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Measure Phrase Equatives and Modified Numerals

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Abstract

In English, equatives can be formed with a numeral or measure phrase (MP) standard (e.g. *John can dive as deep as 500m*; Rett, 2010). These 'measure phrase equatives' (MPEs) differ semantically from their clausal counterparts (e.g. *John can dive as deep as Sue can*) in two important ways. First, while clausal standards set lower bounds, resulting in an 'at least' interpretation of the equative, MP standards tend to set upper bounds, resulting in an 'at most' interpretation. Second, MPEs are restricted in their distribution relative to clausal equatives: they are only acceptable when the subject is associated with a range of values or when the value they're associated with is significantly high (or both). The main goal of this paper is a unified analysis of the equative morpheme that accounts for these semantic and distributional differences between clausal and MP equatives. I attribute these differences to the fact that MPEs can trigger two different conversational implicatures: a quantity implicature (because they are less informative than MP comparatives); and a manner implicature, because they are more marked than MP constructions like *John can dive 500m (deep)*. I end by suggesting an expansion of this account of MPEs to modified numerals generally, in particular to the differences between Class A and Class B modifiers (Geurts & Nouwen 2007; Nouwen 2010).

1 INTRODUCTION

In English, equatives can be formed with a numeral or measure phrase (MP) standard (e.g. *John can dive as deep as 500m*; Rett 2010). These measure phrase equatives (MPEs) are semantically different from clausal equatives in a number of different ways. I argue here that the difference is best attributed to the fact that MPEs trigger an additional manner implicature, in contrast to clausal equatives, as a result of their relationship to MP constructions like *John dove 500m (deep)*. The analysis provides insight into the semantic relevance of manner implicatures; I will argue that it can also inform the discussion of modified numerals (e.g. *John read fewer than 3 books*) generally.

I'll begin by describing the empirical challenge posed by these measure phrase equatives. Section 1.2 outlines the approach and the organization of the article.

1.1 *Measure phrase equatives: an empirical overview*

In English, equatives can be formed with clausal standards, DP standards or MP standards, as exemplified in (1).

(1) a. Some barrel organs are as heavy as the organ grinder is. *clausal*
b. Some barrel organs are as heavy as the organ grinder himself (??is). *DP*
c. Some barrel organs are as heavy as 100lbs.[1] *MP*

A quick terminological side note: I'll refer to the external argument of equatives (and comparatives) as the 'correlate', and the internal argument as the 'standard'. In the clausal equative in (2a), John is the correlate and Bill the standard. I'll use the terms 'correlate value' and 'standard value' to refer to the measures associated with the correlate and standard, respectively. The dimension of measurement reflected in these values will vary depending on the adjectival parameter. In (2a), the correlate value is John's height and the standard value is Bill's height.

(2) a. John is as tall as Bill (is).
b. The linguists are as tall as the philosophers.

In (2b) the correlate and standard are plural entities; I'll use the terms 'plural correlate' and 'plural standard' to describe them (and 'singular correlate' etc. for (2a)). It will be important in what follows to make one additional distinction: between punctual and range values. Singular correlates are associated with a singular, punctual value; John in (2a) is associated with only one height. But plural correlates can be associated with either punctual or range values. In (2b), the correlate value will be punctual iff the linguists are all the same height, and it will be a range iff the linguists differ in heights.

1.1.1 *'At least' and 'at most'* Clausal equatives typically receive an 'at least' interpretation in contexts that support it. This is demonstrated by the continuation in (3a); the continuation in (3b) shows that clausal equatives cannot receive an 'at most' interpretation.

(3) The kids dove as deep as their parents (did).
a. ...Each parent dove 10m deep and their children dove 15m deep.
b. #...Each child dove 10m deep and their parents dove 15m deep.

[1] Based on the sentence 'Use of these organs was limited by their weight. Most weighed 25 to 50 pounds but some were as heavy as 100 pounds', from https://en.wikipedia.org/wiki/Barrel_organ.

That clausal equatives are 'at least'/'exactly' ambiguous is generally characterized as the result of a quantity implicature, a consequence of the semantic relationship between the equative and the comparative: the comparative (*more*/*-er*) encodes a strict linear order $>$, while the equative encodes a non-strict linear order $\geq$ (Horn 1972; Klein 1980; Bierwisch 1989; Horn 2001; Chierchia 2004). This assumption underwrites the (asymmetric) entailment relation demonstrated in (4a), reminiscent of the relationship between conjunction and disjunction shown in (4b).

