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Alternative comparison in underspecified degree operators*

Ang Li
Rutgers University

Abstract This paper proposes a new theory for the recurrent ambiguities between the meaning of comparison, additivity, and continuation (CAC) across languages. The theory has two pillars. One is a semantic reanalysis of CAC meanings. I will show that all three meanings can be cashed out via comparisons between alternatives, and that by doing so we can establish inherent logical connections between them. The second pillar is a de-compositional analysis of lexical items expressing CAC meanings (henceforth CAC operators), which makes use of their logical connections to derive the ambiguities as results of underspecification.

Keywords: comparison, additivity, continuation, alternatives, degree semantics, distributed morphology

1 Introduction

Sometimes seemingly distinct meanings are expressed as the same morphosyntactic item; we call it ambiguity. Ambiguities could be nothing but accidents. However, when ambiguities between a given set of meanings are repeatedly attested across different languages, it is more likely that these meanings are inherently related, and we would prefer our language theory to explain this connection.

This paper presents a case study; it is about the recurrent ambiguities between comparison, additivity, and continuation. Section 2 introduces the empirical landscape regarding CAC ambiguities, which summarizes the fieldwork in the previous literature (Greenberg 2010; Thomas 2010, 2018). Section 3 briefly reviews the literature on these three meanings, and explains why the ambiguities constitute a challenge for previous theories. The proposal in section 4 contains two parts. The first part establishes the logical connection between CAC meanings, based on a re-analysis of comparatives presented in Li 2022. The idea is that comparatives always compare two things of the same type, i.e. two alternatives, on a structurally derived measurement dimension; additivity and continuation can both be derived on top of alternative comparisons. The second part, borrowing the insight in Thomas

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2018, uses Distributed Morphology to explain how these related (but not identical) meanings can get realized as the same lexical item in a language. Section 5 compares the current proposal to the previous theory in Thomas 2018. Section 6 concludes.

2 Cross-linguistic ambiguities

Sentences like (1) are ambiguous. In its first interpretation, *more* intuitively expresses a strictly exceeding relation between the apples John bought and the apples Mary bought; the second sentence is true iff John bought eight apples. In the second interpretation, the second sentence is true iff John bought three apples *in addition to* the apples that Mary bought. This is the additive reading of *more*.

(1) Mary bought five apples. ... John bought three more apples.

That a sentence with *more* is truly ambiguous between the two readings can be shown by the fact that, in certain contexts, it is false under one reading and true under another. Consider, for instance, example (2). In the context of (2a), the sentence is true under the comparative reading and false (or infelicitous) under the additive reading; in the context of (2b), the sentence is true under the additive reading and false under the comparative reading.

(2) Twenty people died in the church bombing, and ten more people died in the school bombing.

a. Thirty people died in the school bombing.

b. Ten people died in the school bombing. Thomas 2018: (7)

This additive interpretation of the comparative word – *more* and its cross-linguistic counterparts – is attested in a variety of languages, including (at least) Spanish, Brazilian Portuguese, Guarani, and French.

Another widely attested ambiguity is between additivity and continuation. (3) is an example from German. The particle *noch* has an additive reading exemplified in (3a): the sentence conveys that Otto drank a Schnapps, presupposing that he had drunk Schnapps before. In (3b), the same particle expresses the continuation of an event from an earlier time – the sentence in (3b) conveys that the rain has continued from past to present. Other languages such as Italian (*anchora*) have been reported to have the same ambiguity too (Tovena & Donazzan 2008; Thomas 2018).

(3) *German*

a. Otto had noch einen Schnapps getrunken.
Otto had *noch* one Schnapps drunk
“Otto had another Schnapps."

b. Es regnet noch.
It raining *noch*
"It is still raining."

There are also languages that exhibit a three-way ambiguity. For example, the Romanian particle *mai* can be used to express comparison, additivity, and continuation, as exemplified in (4).

(4) *Romanian*

a. Ion e mai inteligent decât Petre
John is *mai* intelligent than Petre
"John is more intelligent than Petre." comparison

b. Ion va mai citi un roman.
John AUX *mai* read a novel.
"John will read another novel." additivity

c. Ion mai merge la bibiotecă.
John *mai* goes at library
John still goes to the library. continuation

Donazzan & Mardale 2010: (4), (30b), (36)

Moreover, while there are also languages that exhibit ambiguity between additivity and comparison to the exclusion of continuation (e.g., English *more*), languages that exhibit ambiguity between additivity and continuation to the exclusion of comparison (e.g., German *noch*), as well as languages that exhibit no ambiguity between these three meanings (e.g., Vietnamese), the typological investigation in Thomas 2018 found no language that can have ambiguity between comparison and continuation to the exclusion of additivity. In other words, we observe the following implicational universal:

(5) If a morpheme in a language exhibits ambiguity between comparison and continuation, it must also have an additive interpretation.

The above observations strongly suggest the repeated ambiguities are no accident.

3 CAC meanings in the literature

For the majority of the contemporary semantic literature, the comparative marker expresses a relation between two *degrees* – abstract entities corresponding to measurements on a scale. (6) is a typical lexical entry; with this, the meaning of *John is taller than Mary is* is put together in Figure 1: suppose Mary's height is 5'8", the *than*-clause denotes this degree, and the meaning of the whole sentence says John's

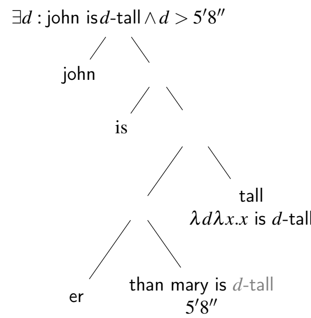


Figure 1 Traditional composition of a comparative construction.

maximal degree of tallness exceeds 5’8”. Amount comparatives receive a similar analysis where cardinality measures are seen as degrees on a strictly numerical scale. Suppose Mary bought five apples, the meaning of *John bought more apples than Mary* comes out as (7).

