## Rising scale segments: additivity, comparison and continuation

**Problem** In several unrelated languages, additivity is homophonous with comparison (e.g. English *more*) and/or continuation (e.g. German *noch*, 'still'), as illustrated in examples (1) and (2), where the additive interpretation of *more* and *noch* is the most salient. The homophony between comparison and additivity is also attested with the Guarani suffix *-ve* (see Thomas 2009), with the French *de plus*, Spanish *más* and Portuguese *mais*. The homophony between additivity and continuation is attested in Hebrew (*od*, Greenberg 2012) among other languages. Finally, Romanian *mai* may be interpreted as an additive, comparative or continuative operator.

(1) Tom had two coffees this morning, and he had one more after lunch.

(2) Otto hat NOCH einen Schnaps getrunken. (Otto had another Schnaps, Umbach 2012)

Existing analyses of additivity (Greenberg 2009, 2010, Thomas 2009, 2010) posit an ambiguity between the additive and the non-additive interpretations of these particles. This does not account for the lexical association of additivity with comparison and continuation cross-linguistically. The goal of this talk is to explain this association by decomposing the denotation of the relevant particles and pointing out a common core, using Schwarschild's (2012, 2013) notion of directed scale segments and an analysis of semantic underspecification in Distributed Morphology (DM).

**Comparison** Schwarzschild (2012, 2013) proposes that comparative statements assert the existence of a scale segment $\sigma$ that is rising ($\nearrow\sigma$), whose starting point $\text{START}(\sigma)$ is the measurement of the standard of comparison and whose endpoint $\text{END}(\sigma)$ is the measurement of the target of comparison. I propose an extension of Schwarzschild's analysis that deals with amount comparison in the following way: (3) asserts the existence of a rising segment $\sigma$ on a scale of cardinalities, such that $\text{START}(\sigma)$ is the cardinality of the set of beers that Sandra drank, $\text{END}(\sigma)$ is the cardinality of the set of beers that Tom drank, and the difference $\Delta(\sigma)$ between $\text{END}(\sigma)$ and $\text{START}(\sigma)$ equals 2:

(3) Tom drank two more beers than Sandra.

$$\exists\sigma[\nearrow\sigma \wedge \text{START}(\sigma) = |\{x : \mathbf{beer}(x) \wedge \mathbf{drink}(x)(\mathbf{Sandra})\}|$$
$$\wedge \text{END}(\sigma) = |\{x : \mathbf{beer}(x) \wedge \mathbf{drink}(x)(\mathbf{Tom})\}| \wedge \Delta(\sigma) = 2]$$

Following Bresnan (1973), a gradable predicate is formed from a non-gradable NP (or VP) by inserting a covert MUCH operator in the LF. MUCH combines with a measure function $f$, two sets of entities $P$ and $Q$ and a functional head $\Sigma$ (of the type of END or START). RISE denotes a property of rising scale segments and is combined intersectively with the property of scale segments it c-commands. A differential expression in (9) measures the difference between the extremities of the scale. The LF of (3) is given in (10), where expressions in big caps stand for (bundles of) features in DM:

(4) $[\![\text{MUCH}]\!]^c = \lambda f.\lambda P.\lambda Q.\lambda\Sigma.\lambda\sigma.\Sigma(\{x : P(x) \wedge Q(x)\})(f)(\sigma)$

(5) $[\![\text{COUNT}]\!]^c = \lambda P.|P|$

(6) $[\![\text{END}]\!]^c = \lambda P.\lambda f.\lambda\sigma.\text{END}(\sigma) = f(P)$

(7) $[\![\text{START}]\!]^c = \lambda P.\lambda f.\lambda\sigma.\text{START}(\sigma) = f(P)$

(8) $[\![\text{RISE}]\!]^c = \lambda\sigma.\nearrow\sigma$

(9) $[\![\text{DIFF TWO}]\!]^c = \lambda\sigma.\Delta(\sigma) = 2$

(10) [$\exists_\sigma$ [[[ DIFF TWO ] [ RISE [ END [[[ MUCH COUNT ] BEER ] 1 TOM DRANK $t_1$ ]]]]
[ START [[[ MUCH COUNT ] BEER ] 1 SANDRA DRANK $t_1$ ]]]]

In the talk, I will also present an analysis of adverbial comparison along the same lines.