(4) a. John is taller than Mary. $\rightarrow$ John is as tall as Mary.
b. John and Mary went to the party. $\rightarrow$ John or Mary went to the party.

In quantity-implicature treatments of conjunction and disjunction, disjunction is analyzed as semantically encoding the weak, inclusive interpretation (A or B or both). In most contexts, it comes to have the strong, exclusive interpretation (A or B but not both) via pragmatic strengthening, the result of the hearer attributing to the speaker the knowledge that $\neg(A \wedge B)$. Similarly, the entailment pattern in (4a) suggests an analysis in which the equative morpheme semantically encodes the weak, 'at least' interpretation ($\geq$) and its stronger, 'exactly' interpretation is derived via pragmatic strengthening, the result of the hearer attributing to the speaker the knowledge that $\neg(A > B)$.

MPEs are apparent counterexamples to the empirical generalization in (3), and so they threaten this simple account. When the English equative morpheme *as* takes a numeral or MP as its standard, the resulting equative construction most naturally receives an 'at most' interpretation instead of an 'at least' interpretation, as shown in (5).

(5) (Over the course of the day,) The divers dove as deep as 20m.[2]
a. #...For instance, Michael dove 25m. *'at least'*
b. ...For instance, Michael dove 15m. *'at most'*

The availability of the 'at most' interpretation is supported by the following naturally occurring examples and their paraphrases. From this point forward, I will mark examples culled from the internet with †.

(6) Skunk cannabis potency ranges usually from 6% to 15% and is sometimes **as high as 20%**. The average THC level in coffee shops in the Netherlands is about 18–19%.†

[2] Based on the sentence 'The divers dove as deep as 60 feet to collect fish, algae, bottom-dwelling organisms...' from http://www.sfos.uaf.edu/news/story/?ni=177.

(7) Holocaust deniers say **as many as 250,000 people** were killed in Dresden air raid. . . .Irvin asserted that the figure was 'between a minimum of 100,000 and a maximum of 250,000'.†

(8) Q: Does anyone know what '100m Water Resistant' means?
A: 100 meters means 'up to a depth of 100 meters'.
A′: Yep, it can go **as deep as 100 metres**.†

(9) Heat index up to 100°. [. . .] On the bright side, humidity levels will be moderate. . . . Combine this with highs in the mid-90s and the heat index could still go **as high as 100 degrees**.†

(10) This complication has been reported to occur **as often as 5%** in one study, but other studies have estimated only a 1–2% incidence.†

(11) I'm 5′1″ and my husband is 6′2″. I've dated guys **as short as 5′4″**. . . . Most of the guys I've dated have been relatively tall, though (5′10″ and up).†

(12) The details in the story let us know that Sarah is **as old as 60** and no younger than 40 when they marry.†

In each of these examples, the MPE sets an upper bound on the correlate value, paraphrased alternatively with *maximum* and *up to*. This is even true for (11), formed with a negative antonym (*short*). The MPE is true only if the speaker dated guys *at most as short as 5′4″*, which sets an upper bound relative to the 'short' scale (see Section 2).

The 'at most' interpretation of MPEs is actually even stronger than these paraphrases suggest. When an MPE's correlate value is a range, as it is in (5)–(11), the MPE is acceptable only if at least one of the entities in the range value measures (exactly) MP. This is reflected in the intuition that e.g. (11) would be odd or unacceptable in a context in which the shortest man the speaker has dated was 5′6″. So instead of *up to MP*, these sentences are better paraphrased as *up to and including MP*, which I'll call the 'inclusive at most' interpretation.

The difference in meaning between clausal and MP equatives—the difference between an 'at least' interpretation and an inclusive 'at most' interpretation—is due to the MP standard itself, not due to the difference between clausal and phrasal standards. DP equatives provide the perfect control for this distinction, and they receive an 'at least' interpretation.

(13) This camera is as heavy as the lens itself (?is).†
a. . . .In fact, it is heavier. *'at least'*
b. #. . .In fact, it is lighter. *'at most'*

(14) This train will take you as far as Berkeley (*is).
a. . . .In fact, it will take you farther. *'at least'*
b. #. . .In fact, it will stop short of Berkeley. *'at most'*

1.1.2 *A restricted distribution* The idiosyncratic interpretation of MPEs goes hand in hand with a restricted distribution. The restriction is (weakly) disjunctive: MPEs are licensed in contexts where the correlate value is a range (the 'range restriction') or when the standard value counts as significantly high in the context (the 'evaluativity restriction,' Rett 2008a,b). I will illustrate each in turn.

As a consequence of the range restriction, MPEs tend to involve a plural correlate or a modal, as illustrated in (15).

