have to think in more general terms about a higher degree measuring the event, which can be the value of various types of measure functions: those measuring the number of individuals involved, the length of the run time of the event, the length of the spatial path of the event, the cardinality of the event, etc. That is, the development of the summed eventuality should be characterized in terms of the correlation between the change in the value of the measure function measuring this eventuality, and a change in the value of another measure function, measuring another event or entity. Together with Beck's 1997 modalized approach to comparative correlatives we can require, then, that for any measure function  $\mu$  measuring  $e_3$  and  $e_2$  it holds that in  $w_0$   $\mu(e_3) > \mu(e_2)$  and that in all accessible worlds  $w'$ , and  $w''$ , if  $\mu(e_3)$  in  $w' > \mu(e_3)$  in  $w''$ , then there is another measure function,  $\mu'$ , measuring another entity (eventuality or individual)  $x$ , such that  $\mu'(x)$  in  $w' > \mu'(x)$  in  $w''$ .

The analysis just presented can help us explain why verbal *more<sub>add</sub>* is compatible with *for x time*, modifying activities, but not with *in x time*, modifying achievements and accomplishments:

- (52) a. John ran for 20 minutes (more)  
 b. John arrived to the station / crossed the road in 20 seconds (#more)

I suggest that this contrast is due to the fact that while *for x time* is an additive temporal measure function, *in x time* is non-additive. For example, if (53a) and (53b) are true, then, assuming that there are no additional walking eventualities by me this week, (53c) is entailed:

- (53) a. On Sunday I walked for 30 minutes  
 b. On Tuesday I walked for 20 minutes  
 c. This week I walked for 50 minutes.

In contrast, assuming that no other eventualities of crossing the road by John happened today, the truth of (54a) and (54b), does *not* entail (54c):

- (54) a. In the morning John crossed the road in 30 seconds  
 b. In the afternoon John crossed the road in 20 seconds  
 c. Today John crossed the road in 50 seconds.

The additive presupposition of verbal *more<sub>add</sub>* in (49) above, then, fails with the nonadditive measure phrase *in x time*, in a similar way to the failure of the additive presupposition of nominal *more<sub>add</sub>* with nominal nonadditive measure phrases like *12 carat*, as discussed in section 4 above.

## 5 Summary and some directions for further research

We saw, then, that both nominal and verbal *more<sub>add</sub>* are overt realizations of measure functions in the eventuality domain, which trigger presuppositions of additivity. In the case of nominal *more<sub>add</sub>*, a nominal predicate (type  $\langle e, t \rangle$ ) is always involved. Hence this measure function has to be *derived*: That is, it indirectly measures the growth and development of a summed eventuality by measuring the individuals participating in its subevents (using a homomorphism). In contrast, in the case of verbal *more<sub>add</sub>* the function can be *derived* or *nonderived*: It can indirectly measure the summed eventuality by using homomorphisms, or it can directly measure the cardinality of the summed eventuality, without using any homomorphism.

We saw that the analysis accounts for a number of novel observations concerning the distribution and interpretation of *more<sub>add</sub>*. It also raises, of course, some open questions and directions for further research. One such direction concerns the fact that in addition to its use as an additive operator on eventualities, *more* has other associated meanings in various languages. One such meaning, already mentioned at the beginning of the paper, is comparison. Intuitively, both comparison and additive measurement involve measurement and degrees. We can attempt exploit this similarity in order to develop a unified analysis of both readings by relying on the notion of 'difference functions' used by e.g. Kennedy & McNally 2005, Kennedy & Levin 2008 for capturing the semantics of comparatives and degree achievements. Under the view, for example, the comparative in (55) says that the difference between John's height and Mary's height is 20 cms:

- (55) John is 20 cms taller than Mary

A similar intuitive interpretation can be assigned to the verbal comparative in (56):

- (56) (In the morning John ran 3 kilometers). In the afternoon he ran 2 kilometers *more<sub>comparative</sub>* than he ran in the morning.

Suppose the afternoon running is  $e_1$  and the morning running is  $e_2$ . The use of *more<sub>comparative</sub>* in (56) indicates that the difference between the length of the spatial path of  $e_1$  and  $e_2$  is 2 kilometers. Therefore, John ran 5 kilometers in the afternoon, and altogether he ran 8 kilometers.

Now consider the verbal additive, *more<sub>add</sub>* in (57):

- (57) (In the morning John ran 3 kilometers). In the afternoon he ran 2 kilometers *more<sub>add</sub>*

Assuming again that the afternoon running is  $e_1$  and the morning running is  $e_2$ , the use of *more<sub>add</sub>* in (57) indicates that the difference between the length of the spatial path of  $e_3$  (i.e. the sum of  $e_1$  and the presupposed  $e_2$ ) and  $e_2$  (where John ran 3 kilometers) is 2 kilometers. Therefore, John ran 5 kilometers altogether (i.e. the length of the spatial path of  $e_3$  is 5 kilometers).