**Additivity** The additive interpretation of (11) is captured by letting the starting point of the segment be the measurement of a contextually salient set of beers $\phi_{\text{BEER},c}$, while its endpoint is the measurement of the union of this set with the set of beers that Tom drank. The numeral *one* is interpreted as a differential expression: (9) is true iff there is a rising scale segment $\nearrow\sigma$ that starts with the cardinality of some salient set $\phi_c$ and that ends with the cardinality of the union of $\phi_c$ with the set of beers that Tom drank, and the difference between the endpoint and the starting point of the scale equals one (which entails that Tom drank one beer).

(11) Tom drank one more beer.

Whereas comparative interpretations of *more* are generated by combining MUCH with END and START, which fix the endpoint and the starting point of a scale segment respectively, additive interpretations are obtained by combining MUCH with the additive head ADD, which fixes both the starting point and the endpoint of a scale, as shown in (12). The LF of (11) is given in (13):

(12) $[\![\text{ADD}]\!]^c = \lambda P.\lambda f.\lambda\sigma.\textsc{start}(\sigma) = f(\phi_{P,c}) \wedge \textsc{end}(\sigma) = f(P \cup \phi_{P,c})$

(13) [$\exists_\sigma$ [ [DIFF TWO] [ RISE [ ADD [ [[MUCH COUNT] BEER] 1 TOM DRANK $t_1$ ] ] ] ] ]

**Continuation** Temporal continuation is expressed by quantifying over segments of the time line (the set of instants of time ordered by the temporal precedence relation). Let $\partial$ be the static presupposition operator of Beaver and Krahmer (1998). Then *es regnet noch* ('it is still raining') is analyzed as in (14). It asserts that there is an increasing segment $\sigma$ of the time line whose endpoint is the time of utterance $t^*$ such that it is raining at $\sigma$'s endpoint, and it presupposes that it is raining at every instant in $\sigma$ that precedes its endpoint:

(14) $\exists\sigma[\nearrow\sigma \wedge \textsc{end}(\sigma) = t^* \wedge \textbf{rain}(t^*) \wedge \partial\forall t(t \in \sigma \wedge t < \textsc{end}(\sigma) \rightarrow \textbf{rain}(t))]$

(15) $[\![\text{CONT}]\!]^c = \lambda P_{<i,t>}.\lambda\sigma.\lambda t.\textsc{end}(\sigma) = t \wedge P(t) \wedge \partial\forall t(t \in \sigma \wedge t < \textsc{end}(\sigma) \rightarrow P(t))$

(16) [$\exists_\sigma$ [ PRES [ RISE [ CONT [ RAIN ] ] ] ] ]

**Vocabulary insertion** In English, the vocabulary item *still* is specified for the feature RISE in the context of the feature CONT. On the contrary, *more* is specified for the feature RISE without contextual restriction. Consequently, the insertion of *more* in the context of CONT is blocked by the availability of the more specific VI *still*. In German, *noch* is only specified for RISE, while *mehr* is specified for RISE in the context of END, which prevents *noch* from spelling out comparison. Finally, in Romanian *mai* is specified for RISE without contextual restriction and no other VI is specified for RISE. In all of these languages, ADD, END and CONT are realized as zero morphemes.

**Restrictions on additivity interpretations of *more*** Greenberg (2009, 2010) and Thomas (2009, 2010) observed that *more* is unattested with gradable predicates that denote intensive measure functions, as illustrated in (17). I propose that this follows from the fact that additive *more* requires the insertion of MUCH for type theoretic reasons. As Schwarzschild (2006) observed, MUCH is incompatible with gradable predicates that are interpreted intensively, even in comparative sentences. To wit, (18) cannot mean that the coffee that I bought was hotter than the coffee than Bill drank, but only that I bought more coffee by volume, price, or some other salient extensive measurement.

(17) Yesterday John bought 10 carat gold. #Today he bought 12 carat more. (Greenberg 2010)

(18) I bought more coffee than Bill.

One advantage of this analysis it that it reduces the anti-intensiveness of additivity to a restriction that is independently attested with comparative interpretations of *more*. Other restrictions on additive interpretations of *more* will be discussed in the talk.

**Conclusion** The common semantic core of additive, comparative and continuation operators is quantification of rising scale segments. These operations differ from one another in the identification of the segments' extremities and the nature of the scales. The homophony that this observed cross-linguistically is due to semantic underspecification of VIs such as *more*, *noch* and *mai*.