(15) a. The Watts Towers are as tall as 30m.
b. The river is as wide as 20ft at points.
c. The baby wakes up as many as 5 times a night.
d. The price of gold is expected to go as high as $2,000.
e. The newest wetsuit is capable of going as deep as 1,000m.

In (15a), the correlate value is a range from the height of the shortest tower to the height of the tallest tower. In (15b), it's a range calculated from the river's change in width over its length, and in (15c) it's a range calculated from the change in the baby's sleep schedule over time. The correlate values in (15d) and (15e) are formed from changes in a measure (the price of gold, how deep the wetsuit can go) across possible worlds. In (15d) they're worlds accessible via an expectation relation, and in (15e) the modal base is one of ability.

As a consequence of the disjunctive distribution restriction, MPEs with punctual correlate values (i.e. those with singular correlates, or plural correlates in a context in which it's clear the members of the plurality share the same measure) are evaluative. (16) contains some naturally occurring examples.

(16) a. Danny Gibbons is as tall as 6′3″.†
b. I know 5 other DJs personally, one is as old as 55 and he doesn't even use vinyl any longer.†
c. Hutchison hasn't always scored a zero on the Scorecard. In fact, she once scored as high as 50, for the 103rd Congress is 1993-94.†
d. With a collection to rival famous shoe addict Imelda Marcos, the 27-year-old owns as many as 100 pairs of Christian Louboutin heels, each worth around £600.†

All of these examples are evaluative in the sense in Rett 2008a,b: the standard value must exceed a contextually valued standard. (16a) is only acceptable in a context in which 6′3″ counts as tall (for Gibbons' salient comparison class), and (16b) only acceptable in a context in which 55 counts as old (for a DJ), etc. Importantly, evaluativity is generally not a property of MP constructions (as shown in (17)) or positive-antonym equatives (as shown in (18)).

(17) a. Joe is 4ft tall. $\nrightarrow$ Joe is tall.
b. Barry is 6 years old. $\nrightarrow$ Barry is old.
c. Jenny dove 10ft deep. $\nrightarrow$ Jenny dove deep.

(18) a. Joe is as tall as George. $\nrightarrow$ Joe/George is tall.
b. Barry is as old as Barbara. $\nrightarrow$ Barry/Barbara is old.
c. Jenny dove as deep as Sue. $\nrightarrow$ Jenny/Sue dove deep.

Another way to demonstrate the evaluativity of these punctual value MPEs comes from Barker (2002), who observes that evaluative constructions can have a metalinguistic use in addition to a descriptive use. Barker's example comes from positive constructions like *Feynman is tall*, which are also evaluative. The descriptive interpretation of a positive construction informs interlocutors about the relevant value, in this case Feynman's height. The metalinguistic interpretation, in contrast, uses Feynman's height to inform interlocutors about the value of the relevant contextual standard. This interpretation is natural in a situation in which the speaker and hearer both know Feynman's height—say, they're standing in a room with him—but the speaker wants to inform the hearer about what counts as tall in the relevant context (say, the hearer is a linguist, trying to understand what counts as tall for a physicist).

MPEs too, have this metalinguistic use, as shown in (19).

(19) Australian: It gets really hot in Australia. For instance, it was as hot as 35° today in Melbourne!
American: Oh, so 35° is hot in Celsius. 35° is cold in Fahrenheit!

I'll stress the disjunction of this requirement: an MPE must have a correlate measure that is a range, or it must have an evaluative standard measure. It can have both, but it cannot have neither. This accounts for the unacceptability of MPEs like the ones in (20), provided the speaker is not clearly uncertain of the value, and provided the standard values are not evaluative in context.

(20) a. ??John is as tall as 5ft.
b. ??A hexagon has as many sides as 6.

c. ??This hamburger is as cheap as $40.
d. ??Sue leaves her house as often as once a year.

It also affects the possible interpretations of acceptable MPEs. Because 30m isn't generally considered tall for a tower (and so the sentence would not satisfy the evaluativity restriction), (21) would be odd or unacceptable in a context in which the Watts Towers were all exactly 30m tall (thereby satisfying the range restriction).

(21) The Watts Towers are as tall as 30m. #They are in fact all 30m tall, which makes them very short towers indeed.

To summarize: clausal (and DP) equatives enjoy a straightforward relationship to clausal (and DP) comparatives, which motivates a straightforward, scalar-implicature-based semantic account of this relationship and, in turn, a clear semantics for the equative morpheme *as*. This account seems to be undermined by equatives with numeral or MP standards. These MPEs receive (inclusive) 'at most' interpretations, rather than 'at least' interpretations. They're also restricted in their distribution in surprising ways relative to clausal (and DP) equatives: their correlate values must be a range or be evaluative.