(6) er := $\lambda d' \lambda g \lambda x. \exists d : gdx \wedge d > d'$

(7) $[\![$John bought more apples than Mary $]\!] \rightsquigarrow$
$\exists d$: John bought d-many apples $\wedge\, d > 5$

On the other hand, the meaning of additive *more* has been characterized in terms of additive measurements of events, instead of degree orderings. For example, Greenberg (2010) assigns additive *more* the meaning in (8): *more* measures events using a derived measurement function μ – *derived* in the sense that it indirectly measures events by measuring the range of a homomorphism on events, $h(e)$. In the additive reading of (1), *more* operates on a homomorphism between events and individuals, presupposing that there is another event e', asserts that e' and the current event e sum into a bigger event e'' that exceeds e in the derived event measurement function. In plain English, the additive reading of (1) is true as long as there is another event that can be summed into the current apple buying event, and the theme of the sum of the two events exceeds the theme of the prior event by three apples, which is true if John bought three apples.

(8) $[\![\text{more}]\!]^1 := \lambda d \lambda Q \lambda P \lambda e. \exists x : [Qx \wedge P(x,e) \wedge \mu(h(e)) = d] \wedge$
$\partial(\exists e', P', d', y : [Qy \wedge P'(y,e') \wedge \mu(h(e')) = d']) \wedge$
$\exists e'' \exists P'' \exists z : [Qz \wedge P''(z,e'') \wedge z = x + y \wedge \mu(h(e'')) = d + d']$

Finally, the meaning of continuative particles like *still* is typically captured in terms of neither degree orderings nor event measurements. The previous literature

1 In this paper I use the partiality operator ∂ (Beaver & Krahmer 2001) to indicate presupposition: $\partial(p) = 1$ iff $p = 1$, otherwise $\partial(p) = \#$.

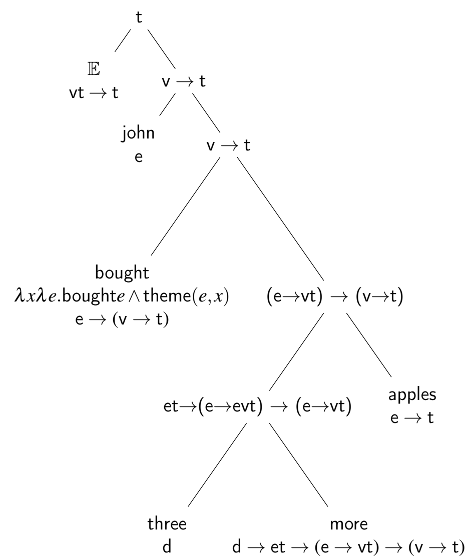


Figure 2 Composition of additive *more* as additive event measurement. I use e for the type of individuals, *t* for truth values, and *v* for events.

usually assumes these particles are associated with a contextually determined scale and the particle adds some presuppositional constraint to the scale. For example, Beck (2020) assigns *still* the lexical entry in (9)[2] and *it is still raining* the composition structure in Figure 3. This derives the most salient reading of this sentence, in which the associated scale is the temporal scale, and the sentence presupposes that there is an alternative time t' that immediately precedes the present time on the temporal scale and that t' is also in the duration of a raining event.

(9) $[\![\text{still}_{x',S'}]\!] := \lambda x \lambda P.\partial(x' \prec_S x \wedge Px') \wedge Px$

The issue: the three literatures on comparison, additivity, and continuation has been developed independently of each, for the most part[3]. The lexical entries proposed for CAC operators are wildly different from each other, which makes it very difficult to establish any logical connections between these three meanings. Without such connections, the recurrent ambiguities shown in section 2 remain a mystery.

Before getting into my own proposal, I ought to mention that Thomas (2018) has taken the first step in the program of connecting CAC meanings. This proposal

2 In Beck's original formulation, x' and S' are treated as arguments of *still*, not subscripts.
3 Feldscher (2017) proposes a way to derive the additive reading from the comparative reading, but didn't discuss the continuative readings.

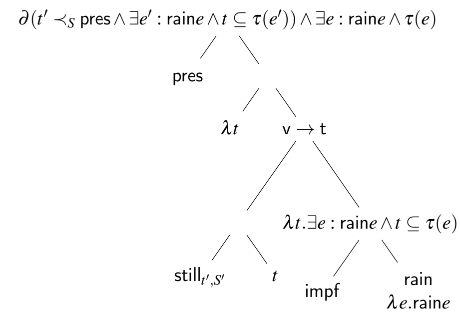


Figure 3 Composition of *it is still raining* in Beck (2020)

is based on a re-analysis of the comparative marker in the framework of scale segment semantics (Schwarzschild 2013), which assumes degree constructions like the comparatives quantify over scale segments, another type of abstract entity we can add to the semantic ontology. My analysis is based on a different re-analysis of the comparative marker, which does not involve scale segments. I will circle back to a comparison to Thomas's theory after the next section.

4 Alternative comparisons

4.1 The baseline re-analysis of comparatives

Li (2022) proposes that comparatives always compare two things of the same type (i.e. two alternatives) on a locally derived measurement dimension (cf. Heim 1985; Bhatt & Takahashi 2007). In her theory, the comparative marker er has the meaning in (10). Its function can be appreciated using an example derivation of *John is taller*, illustrated in Figure 4: er intervenes between a scope-taker in the sentence – here the subject *John* – and its abstraction, and presupposes that a contextually provided degree d' is the maximal measurement of a contextually provided alternative individual y on the dimension of its scope function, i.e. the dimension of people's height in this case. The assertion is that John's height exceeds this degree d', i.e. John is taller than the alternative y.

(10) $\mathsf{er}_{d',y} := \lambda f \lambda x.\partial(d' = \mathsf{max}(\{d \mid fdy\})) \wedge \mathsf{max}(\{d \mid fdx\}) > d'$

Because er can, in principle, intervene between any other scope-taker in the same sentence, it can be licensed by any such scope-taker O and generate a comparison that is about the variable bound by O. This results in a wide variety of possible comparison meanings, as shown in (11) - (14).

