Equatives, measure phrases and NPIs

The goal of this paper is to establish a compositional semantic analysis of the equative morpheme that accounts for a variety of empirical facts: 1) that equatives are typically ambiguous; 2) that NPIs are licensed in their subordinate clauses; and 3) that measure phrase ('MP') equatives are interpreted differently than clausal equatives. While standard theories of the equative can account for (1), I present a new approach that additionally addresses (2) and (3).

Equatives are typically ambiguous between an 'at least' and an 'exactly' interpretation, illustrated by the two different felicitous responses to A's utterance below.

(1) A: John is as tall as Sue is.
B: Yes, in fact John is taller than Sue is. 'at least' reading
B′: No, John is actually taller than Sue is. 'exactly' reading

The response B is consistent with John being taller with Sue; B′ is inconsistent. No interpretation of A's utterance in (1) is compatible with John being shorter than Sue (an 'at most' reading).

Anyone who is exactly as tall as Sue is always at least as tall as Sue, so the 'exactly' reading entails the 'at least' reading. This suggests that the equative is a good candidate for a scalar-implicature ('SI') account (Horn, 1972; Klein, 1980; Chierchia, 2004) which assigns the equative the weak semantic meaning and achieves the strong reading via pragmatic implicature, when possible. A recent formalization of this approach gives the equative the meaning in (2) (Heim, 2000; Schwarzschild, 2008).

(2) $[\![\text{as}]\!] = \lambda D' \lambda D \exists d[D(d) \wedge \textsc{Max}(D') = d]$

I'll refer to the subordinate clause or phrase in equatives as the **target**, and the matrix clause as the **correlate**. The first argument of the equative in (2) will be filled by the denotation of the target, e.g. $\{d$: Sue is d-tall$\}$ in *John is as tall as Sue is* (Bresnan, 1973). The second argument will be filled by the denotation of the correlate, e.g. $\{d$: John is d-tall$\}$ in *John is as tall as Sue is*.

The analysis in (2) has two problems: it fails to account for the licensing of NPIs in the equatives, and it fails to correctly predict the interpretation of equatives with MP targets. First: equatives, like comparatives, license NPIs in their targets.

(3) a. John is taller than he has **ever** been.
b. John is as tall as he has **ever** been.

Ladusaw (1979) has famously argued that NPIs are licensed in downward-entailing (DE) contexts. And, in fact, the internal argument of the comparative is downward-entailing. (Because the comparative is a degree quantifier, a DE test must be performed with sets of degrees, not individuals, contra Seuren (1984); von Stechow (1984); Hoeksema (1983). Just because white cats form a subset of cats doesn't mean that the degrees to which white cats are tall form a subset of the degrees to which cats are tall.)

Many scholars have therefore used (3a) to argue for a particular analysis of the comparative, (4), which is DE in its first argument (D'; McConnell-Ginet, 1973; Seuren, 1984, a.o).

(4) $\lambda D' \lambda D \exists d[D(d) \wedge \neg D'(d)]$

The analysis of the equative given in (2) is not DE, but rather non-monotonic, in its first argument, and therefore it provides no explanation for (3b).

Second: while clausal equatives like (1A) (or equatives with a potential clausal source, like *John is as tall as Sue*) are ambiguous between an 'at least' and 'exactly' reading, equatives with MPs as targets ('MP equatives') like (5) are ambiguous between an 'at most' and 'exactly' reading.

(5) a. GM plans on laying off as many as 5,000 employees.
b. The plant could grow as high as 5ft.

(5a) is true if GM plans on laying off 4,500 employees, but false if it plans on laying off 5,500. (5b) is true if the plant has the potential to grow $4\frac{1}{2}$ft tall, but not if it has the potential to grow $5\frac{1}{2}$ft tall. (N.B. the distribution of MP equatives is relatively narrow, especially in contrast to MP constructions like *The plant could grow 5ft high*: they are only felicitous if the measure of the correlate exceeds a contextually relevant standard (is 'evaluative'; Rett, 2008) and if the speaker has an imprecise idea of this measure.)

The analysis in (2) fails to capture this generalization, too. Assuming that MPs denote singleton degree sets (e.g. $[\![5\text{ft}]\!] = \{5\text{ft}\}$), (2) predicts that MP equatives, like clausal equatives, are ambiguous between 'at least' and 'exactly' readings.

Arguably, these two complications to the standard analysis of the equative are related. I'll argue that the licensing of NPIs in the target of equatives give us insight into how to best analyze MP equatives. Chierchia (2004) argues convincingly that SIs can be computed locally but are effectively suspended in DE environments. I assume, following SI accounts of numerals, that MPs, too, are an SI phenomenon. Specifically, I assume that the weak meaning of an MP (like *6ft*) is something like 'd or more' (and so $[\![5\text{ft}]\!] = [5\text{ft},\infty]$; where a set of the form $[a, b]$ should be interpreted as $\{x : a \leq x \leq b\}$.) I assume that the stronger, 'exactly' interpretation of MPs is computed pragmatically, in upward-entailing contexts.

Finally, I propose an analysis of the equative that is DE in its first argument. As Hoeksema (1983) argues, the definition of the comparative in (4) is formally equivalent to one that invokes set complementarity (i.e. $[\![\text{er}]\!](D')(D) = \exists d[D(d) \wedge \overline{D'}(d)]$.) To get an DE definition of the equative, we can adopt a notion of a variant of a set complement: the closure of a complement, which I'll represent as $\widehat{D}$.

(6) a. $\widehat{D} =_{def}$ the smallest D' such that $\overline{D} \subseteq D'$ and D' is a closed set.
b. $[\![\text{as}]\!] = \lambda D' \lambda D[\textsc{Max}(D) \in \widehat{D'}]$

In a context in which Sue is 5ft tall, the denotation of the target in the clausal equative *John is as tall as Sue (is)* is (0,5] (where a set of the form $(a, b]$ should be interpreted as $\{x : a < x \leq b\}$.). The complement of this set is $(5,\infty]$, and the closure of this complement is $[5, \infty]$. (6b) predicts that *John is as tall as Sue (is)* is true if John's height is in the closure of the complement of the set of degrees to which Sue is tall: a 'greater than or equal to' interpretation.

The denotation of the target in the MP equative *The plant could grow as high as 5ft* is $[5, \infty]$. Its complement is (0,5), and the closure of its complement is [0,5]. (I assume that the zero degree is ruled out pragmatically.) (6b) therefore predicts that *The plant could grow as high as 5ft* is true if the potential height of the plant is in the closure of the complement of the set denoted by the MP: a 'less than or equal to', or 'at most', interpretation.

The innovation of the proposal in (6b) is to take a semantic notion like 'at least as' or 'greater than or equal to' and make it sensitive to the direction of a scale. I'll additionally argue that the notion of the closure of a complement is independently useful for talking about the differences between antonyms.

I hope to address some extensions of this analysis, as well: how to extend the assumptions made here about MPs in DE contexts to comparatives like *John is taller than 6ft*; why languages with equative morphemes derived from *wh*-phrases disallow MP equatives; and how to define equative modifiers like *at least* and *at most*, which have the ability to either disambiguate (as *at most* does to MP equatives) or to change the meaning of an equative (as *at least* does to MP equatives).

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