And while most DPs can be used as correlates to create a range correlate value, there is a surprising prohibition on universal quantifiers in the correlates of MPEs, as in (22), unless the correlate contains some other existential (as in (22c)). This prohibition doesn't appear to extend to universal modals, as (23) demonstrates, which is reminiscent of the scope restrictions on comparison constructions discussed in Heim (2000). I'll return to address this problem with universal DPs in Section 3.

(22) a. ??Every linguist is as tall as 5ft.
b. ??All mature labradors are as heavy as 30lbs.
c. All other classes can be as big as 40.†

(23) a. Over 9000 holes must be drilled as deep as 30 feet for the anchors for the cabling.†
b. Mineral loss in bone must be as high as 30%–40% before any change is visible.†

1.2 *Outline*

What follows is the outline of a proposal that we can maintain a straightforward, scalar-implicature-based account of the equative in the face of the MPE data as long as we expand the role of implicature in our

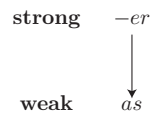


Figure 1 The traditional scale for comparatives and equatives.

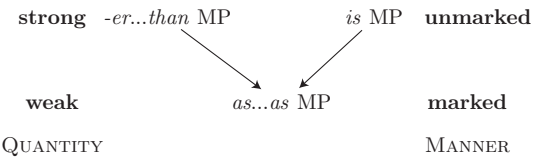


Figure 2 The proposed scales for measure phrase equatives.

theory. I will argue that, while clausal equatives bear the traditional, informativity-based relationship to clausal comparatives, as shown in Figure 1, MP equatives bear a relationship to more than one alternative construction, as shown in Figure 2.

MP equatives are alternatives to MP comparatives like *taller than 6ft* on a quantity scale because the comparative is more informative with the equative. I'll argue that MP equatives are additionally alternatives to MP constructions like *6ft tall* on a manner scale, because, in many contexts, MPEs are synonymous with but more complex than their MP construction counterparts. Following related observations in Levinson 2000; Nouwen 2010, and Rett (to appear), I'll argue that MPEs trigger quantity *and* manner implicatures, and that these combine with the semantics of the equative morpheme to produce the distributional and interpretive oddities described in the previous section.

The proposal that MPEs carry multiple implicatures interacting with one another and with the truth-conditional meaning of the equative perhaps explains that native speakers' semantic intuitions about MPEs are a bit hazier than they are for, say, clausal equatives. However, the speakers whose judgments I have informally relied on all agree that MPEs tend to receive 'at most' interpretations and tend to be unacceptable if neither the range nor evaluativity restriction apply.

There's an added complication that MPEs, as far as my research suggests, are an English-only phenomenon. This does not mean that we should neglect the intuitions of English speakers but it has, in my experience, bred skepticism in native speakers of other languages. So before I present my account I'll briefly (in Section 1.3) address a few possible explanations for the relative rarity of MPEs.

The rest of the article will proceed as follows. Section 2 presents a standard degree-semantic account of the comparative and equative morphemes. This formal system will serve as a background for the rest of the analysis, which is presented in Section 3. In Section 4, I'll suggest that some aspects of the analysis are useful in the ongoing debate about the difference between Nouwen's (2010) Class A and Class B modifiers.

1.3 *Equatives crosslinguistically*

I know of no language other than English that allows MP equatives.[3] In this section, I'll address the issue of why that might be.

Stassen (1985) demonstrates that there are many different types of comparative strategies employed in natural language: English uses a degree quantifier *-er* as well as some other strategies, like *John exceeds Sue in height* or *John is tall relative to Mary* (Kennedy 2009).

Similarly, languages use a variety of equative strategies (Haspelmath & Buchholz 1998; Henkelmann 2006). These include the use of a degree quantifier like *as*, but also a variety of other strategies, some of which English employs: *John equals Mary in height* (the verbal strategy); or *John and Sue are equally tall* (the coordination strategy).

I list some other equative strategies below; all data come from Haspelmath & Buchholz (1998) (labeled HB) or Henkelmann (2006) (labeled H).