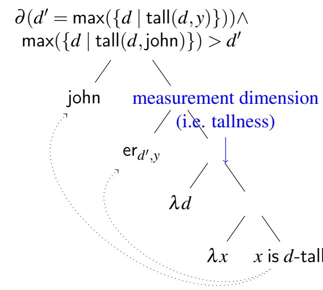


Figure 4 Derivation of *John is taller* in Li 2022

(11) Mary^{y} is 6 ft$^{d'}$ tall. ... Today I finally met a taller$_{d',y}$ woman. $\rightsquigarrow$
$[\text{a}\,[\text{er}_{d',y}\,\lambda x \lambda d\,[x[d\text{-tall woman}]]]$ determiner

(12) John criticized^{P} five$^{d'}$ books. ... He PRAISED more$_{d',P}$. $\rightsquigarrow$
$[\text{PRAISED}\ [\text{er}_{d',P'}\,\lambda P \lambda d\,[d\text{-many books}\,\lambda z[\text{He}\,P z]]]$ predicate

(13) This boat is 20 ft$^{d'}$ long. ... I thought it was longer$_{d',w_@}$. $\rightsquigarrow$
$[\text{I thought}_{w_@}\ [\text{er}_{d',w_@}\,\lambda w \lambda d\,[\text{it was}_w\ d\text{-long}]]$ intensional Op

(14) John^{y} criticized^{P} five$^{d'}$ books. ... Mary PRAISED more$_{d',P,y}$. $\rightsquigarrow$
$[\text{Mary}\ [\text{PRAISED}\,[\text{er}_{d',P',y}\,\lambda P\,\lambda x\,\lambda d\,[d\text{-many books}\,\lambda z[x P\,z]]]]$
multi licensors[4]

In fact, in Li's theory, the only restriction for a possible comparison meaning is that the standard degree must be the measurement of *some* standard alternative on the locally derived dimension. We will see that this restriction is useful to account for some constraints on additive comparatives.

4.2 Connecting CAC meanings

Now we can compositionally derive the meaning of additivity and continuation on top of a comparative. The central idea is that all three meanings can be cashed out as alternative comparisons.

Let's begin with composing the meaning of comparison. In Li's alternative-based theory, the amount comparative *John bought more apples* can have a variety of different meanings, depending on which alternative is available in the context. In the mini discourse of (15), the only contrasting element we can find is the subject,

4 Technically, for this we need to adjust the meaning of *er* to a more general one: $\partial(d' = \mathsf{max}(\{d \mid f d y_0 \ldots y_n\})) \wedge \lambda f \lambda x_0 \ldots \lambda x_n.\mathsf{max}(\{d \mid f d x_0 \ldots x_n\}) > d'$.

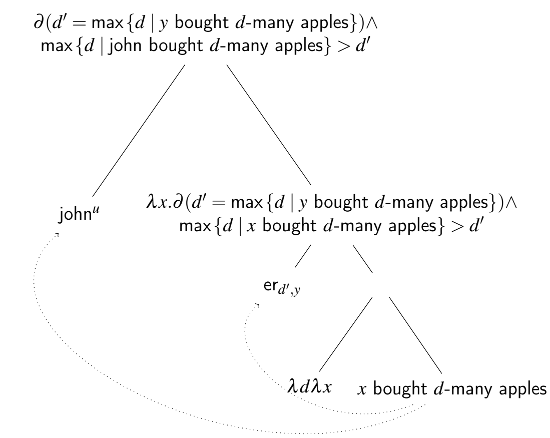


Figure 5 Alternative-based composition of an amount comparative

so a viable semantic derivation of *John bought more apples* in this context is one where the comparative gets licensed by the subject, i.e. it takes parasitic scope under the subject *John*. The complete derivation is given in Figure 5. The meaning we get at the top node says that the maximal number of apples John bought exceeds a contextually salient degree d', presupposing that d' is the maximal number of apples bought by some alternative individual y. In this context, this is true as long as John bought more than what Mary bought – more than five apples.

(15) Mary bought five apples. ... John bought more (apples).

Deriving the additive reading on top of this amount comparison takes no more than inserting an additional operator; call it ADD. ADD has the meaning in (16): it intervenes a predication between a property f and its argument x, and applies f to the summation of x and an alternative y instead.

(16) $\mathsf{ADD}_y := \lambda f \lambda x. f(x \oplus y)$

Figure 6 shows how we can use ADD to get the additive reading: when ADD is co-indexed with the comparative marker and inserted between the comparative marker and its licensor, it effectively turns the target of comparison from x to the summation of x and the standard correlate, y. The meaning we derive at the top node thus becomes a comparison between John and Mary on the one hand, and Mary alone on the other hand, in terms of the number of apples they bought. It is true as long as John bought any apples, in addition to Mary.

Continuation can be characterized using a presupposed additive comparison. Notice that sentences with continuative operators, such as *it is still raining*, don't

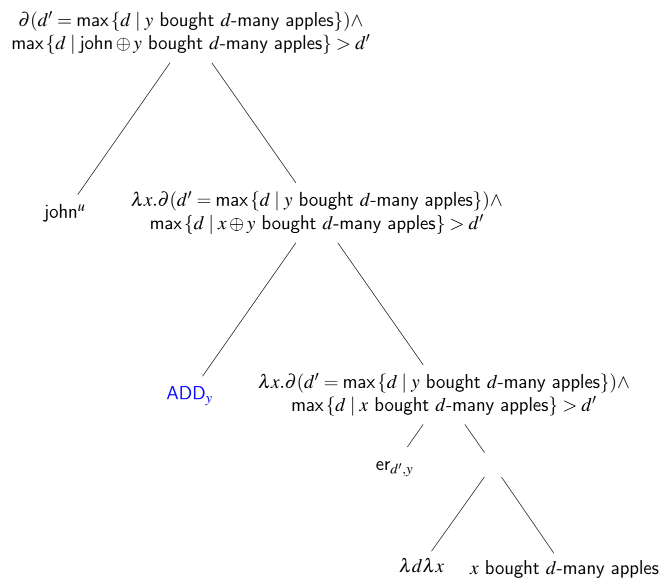


Figure 6 Alternative-based composition of additivity

necessarily have overt degree phrases; I propose that these sentences also contain a comparative marker in the semantic derivation, but the *degrees* that the comparative marker operates on are introduced by a covert operator, which I will call CONT. Its meaning is given in (17).