The operation of both verbal *more<sub>comparative</sub>* and *more<sub>add</sub>*, then, can be intuitively characterized in terms of difference functions. The contrast between them lies in the input to these functions, i.e. in the choice of the two eventualities between which the difference is calculated. In Greenberg (in progress, A) I attempt to make this intuitive similarity precise, and to derive the contrast from the different syntax of *more<sub>comparative</sub>* and *more<sub>add</sub>*.

Notice, though, that English seems to be quite unique in using one and the same particle for comparison and addition. The situation in other languages is more varied: Some languages (German (e.g. Umbach 2008), Chinese (Tovena & Donazzan 2008)) seem to have *two* lexical items: One for additivity, and one for comparison. Other languages (e.g. Italian (G. Chierchia, p.c.) or French (G. Thomas, p.c.)) seem to have one unambiguous item and / or one which is specified for comparison only, or for additivity only. Hebrew may be a language like that too, since there are constructions where the comparative *yoter* can function as an additive. For example *yoter* in the positive (55) is comparative, but in the negative (56) it is additive (A. Cohen, p.c.):

(58) yeS li yoter ugiyot (mi-le-rina): "I have *more<sub>comparative</sub>* cookies (than Rina)"

(59) ein li yoter ugiyot (I have no *more<sub>add</sub>* cookies =I don't have cookies at all")

A much more common meaning associated with *more<sub>add</sub>*, however, is aspectual additivity (see e.g. German (Umbach 2008), French, Italian and Chinese (Tovena & Donazzan 2008), Hebrew (Greenberg 2009C)). For example, in Hebrew both *more<sub>add</sub>* and the aspectual additive particle *still* are translated as *od*:

(60) a. ba-boker dani yaSan **od** ("In the morning Danny slept some *more<sub>add</sub>*)  
 b. ba-boker dani **od** yaSan ("In the morning Danny was still asleep")

In fact, this is seen in English as well, since the negative counterpart of the aspectual additive particle *still*, is the NPI *anymore*, as in (61):

(61) John is not asleep anymore.

This makes a unified analysis for additive measurement and aspectual additivity desirable. When considering such a potential analysis, we should take into account three interesting differences between aspectual *still* and additive *more<sub>add</sub>*: First, unlike additive *more<sub>add</sub>*, *still* can only combine with homogeneous predicates, e.g. statives and progressives (e.g. Michaelis 1993). Second, unlike what we saw with *more<sub>add</sub>* the presupposed and asserted eventualities with aspectual *still* must be temporally continuous. Third, unlike the variability between the presupposed and asserted eventualities with *more<sub>add</sub>* (which can have different participants (as in (12) above), hold in different spatial locations (as in (16) above), and be even denoted by different verbal predicates (as in (18) above)), with aspectual *still* these eventualities cannot vary. E.g. in *Mary is still singing in the shower* the presupposed eventuality must be also a singing eventuality by Mary in the shower.

A preliminary suggestion to account for these facts is to assume that these differences may result from the fact that with additive *more<sub>add</sub>* the presupposed and asserted eventualities are distinct, while with aspectual *still* the presupposed eventuality is the very same eventuality in the assertion, whose run time is simply prolonged. This direction is theoretically supported by Ippolito's 2007 claim that the eventualities in the assertion and presupposition of *still* are the same.<sup>6</sup> If this is indeed the underlying difference between *more<sub>add</sub>* and aspectual *still*, it can account for the three observations just mentioned: A single eventuality in the assertion and presupposition of *still* cannot be temporally discontinuous and cannot have distinct participants, hold in distinct locations or be in the denotation of different verbal predicates. In addition, only prolonging the run time of an event in the denotation of a homogeneous predicate guarantees that we end up with a single eventuality (and not with a plural one). Further research should examine the similarities and differences between *more<sub>add</sub>* and *still* more closely, and derive them from the different syntactic position of these two particles (see Tovena & Donazzan 2008 for a preliminary proposal.).

Finally, above we saw that verbal *more<sub>add</sub>* is compatible with activities (modified by *for x time*), but not with telic predicates, e.g. accomplishments and achievements (modified by *in x time*). We would thus expect that verbal *more<sub>add</sub>* would be felicitous with accomplishments with bare plural objects, which, as is well known, are atelic and can be modified by *for x time* (as in (62a)). However, as seen in (62b), this prediction is not borne out:

- (62) a. John picked flowers for 20 minutes  
 b. #John picked flowers some more

Further research should examine this data more closely, as well as further interactions between *more<sub>add</sub>* and aspectual categories in detail.<sup>7</sup>

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<sup>6</sup> See Greenberg 2009A for a discussion of this claim.

<sup>7</sup> I develop such an examination and analysis in Greenberg (in progress, B).

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