(24) Chii tôi xinh nhu/bằng bản.
elder-sister 1.SG be.pretty be.equal 2.SG
'My elder sister is as pretty as you'. **co-verbal**; VIETNAMESE, H 390

(25) ŋaya ŋa-balayi, ñaŋgi wadi̇j ña-balayi.
1.SC (NOM) 1.SC-big 2-SG (NOM) also 2.SG-big
'I am big, you are also big'. **paratactic**; MANGARAYI, H 395

(26) a-wòs ay` ɔn kì-ri-ààn ka' kèci'.
1.SG-clever 1.SG (NOM) 1.SG-compare-HAB with 3.PL
'I am clever like them'. **subordinator only**; TURKANA, H 392

(27) m-àsʊr-áací kʊʊfi àsí nìisàa-tí.
F-be.long(IMPERF)-SUFF stick like arm-my
'The stick is as long as my arm'. ***as* + NP**; KRONGO, H 383

[3] There may be MP equatives in Spanish—an internet search reveals data like *Algunos bancos ofrecen CDs tan bajo como $500*, 'Some banks offer CDs as low as $500'—but my Spanish consultants differ on how acceptable they are, and a high proportion of them seem to come from direct translations from English, as in http://www.scielo.org.mx/pdf/rmf/v54n3/v54n3a5.pdf 'processing times as short as 120 minutes.'

(28) Moja sestra je tako čedna kot ti.
my sister is so pretty how you.
'My sister is as pretty as you'. ***as* + free relative**; SLOVENE, HB 288

Some languages (like English) form equatives with degree quantifiers as well as some of these other strategies; some languages form equatives with only one or a few of these strategies, but not with degree quantifiers.

Pre-theoretically, in order to be able to form MP equatives, a language must have an equative degree quantifier strategy, and that strategy must demonstrate a few characteristics. First, it must not require that the target and correlate be members of the same syntactic category. Henkelmann calls this property 'unified'; the coordination and paratactic strategies, for instance, are unified.

Second, it must be a construction that doesn't require that its target be a clause. There are a number of Indo-European languages which form equatives with a degree quantifier (equivalent to the first *as* in English equatives) coupled with a *wh*-phrase subordinator (equivalent to the second *as* in English equatives), illustrated in (28). If these targets are effectively free relatives, then they are necessarily clausal, which explains why such languages—as far as I know—don't allow MPEs.

Third, it must be a construction which doesn't require that its phrasal target be individual-denoting. There are a few strategies, for instance, in which the target must be marked with genitive case. In Harar Oromo, in (29), the subordinator means 'manner'.

(29) Isii-n akká isaa-ní d'eertuu.
she-NOM STM they-GEN tall
'She is as tall as them.'
(Lit. 'She is their manner tall.') HARAR OROMO, HB 286

It seems possible that an MP target would be disallowed in this strategy, either for morphological reasons (it might not have a genitive form) or semantic reasons (it doesn't make sense to talk about the manner of an MP).

Much like Slavic languages are unusual in that they have phrase- and clause-specific comparative subordinators (Pancheva 2006), it's possible that English is unusual in that it has an equative strategy with a degree quantifier and a subordinator that can occur with both phrases and clauses. These properties are plausibly necessary conditions for MP equatives; but the apparent unacceptability of MP equatives in languages similar in these respects to English (e.g. Dutch) suggests that they are not sufficient conditions.

2 A DEGREE SEMANTICS FOR ADJECTIVAL CONSTRUCTIONS

I'll refer to comparatives and equatives collectively as 'comparison constructions.' In Section 2.1 I present a degree-semantic approach to comparison constructions. In Section 2.2 I discuss the semantics of numerals and MPs.

2.1 *The semantics of comparison constructions*

Comparison constructions employ gradable adjectives as parameters, restricting the dimension of measurement. Gradable adjectives are generally characterized in the degree-semantic literature as denoting relations between individuals and degrees of measurement, type $\langle d, \langle e, t\rangle\rangle$ (see especially Heim 2000).

(30) $[\![\text{tall}]\!] = \lambda d \lambda x.\text{tall}(x, d)$

In (30) *tall* relates a degree and an individual; the value can be read as 'x is tall to degree d'. Because *tall* is a positive antonym, it will associate an individual with a downward-monotonic set of degrees. This means that if x is tall to d, then he is also tall to degree d' for all $d' \leq d$ (Heim 2000). In contrast, the negative antonym *short* relates John to a dense, upward-monotonic set of degrees.[4]

There is a strong and productive tradition of analyzing the comparative and equative morphemes as degree quantifiers (denoting relations between sets of degrees, type $\langle\langle d, t\rangle, \langle d, t\rangle\rangle$; Ross 1969; McConnell-Ginet 1973; Kamp 1975; Cresswell 1976; Hellan 1981; Hoeksema 1983; Seuren 1984). Following Bresnan (1973), I consider the standard of clausal comparatives and equatives to be an elided clause containing a set-forming null degree operator, as in (31).