(17) $\text{CONT} := \lambda P \lambda f \lambda Q \lambda u. fu \wedge \partial(Q(P(\lambda n \lambda u. fu \wedge n \leq_f u))(u))$, where

a. For any two propositions p,q, $p \models_c q$ iff $\forall w \in c : pw \to qw$

b. $n \leq_f u := fu \models_c fn$

The exact semantic function of CONT, including how it introduces *degree*-like objects, can be better appreciated using a concrete example. Consider the detailed derivation for *it is still raining* in Figure 7. To derive the most salient, temporal reading of this sentence, CONT intervenes between the present tense PRES and its scope, and returns a conjunction. The first part of the conjunction is the predication as it would be without the intervening degree operators, i.e. it is raining (18).

(18) $\text{impf}(\text{rain})(\text{pres}) = \exists e : \text{rain}\, e \wedge \text{pres} \subseteq \tau(e)$

The second part of the conjunction is an additive comparison wrapped in the scope of the presupposition operator ∂. The measurement dimension in this additive comparison is manually created by CONT: given its function argument f, CONT creates a measurement dimension $\lambda n \lambda u. fu \wedge f \leq_f u$ and passes it to the comparative and the additive marker. Let's take a closer look at the measurement dimension

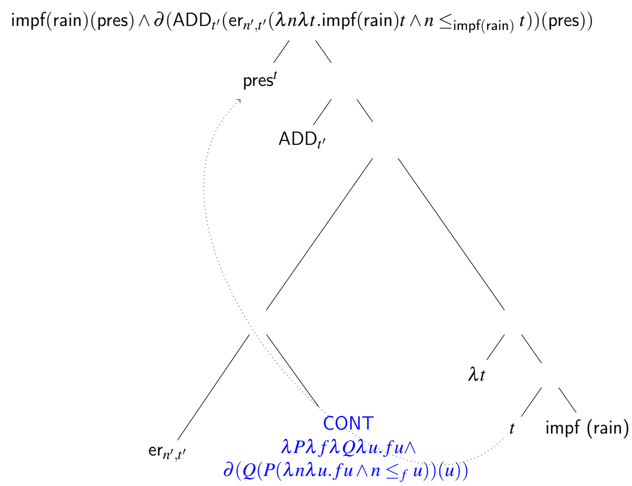


Figure 7 Alternative-based composition of continuation

in this example (19). This is a relation between a time t that is in the duration of a raining event (i.e. $\mathsf{impf(rain)}t$) such that t being in the duration of a raining event entails n is in the duration of a raining event (19a), which is only possible if n is a subinterval of t (19b). In other words, the *degrees* used for comparison, in this derivation, is the subintervals for a given time. Therefore, the comparison in this example is a comparison between t and an alternative time on their maximal subinterval (20). The truth condition of this comparison can be reduced to $t > t'$ (20c) , i.e. t' is a prior time than t if we assume the times are inherently ordered by the precedence relation. Finally, we plug this into the scope of $\mathsf{ADD}_{t'}$ and get an additive relation in return (21b). Note that this doesn't change the ordering relation between t and t': $(t \oplus t') > t'$ is still only true if t' is a prior time than t. The contribution of the additive operator is the continuation inference: $\mathsf{impf(rain)}(t \oplus t')$ abbreviates $\exists e : \mathsf{rain}e \wedge (t \oplus t') \subseteq \tau(e)$, i.e., both t and t' are now in the duration of one, same raining event, so the rain must have *continued* from t' to t.

(19) $\lambda n \lambda t.\mathsf{impf(rain)}t \wedge n \leq_{\mathsf{impf(rain)}} t$

a. $= \lambda n \lambda t.\mathsf{impf(rain)}t \wedge \forall w : \mathsf{impf(rain)}t \text{ in } w \rightarrow \mathsf{impf(rain)}n \text{ in } w$ (by (17b))

b. $= \lambda n \lambda t.\mathsf{impf(rain)}t \wedge n \subseteq t$ (by logical inference)

(20) $\mathsf{er}_{n',t'}(\lambda n \lambda t.\mathsf{impf(rain)}t \wedge n \leq_{\mathsf{impf(rain)}} t)$

a. $= \mathsf{er}_{n',t'}(\lambda n \lambda t.\mathsf{impf(rain)}t \wedge n \subseteq t)$ (by (19b))

b. $= \lambda t.\partial(n' = \mathsf{max}\{n \mid \mathsf{impf}(\mathsf{rain})t' \wedge n \subseteq t'\}) \wedge \mathsf{max}\{n \mid \mathsf{impf}(\mathsf{rain})t \wedge n \subseteq t\} > n'$ (by the definition of $\mathsf{er}_{n',t'}$)

c. $= \lambda t.\partial(\mathsf{impf}(\mathsf{rain})t') \wedge \mathsf{impf}(\mathsf{rain})t \wedge t > t'$ (by logical inference)

(21) $\mathsf{ADD}_{t'}(\mathsf{er}_{n',t'}(\lambda n\lambda t.\mathsf{impf}(\mathsf{rain})t \wedge n \leq_{\mathsf{impf}(\mathsf{rain})} t))(\mathsf{pres})$

a. $= \mathsf{ADD}_{t'}(\lambda t.\partial(\mathsf{impf}(\mathsf{rain})t') \wedge \mathsf{impf}(\mathsf{rain})t \wedge t > t')$ (by (20c))

b. $= \lambda t.\partial(\mathsf{impf}(\mathsf{rain})t') \wedge \mathsf{impf}(\mathsf{rain})(t \oplus t') \wedge (t \oplus t') > t'$ (by the definition of $\mathsf{ADD}_{t'}$)

When we put this additive comparison relation back to the conjunction meaning of the whole sentence, we get the same semantic entailments that have been conventionally associated with *it is still raining*. The literal logical expression of the conjunction meaning is (22a). A part of the presupposed right conjunct, namely the meaning that now is in the duration of a raining event, is also in the asserted left conjunct. We can safely assume this part of the proposition doesn't project as a result, by the same logic that conjunctive sentences like *there is a King of France and the King of France is bald* doesn't presuppose anything on the sentence level; for example, we can adopt the fairly standard view that for any proposition conjunction $p \wedge q$, a presupposition of q won't project to the sentence level if the presupposition is asserted in p. Therefore the left conjunct remains as the asserted meaning of the sentence (22b). The rest of the presupposed content in the right conjunct is the presupposed meaning, namely that the current time and a prior time t' are in the duration of the same raining event (22c). Because they are in the duration of the same event, and generally we think of an event as a temporal continuity, this presupposition gives rise to the inference that the rain never stopped between now and then.

(22) $\mathsf{impf}(\mathsf{rain})(\mathsf{pres}) \wedge \partial(\mathsf{ADD}_{t'}(\mathsf{er}_{n',t'}(\lambda n\lambda t.\mathsf{impf}(\mathsf{rain})t \wedge n \leq_{\mathsf{impf}(\mathsf{rain})} t))(\mathsf{pres}))$

a. $= \mathsf{impf}(\mathsf{rain})\mathsf{pres} \wedge \partial(\partial(\mathsf{impf}(\mathsf{rain})t') \wedge \mathsf{impf}(\mathsf{rain})(\mathsf{pres} \oplus t') \wedge (\mathsf{pres} \oplus t') > t')$ (by (21b))

b. Assertion: it is raining now.

c. Presupposition: the current time and a prior time t' are in the duration of the same raining event.

In addition to these entailments, it has been argued before that *it is still raining* also gives rise to an implicature that it might/will stop raining later (cf. Krifka 2000). I believe this implicature can be derived using Gricean reasonings. If the speaker believes that the rain will continue to a later time, then they could have expressed that by choosing a different tense, e.g., saying *it will still be raining*. In my analysis, this alternative sentence conveys that the raining continues from past to a time later than now, which is strictly more informative than *it is raining*, since the latter only says that the raining continues to now. A pragmatic speaker thus should have said *it will still be raining* if they could have, in order to embrace the principle of Quantity (i.e., be informative). So, the fact that they have not used it suggests they couldn't have, i.e., it is not in their beliefs that the raining might continue to a later time, making *it is still raining* the most informative utterance they can choose.

4.3 Deriving the typology

After establishing the logical connection between CAC meanings, my proposal for deriving the observed typological distributions from there is essentially no different from Thomas 2018, i.e., they can be accounted for using a decompositional analysis of CAC operators couched in Distributed Morphology (DM) (Halle 1990; Bonet 1991; Noyer 1992; Pesetsky 1996).

At a broad level, DM represents a set of hypotheses about the interaction among components of a grammar. The center of the architecture is the synthesis of the following two hypotheses:

(23) **Syntax all the way down:**
The primary mode of meaningful composition, both above and below the word level, is the syntax. Syntax operates on sub-word units, and thus (some) word-formation is syntactic.

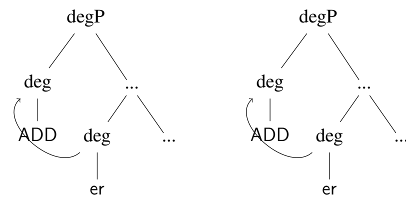
(24) **Realization:**
The pieces manipulated by the syntax (*functional morphemes*) are abstract, lacking phonological content. The pairing of phonological features with the terminals of the syntax (*vocabulary insertion* or *exponence*) happens post-syntactically, in the mapping from syntax to phonological form (PF).

Bobaljik 2017: (2)

In DM, the terminals of syntactic structures are morphemes, i.e. sets of features without phonological content; the phonological realization of a morpheme is governed by the subset principle:

(25) **The subset principle:**
The phonological component of a Vocabulary Item is inserted into a morpheme in the terminal string if the item matches all or a subset of the grammatical features specified in the terminal morpheme. (...) Where several Vocabulary Items meet the conditions for insertion, the item matching the greatest number of features specified in the terminal morpheme must be chosen. Halle 2000

With the subset principle, DM is useful in explaining possible one-to-many correspondences between presentations output by the syntax and phonological realization. For example, for a morpheme $\{x, y\}$ that consists of two features x, y, its



Before After

Figure 8 Merger and fusion in additivity

phonological realization in a language α is determined by the phonological forms in the lexical inventory of α that match subsets of these features. If α has a form A that matches $\{x\}$ and nothing else, then A will be inserted as the spell-out of either $\{x\}$ or $\{x,y\}$. If there is another form, B, in α that matches the feature bundle $\{x,y\}$, then B will be the only possible phonological realization of $\{x,y\}$, since it matches a greater subset of $\{x,y\}$ than A. I propose (again following the basic idea proposed in Thomas 2018) this kind of one-to-many correspondence is exactly what we need to account for the cross-linguistic variation in terms of CAC ambiguities.

First, I assume the degree operators – er, ADD, and CONT – undergo head movement and are fused into one feature bundle at one terminal node on the structure. I assume this could be achieved by Merger and Fusion (Halle & Marantz 1993). Merger first applies to join the head and the head of its complement into a bundle, resulting in either upward or downward movement of a head (26); then Fusion reconfigures a complex head into a singular head with a complex morpheme (27).

(26) Merger:

a. $[_{X'}[_X F_1][_{YP}\ldots[_{Y'}[_Y F_2]\ldots]]] \rightarrow [_{X'}[_X F_1\, F_2][_{YP}\ldots[_{Y'}[_Y]\ldots]]]$

b. $[_{X'}[_X][_{YP}\ldots[_{Y'}[_Y F_2]\ldots]]] \rightarrow [_{X'}[_X F_1][_{YP}\ldots[_{Y'}[_Y F_1\, F_2]\ldots]]]$

(27) Fusion: $[_X F_1\, F_2] \rightarrow [_X\{F_1,F_2\}]$

In the derivation of an additive comparison, the degree head er undergoes upward head movement and then are fused with the head filled by ADD, which results in complex morpheme {er, ADD} (Figure 8). In the derivation of a continuative meaning, the complex deg head er-CONT also moves up to be fused with upper head ADD, resulting in a feature bundle {er,CONT, ADD} (Figure 9). In a given language, the comparative *more* is the spell-out of the morpheme {er}, the additive *more* is the spell-out of the morpheme {er, ADD}, and the continuative operator is the spell-out of the morpheme {er,CONT, ADD}.