(31) a. John is as tall as/taller than Sue (is).
b. -er/as ([Op$_d$ John is d-tall])([Op$_{d'}$ Sue ~~is d'-tall~~])

The few semantic theories of the equative I am aware of generally follow Horn 1972 in assuming that the comparative and the equative are semantically similar, differing only in the strictness of their ordering

[4] I assume, following Bartsch & Vennemann (1972), that differences in antonymy and dimension between gradable adjectives are encoded in these degrees, which are actually shorthand for triples consisting of a set of points, an ordering, and a dimension of measurement. In recent work, Schwarzschild (2012) has encoded the difference in ordering explicitly.

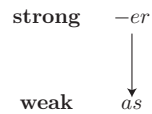


Figure 1 The traditional scale for comparatives and equatives.

(Klein 1980; Bierwisch 1989; Horn 2001; Chierchia 2004; Bale 2008), as in Figure 1, repeated above.[5]

There are a number of competing semantic analyses of the comparative morpheme (although relatively few of the equative). I'll adopt some relatively standard definitions here, while noting that they are not without their problems (see, for example, von Stechow 1984; Heim 2000; Schwarzschild 2008).[6]

(33) a. $[\![\text{er}]\!] = \lambda D'\lambda D.\textsc{Max}(D) > \textsc{Max}(D')$
b. $[\![\text{as}]\!] = \lambda D'\lambda D.\textsc{Max}(D) \geq \textsc{Max}(D')$

These definitions will result in truth conditions like those in (34) for clausal comparatives and equatives.

(34) John is as tall as/taller than Sue (is).
a. $\textsc{Max}(\lambda d.\textsf{tall}(\textsf{j}, d)) > \textsc{Max}(\lambda d'.\textsf{tall}(\textsf{s}, d'))$ *comparative*
b. $\textsc{Max}(\lambda d.\textsf{tall}(\textsf{j}, d)) \geq \textsc{Max}(\lambda d'.\textsf{tall}(\textsf{s}, d'))$ *equative*

The truth conditions in (34a) predict that the comparative is true iff John's height exceeds Sue's height (on the 'tall' scale). (34b) predicts that the equative is true iff John's height is greater (on the 'tall' scale) or equal to Sue's height.

As indicated in the quantity scale in Figure 1, the equative carries the additional quantity implicature that the speaker does not know that the comparative *John is taller than Sue* is true. Given other considerations about the speaker's authority on John's and Sue's heights, this implicature can itself be strengthened to something like, 'The speaker knows that it's not the case that John is taller than Sue' (see Geurts 2012, for a

[5] There are two classes of notable exceptions: the proposals in Cresswell (1976); Seuren (1984); von Stechow (1984); Schwarzschild & Wilkinson (2002), which analyze the alternation between the 'at least' and 'exactly' interpretations of equatives as an ambiguity; and the syntactic proposal in Bhatt & Pancheva (2004), in which it is characterized as a scope ambiguity.

[6] I assume, following Rullmann (1995) and Heim (2000), a maximality operator that is order-sensitive.

(32) Let D be a non-empty set of degrees ordered by the relation $>_{\mathscr{R}}$. Then $\textsc{Max}(D) = \iota d[d \in D \wedge \forall d' \in D[d' \neq d \rightarrow d' <_{\mathscr{R}} d]]$

This means that a downward-monotonic set, like the one associated with *tall*, will have a different maximum than an upward-monotonic set (like the one associated with *short*).

detailed exposition of this Gricean reasoning). In part for simplicity's sake, I will model this implication as a negation of the comparative, as in (35b). ('$\rightsquigarrow_Q$' signifies a quantity implicature.)

(35) John is as tall as Sue (is).
   a. $\textsc{Max}(\lambda d.\textsf{tall}(\textsf{j}, d)) \geq \textsc{Max}(\lambda d'.\textsf{tall}(\textsf{s}, d'))$
   b. $\rightsquigarrow_Q$: $\neg(\textsc{Max}(\lambda d.\textsf{tall}(\textsf{j}, d)) > \textsc{Max}(\lambda d'.\textsf{tall}(\textsf{s}, d')))$
   c. strengthened interpretation: $\textsc{Max}(\lambda d.\textsf{tall}(\textsf{j}, d)) = \textsc{Max}(\lambda d'.\textsf{tall}(\textsf{s}, d'))$

The result is the strengthened interpretation of the equative in (35c), the conjunction of the semantically encoded truth conditions and the calculated quantity implicature. This strengthened interpretation is the 'exactly' reading of the equative; it predicts that *John is as tall as Sue* is true iff John and Sue are exactly the same height. Of course, this implicature is cancellable; which is to say, clausal equatives don't always receive an 'exactly' interpretation (36).