Now we can apply the subset principle to derive the typological distribution of CAC operators. Languages that allow for ambiguity between comparison and

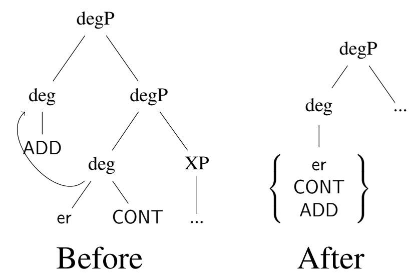


Figure 9 Merger and fusion in continuation

additivity but do not extend it to continuation, e.g. English, must have a lexical item matching the feature {er} (e.g., *more*) and another lexical item matching {er, CONT, ADD} (e.g., *still*), but not a specific one for {er, ADD}. When spelling out {er, ADD}, we can only use the phonological form matching the greatest number of subsets, i.e. the one matching {er}; hence the ambiguity between the comparative and additive *more*. For the spell-out of continuation, because a more specific lexical item matching the entire set is available, the less specific item can't be inserted, therefore the ambiguity with continuation is not possible. Reversely, languages that allow for ambiguity between additivity and continuation to the exclusion of comparison, such as German, must have a lexical item matching the feature {er} (e.g., *mehr*), and another lexical item matching {er, ADD} (e.g., *noch*), but not one for {er, CONT, ADD}. In these languages, the phonological realization of the additive *more* (i.e., {er, ADD}) can't be the same as the additive *more* (i.e., {er}), because we have a more specific lexical item matching features of the former set. On the other hand, because there are no more specific lexical items matching the morpheme of continuation (i.e. {er, CONT, ADD}), its phonological realization will be the one matching {er, ADD} instead – this derives the ambiguity between the additive *more* and continuation. Languages that allow for a three-way ambiguity between CAC meanings are languages where the most specific lexical item matching subsets of {er, CONT, ADD} is one matching {er} (e.g., Romanian *mai*). Because of the absence of more specific items, both additive *more* and the continuative operator will be spelt out as the same as the comparative *more*. Reversely, languages where no ambiguities are detected, such as Vietnamese, are languages that have a lexical item *a* matching {er}, a lexical item *b* matching {er, ADD}, and yet another one *c* matching {er, CONT, ADD}. According to the subset principle, the existence of *b* blocks the insertion of *a* as the phonological realization of the additive *more*, and the existence of *c* blocks the insertion of *a* or *b* as the phonological realization of continuation. Consequently, no ambiguity arises. These patterns are summarized in Figure 10.

Comparison/Additivity ǀ Continuation	English: $\{\mathsf{er}\} \leftrightarrow$ er, $\{\mathsf{er},\ \mathsf{CONT},\ \mathsf{ADD}\} \leftrightarrow$ still
Comparison ǀ Additivity/Continuation	German: $\{\mathsf{er}\} \leftrightarrow$ mehr, $\{\mathsf{er},\ \mathsf{ADD}\} \leftrightarrow$ noch
Comparison /Additivity/Continuation	Romanian: $\{\mathsf{er}\} \leftrightarrow$ mai
Comparison ǀ Additivity ǀ Continuation	Vietnamese: $\{\mathsf{er}\} \leftrightarrow$ hon, $\{\mathsf{er},\ \mathsf{ADD}\} \leftrightarrow$ nūa, $\{\mathsf{er},\ \mathsf{CONT},\ \mathsf{ADD}\} \leftrightarrow$ *van*

Figure 10 Typology of CAC ambiguities

We can also explain the implicational universal in (5). Continuation requires the presence of all three features. If a language has an item α that is homophonous between comparison and continuation, it must be that α matches $\{\mathsf{er}\}$, and that α is the most specific lexical item matching subsets of $\{\mathsf{er}, \mathsf{ADD}, \mathsf{CONT}\}$, i.e. there is not other lexical item β that matches $\{\mathsf{er}, \mathsf{ADD}\}$ or $\{\mathsf{er}, \mathsf{ADD}, \mathsf{CONT}\}$. Therefore α must also be inserted when the feature bundle is $\{\mathsf{er},\ \mathsf{ADD}\}$, because it will necessarily be the most specific lexical item matching this set of features. It is thus guaranteed that α can also be used to express additivity.

Note that Figure 10 does not necessarily exhaust the possibilities provided by the current analysis, and it probably doesn't. For example, it is possible that in certain languages, the Merger and Fusion between two degree heads don't apply to begin with. In those languages, we may expect that the two heads are realized as two distinct lexical items that can co-occur. A lot of interesting fieldwork needs to be done in this area, and I have to leave it to future explorations.

5 Comparing to scale segments

5.1 Thomas 2018

As I have mentioned before, Thomas 2018, couched in scale segment semantics, is the only account in the existing literature that addresses the cross-linguistic CAC ambiguities.

A scale segment σ is an abstract entity. Formally it is a quadruple $\langle u, v, >_\sigma, \mu_\sigma \rangle$ where μ_σ is a measurement function, $>_\sigma$ is a partial ordering on the range of μ_σ, and u, v are in the range of μ_σ. In scale segment semantics, instead of a degree relation, adjectives denote a predicate of scale segments (28) that maps the measurement of a scale segment to a pre-existing dimension, such as height. The meaning of a comparative is a quantification over scale segments; e.g., *Mary is taller than John* is rendered as (29), which says that there is a scale segment that starts from John's height and ends with Mary's height, and it is a rising scale segment ($\nearrow \sigma$), i.e., the end of the segment exceeds the start.

(28) $[\![\text{tall}]\!] := \lambda \sigma . \mu_\sigma = \mathsf{height}$

(29) $\exists \sigma.\mathsf{start}(\sigma, \mu_\sigma \mathsf{john}) \wedge \nearrow \sigma \wedge \mu_\sigma = \mathsf{height} \wedge \mathsf{end}(\sigma, \mu_\sigma \mathsf{mary})$

The meaning of an amount comparative is captured in a similar manner. Thomas (2018) assumes that in amount comparatives, the morpheme COUNT, which is decomposed from the *more* in amount comparatives, maps the measurement function of the given scale segment to the cardinality dimension (30). The meaning of the sentence *John bought more apples* will come out as (31); in plain English, this says that there is a rising scale segment of quantity that starts from the measurement of some antecedent apples and ends with the measurement of the apples John bought.

(30) $\mathsf{COUNT} := \lambda \sigma.\mu_\sigma = \mathsf{cardinality}$

(31) $\exists \sigma. \nearrow \sigma \wedge \mu_\sigma = \mathsf{cardinality} \wedge \mathsf{start}(\sigma, \mu_\sigma g_1) \wedge$
$\mathsf{end}(\sigma, \mu_\sigma(\oplus(\{x \mid \mathsf{apples} x \wedge \mathsf{john\ bought}\, x\})))$

Importantly, different components of a scale segment, such as the start and the end point, the measurement function, the differential value, etc., are all composed together in a way similar to theta role specification in event semantics. As a result, it is possible to *hijack* the specification of a certain role and manipulate it. Thomas (2018) proposes this is exactly how we connect the CAC meanings. The additive reading of an amount comparative is derived when an operator ADD hijacks the introduction of the end point and manually reassigns it to a sum value; this reading of *John bought more apples* comes out as (32): instead of ending with the cardinality of the apples John alone bought, the scale segment now ends with the cardinality of the sum of the antecedent and the apples bought by John.

(32) $\exists \sigma. \nearrow \sigma \wedge \mu_\sigma = \mathsf{cardinality} \wedge \mathsf{start}(\sigma, \mu_\sigma(g_1)) \wedge$
$\mathsf{end}(\sigma, \mu_\sigma(\oplus(\{x \mid \mathsf{apples} x \wedge \mathsf{john\ bought}\, x\})) \oplus g_1)$

Same as in my account, the meaning of continuation is derived through a presupposed additive comparison. The measurement dimension of this comparison is *event development* (Landman 1992), which is encoded in the lexical meaning of another operator CON. In short, the temporal continuation reading of *it is still raining* derived in this account is as follows:

(33) Assertion: now is within the duration of a raining event e.
Presupposition: there is a rising scale segment of event development that starts from the measurement of some antecedent event g_1 and ends with the measurement of $g_1 \oplus e$ (i.e. $g_1 \oplus e$ is a more developed event than e).

5.2 Theory comparisons

There are some parallels between this account and mine. For starters, both accounts take the meaning of comparison to be a comparison between two correlates on some dimension, rather than an ordering relation that directly applies to degrees as in traditional comparative semantics. In both accounts, the logical connection between CAC meanings is implemented by incrementally adding covert operators manipulating the comparison correlates and the measurement dimension.

A crucial feature that differentiates these two accounts is the source of the measurement dimension. In my proposal, which revolves around scope-taking, the measurement dimension is structurally derived: it is directly determined by the scope of the comparative marker. In Thomas (2018), the measurement dimension is encoded in the lexical meaning of an overt or covert item, such as the scalar additive or the operator CON. This distinction leads to different predictions in two regards. I will discuss them one by one and argue that, in both of them, my account makes the more desired prediction.

The first is about the context sensitivity of additive comparatives. In Thomas 2018, since the measurement dimension of an amount comparative is simply the cardinality function, lexically encoded in the meaning of *more*, the additive reading of *John bought more apples* would be a comparison between the sum of the apples John bought and some aforementioned objects g_1 and g_1 alone, in terms of their cardinalities (35). It wrongly predicts that this reading is available as long as there is an accessible antecedent denoting a summable object. For example, it predicts that this sentence has the additive reading even in (34), because (34) has an accessible antecedent *those three apples* that can be summed with the apples John bought. In reality, *more* in (34) doesn't have this additive reading; in fact, *more* doesn't seem to have any felicitous reading at all in this negative context. In my account, the additive comparison is one between the sum of John and some alternative person g_1 and John alone, in terms of the number of apples they bought, presupposing that the previous context entails that g_1 has bought some apples (36). The infelicity is expected: this comparison meaning is infelicitous in the negative context, because the presupposition isn't satisfied, thanks to the negation (see Li 2022 for more detailed discussions on amount comparatives' context sensitivity).

(34) Mary didn't buy those three apples. ... John bought more (apples).

(35) $\exists\sigma. \nearrow\sigma \wedge \mu_\sigma = \mathsf{COUNT} \wedge \mathsf{START}(\sigma, \mu_\sigma(g_1)) \wedge \mathsf{END}$
$(\sigma, \mu_\sigma(\oplus(\{x \mid \mathsf{apples} x \wedge \mathsf{john\ bought} x\})) \oplus g_1)$

(36) $\partial(d' = \max\{d \mid g_1 \text{ bought } d\text{-many apples}\}) \wedge$
$\max\{d \mid \mathsf{john} \oplus g_1 \text{ bought } d\text{-many apples}\} > d'$

Another differentiating result is about generating to the variety of non-temporal continuative meanings. Continuative operators like *still* across different languages are consistently ambiguous between a number of flavors. For example, the most salient reading of *Anthea is still tall* is not temporal continuation (which presupposes that Anthea was tall at a prior time); instead, it is a reading that presupposes someone else is taller than Anthea and conveys that she is only marginally tall. This is the so-called *marginal* reading (König 1977; Ippolito 2007; Beck 2020). It's not clear at all how this reading can be captured using event development comparison in Thomas 2018. On the other hand, my account can derive this reading simply by having the degree operators take scope at a different position. When CONT intervenes the predication of the subject as shown in (37), instead of the present tense, the additive comparison effectively derived is one between two (plural) individuals on the number of people whose being positively tall are entailed by them being tall, i.e., the number of people who are not shorter than them (38), and eventually come down to the inferences in (39). The theory can derive non-temporal continuative readings because it has the flexibility of changing the scale of the additive comparison by changing the scope configuration of the sentence.