(36) John is as tall as Sue ... in fact, he's taller.

I follow Pancheva (2006) in analyzing DP-phrasal comparatives and equatives in the same way, given their similar morphology. It has been argued that DP-phrasal comparatives in other languages warrant distinct treatment (e.g. Bhatt and Takahashi 2008), but there is to my knowledge no similar argument for equatives.

Recall that the distribution of MPEs is determined in part by whether a correlate value is punctual or a range. I will therefore end this section by motivating a particular treatment of comparison constructions with plural correlates. I'll begin by a brief review of the semantics of plural subjects generally; I'll then turn to the superlative literature to adopt particular working assumptions about plural subjects of comparison constructions.

Plural definites can receive a 'maximal' or 'non-maximal' interpretation. The former corresponds to a collective or a universal distributive interpretation; the latter admits exceptions, and so can be considered something like an existential interpretation. The example in (37) from Krifka (1996) may receive a maximal interpretation ('all of the windows') in a neutral context, but can receive a non-maximal interpretation ('some of the windows') in a context in which the speaker is worried about an oncoming storm.

(37) The windows are open.

These interpretations are conditioned in part by distributivity (only the maximal interpretation is available for collective predicates like *form a*

circle); in part by aspect (stative predicates are more likely to receive a generic, maximal interpretation); and in part by the polarity of the predicate (e.g. the difference between *clean* and *dirty*; Yoon 1996).

There are roughly two types of accounts of the variable interpretation of plural definites. One type assigns plural definites relatively weak semantic interpretations that can be strengthened by context, when appropriate, to the maximal interpretation. An example is the analysis in Schwarzschild (1991); Brisson (1998) involving covers. The second type of approach assigns them relatively strong semantic interpretations that can be weakened as need be, either semantically or pragmatically (two very different types of this sort of approach are in Lasersohn 1999 and Malamud 2012).

The situation is at least as complicated for plural subjects of comparison constructions, as in (38) (Scha & Stallard 1988; Schwarzschild 1996; Stateva 2005; Matushansky & Ruys 2006; Fitzgibbons *et al.* 2009).

(38) a. The linguists are taller than the philosophers.
b. The linguists are as tall as the philosophers.
c. The linguists are the tallest professors.

Like the plural definite in (37), these degree properties are naturally interpreted as holding of all of the linguists. But, like (37), there are contexts in which the sentences seem much weaker. (38b), for instance, might be true in a context in which only most of the linguists are at least as tall as the philosophers.

To deal with the semantics of plural comparatives, Scha and Stallard (1988) propose a treatment of 'partial distributivity' over 'multi-level plurals', or non-atomic subgroups of the plurality, determined by context to be representative of the plurality as a whole. Matushansky & Ruys (2006) further motivate such an approach; their account of plural comparatives like (38a) is in (39) (see also Schwarzschild 1996: 87).

(39) A is R-er than B if:
a. There is a contextually determined partition of A into A_1, A_2 such that A_1 is R-er than B and A_2 is R-er than B, *or*
b. There is a contextually determined partition of B into B_1, B_2 such that A is R-er than B_1 and A is R-er than B_2.

Applied to (38a), this approach predicts that the sentence is true if some contextually determined partition of linguists are taller than the philosophers, or if the linguists are taller than some contextually determined partition of philosophers. Depending on the context, the partition might track majority or salience, etc. Scontras *et al.* (2012) provide

experimental evidence for these relatively weak truth conditions, showing that, in these constructions, plurals are often interpreted as proxies for the mean value of the plurality or a representative sample.

As it stands, I have no reason to think that the data in (38)—and even of the experimental results in Scontras *et al.* 2012—are incompatible with a different sort of approach: specifically, a universal distributive interpretation (with some sort of pragmatic weakening process) or a group interpretation.[7] However, Fitzgibbons *et al.* (2009) have argued that the plural superlative in (38c) cannot be otherwise analyzed. They argue that, if the plural definite is treated as having a distributive universal interpretation, its truth conditions (given independent accounts of the superlative) would require that each linguist be taller than the others, an impossibility. They therefore propose that plural superlatives be analyzed using a relational distributivity operator ** (as they define it the transitive counterpart to *, Link 1983; Landman 1989a,b; Schwarzschild 1996), as in (40). This approach, too, amounts to an existential treatment of plural definites.