(37) $[\text{Anthea}\,[[\mathsf{ADD}_y\,[[\mathsf{er}_{d',y}\,\mathsf{CONT}\,]\,\lambda x\,[x\,\text{is}\ \mathsf{POS}\ \text{tall}\,]]]]]$

(38) $\mathsf{POS(tall)(anthea)} \wedge \partial(\mathsf{ADD}_y(\mathsf{er}_{n',y}(\lambda n \lambda x.\mathsf{POS(tall)}x \wedge n \leq_{\mathsf{POS(tall)}} x))(\mathsf{anthea}))$

(39) a. Assertion: Anthea is tall.

b. Presupposition: An alternative individual y is tall and taller than Anthea.

c. Implicature: People shorter than Anthea are not tall (i.e. Anthea is only marginally tall).

6 Conclusion

In this paper, I have introduced an account that explains the recurrent ambiguities between comparison, additivity, and continuation. I have shown that while it inherits some key insights from the previous account, Thomas 2018, the current account also improves in predicting the context sensitivity of CAC operators as well as allowing for more flexible scale-associations. In addition, it also shows that giving an account of the phenomenon without introducing scale segments is possible.

I hope to have shown that a semantic approach based on scope-taking and structurally derived alternatives greatly unifies the representations of these meanings. In addition to addressing the CAC ambiguities as discussed in this paper, it is worth considering whether the alternative-based meanings shown in this paper sheds light on other issues in these literatures. For example, a central topic in the literature of continuative operators (also called *scalar particles*) like *still* is how to unify their different readings in different languages. I have shown in section 5 that we can unify the temporal and marginal reading organically; whether it can be further extended to other readings like the concessive reading will be an interesting topic for future explorations.

References

Beaver, David & Emiel Krahmer. 2001. A partial account of presupposition projection. *Journal of logic, language and information* 10(2). 147–182. doi:10.1023/A:1008371413822.

Beck, Sigrid. 2020. Readings of scalar particles: *noch/still*. *Linguistics and Philosophy* 43(1). 1–67. doi:10.1007/S10988-018-09256-1.

Bhatt, Rajesh & Shoichi Takahashi. 2007. Direct comparisons: Resurrecting the direct analysis of phrasal comparatives. In *Semantics and Linguistic Theory*, vol. 17, 19–36. doi:https://doi.org/10.3765/salt.v17i0.2958.

Bobaljik, Jonathan David. 2017. Distributed morphology. In *Oxford research encyclopedia of linguistics*, doi:10.1093/acrefore/9780199384655.013.131.

Bonet, Eulalia. 1991. *Morphology after syntax: Pronominal clitics in Romance*. MIT.

Donazzan, Marta & Alexandru Mardale. 2010. Additive and aspectual adverbs: towards an analysis of romanian *mai*. *Revue roumaine de linguistique* 55(3). 247–269.

Feldscher, Cara. 2017. An additive ambiguity: summing events or degrees. In *Proceedings of the ESSLLI 2017 student session*, 104–115.

Greenberg, Yael. 2010. Additivity in the domain of eventualities (or: Oliver twist's more). In *Proceedings of Sinn und Bedeutung*, vol. 14 14, 151–167.

Halle, M & Alec Marantz. 1993. Distributed morphology and the pieces of inflection. In *The view from building 20*, 111–176. The MIT Press.

Halle, Morris. 1990. An approach to morphology. In *North East Linguistics Society*, vol. 20 1, 12.

Halle, Morris. 2000. Distributed morphology: Impoverishment and fission. *AMSTERDAM STUDIES IN THE THEORY AND HISTORY OF LINGUISTIC SCIENCE SERIES 4* 125–150. doi:10.1075/cilt.202.07hal.

Heim, Irene. 1985. Notes on comparatives and related matters. *Ms., University of Texas, Austin* https://semanticsarchive.net/Archive/zc0ZjY0M/Comparatives%2085.pdf.

Ippolito, Michela. 2007. On the meaning of some focus-sensitive particles. *Natural Language Semantics* 15(1). 1–34. doi:10.1007/S11050-007-9004-0.

König, Ekkehard. 1977. Temporal and non-temporal uses of 'noch' and 'schon' in german. *Linguistics and philosophy* 173–198. doi:10.1007/BF00351102.

Krifka, Manfred. 2000. Alternatives for aspectual particles: semantics of *still* and *already*. In *annual meeting of the Berkeley Linguistics Society*, vol. 26 1, 401–412. doi:10.3765/bls.v26i1.1125.

Landman, Fred. 1992. The progressive. *Natural language semantics* 1(1). 1–32. https://www.jstor.org/stable/23748776.

Li, Ang. 2022. Comparative anaphora: comparing alternatives. In *Semantics and Linguistic Theory*, vol. 31, 484–505. doi:https://doi.org/10.3765/salt.v31i0.5091.

Noyer, Robert Rolf. 1992. *Features, positions and affixes in autonomous morphological structure*: Massachusetts Institute of Technology PhD dissertation.

Pesetsky, David Michael. 1996. *Zero syntax: Experiencers and cascades* 27. MIT press. doi:10.2307/415895.

Schwarzschild, Roger. 2013. Degrees and segments. In *Semantics and Linguistic Theory*, vol. 23, 212–238. doi:10.3765/SALT.V23I0.2661.

Thomas, Guillaume. 2010. Incremental *more*. In *Semantics and Linguistic Theory*, vol. 20, 233–250. doi:https://doi.org/10.3765/salt.v20i0.2558.

Thomas, Guillaume. 2018. Underspecification in degree operators. *Journal of Semantics* 35(1). 43–93. doi:10.1093/jos/ffx015.

Tovena, Lucia M & Marta Donazzan. 2008. On ways of repeating. *Recherches linguistiques de Vincennes* (37). 85–112. doi:10.4000/rlv.1724.

Ang Li
277 Park Avenue
New York, NY 10172, USA
ang.li.aimee@gmail.com