(40) For any relation R, $^{**}R$ is the smallest relation such that:
(i) $R \subseteq {}^{**}R$, and
(ii) If $\langle a, b\rangle \in {}^{**}R$ and $\langle c, d\rangle \in {}^{**}R$, then $\langle a \cup c,\ b \cup d\rangle \in {}^{**}R$.

Given this conclusion, and in light of work in Bobaljik 2012 showing a strong cross-linguistic morphological kinship between the comparative and superlative constructions, I will adopt a weak existential approach to plural comparison constructions, leaving unaddressed the pragmatic mechanisms that strengthen the interpretation from context to context, which would better approximate the approaches in Scha & Stallard 1988 & Matushansky & Ruys 2006.

Like other accounts, I use Link's pluralizing * operator to create plural predicates via the closure of a set of atoms under the sum operation.

(41) For any set P, $^{*}P$ is the smallest set such that:
(i) $P \subseteq P^{*}$, and
(ii) If $a \in {}^{*}P$ and $b \in {}^{*}P$, then $a \cup b \in {}^{*}P$.

[7] I use the term 'group interpretation' to hint at a cumulative approach to these constructions, although there seems to be a divide in the literature about what cumulativity might amount to in the context of degree predicates. Landman (1996) defines a predicate P as cumulative whenever '*x* is *P*' and '*y* is *P*' entails '*x* and *y P*'. But Schwarzschild (2011) defines a distributive degree interpretation as holding of an individual's measure and a cumulative degree interpretation as holding of a group's total measure. It seems as though these two definitions differ in terms of their predictions about whether e.g. the superlative in (38c) is cumulative. It is therefore not clear to me how to adjudicate between such an approach and the one advocated in (42), especially in light of this confusion. Thanks to Rick Nouwen (p.c.) for discussion on this point (and on the treatment of plural comparison constructions generally).

In the case of a gradable predicate $\mathscr{D}$, $*\mathscr{D}$ relates a plural entity to the set of degrees to which each atomic individual satisfies $\mathscr{D}$, effectively the set ranging from the smallest degree to the measure of the $\mathscr{D}$-est atomic member of the plurality.

To denote the maximal plurality denoted by a plural definite, I use Link's (1983) supremum σ operator. To approximate the pragmatic component of these constructions, I adopt a contextually sensitive relation $\Subset$. '$x \Subset \sigma y$' can be read as 'x is a representative subgroup of the maximal plurality of y'.

(42) The linguists are as tall as John.
   a. $\exists x[x \Subset \sigma y.*\textsf{linguist}(y) \wedge \textsc{Max}(\lambda d.*\textsf{tall}(x, d)) \geq \textsc{Max}(\lambda d'.\textsf{tall}(\textsf{j}, d'))]$
   b. $\rightsquigarrow_Q \neg(\exists x[x \Subset \sigma y.*\textsf{linguist}(y) \wedge \textsc{Max}(\lambda d.*\textsf{tall}(x, d)) > \textsc{Max}(\lambda d'.\textsf{tall}(\textsf{j}, d'))])$
   c. strengthened interpretation:
   $\exists x[x \Subset \sigma y.*\textsf{linguist}(\textsf{y}) \wedge \textsc{Max}(\lambda d.*\textsf{tall}(x, d)) = \textsc{Max}(\lambda d'.\textsf{tall}(\textsf{j}, d'))])$

Informally, the strengthened truth conditions in (42c) mean 'Some representative supgroup of the linguists is exactly as tall as John'. I take (42) to represent a relatively transparent way of incorporating the weak distributive accounts in Scha & Stallard (1988), Matushansky & Ruys (2006) and Fitzgibbons *et al.* (2009) into the degree-semantic framework introduced here.

As a reminder, (42) serves as only a baseline semantics for this account; the analysis proposed in Section 3 will derive the 'inclusive at most' interpretation of and disjunctive restriction on MPEs. Notice that in (42c) the existential scopes outside of the maximality operator provided by the degree quantifier. This is in line with Kennedy's Generalization about the scope possibilities of quantificational DPs in these constructions (Kennedy 1999; Heim 2000).

2.2 *The semantics of numerals and MPs*

MP constructions play a significant role in the analysis presented in Section 3. I'll outline their treatment in this degree-semantic approach before I present the analysis itself.

Part of the motivation for the treatment of gradable adjectives as relations between individuals and degrees comes from the assumption that MPs play the role of the gradable adjective's degree argument in MP constructions like (43).

(43) John is 6ft tall.
   a. $[\![\text{tall}]\!] = \lambda d \lambda x.\textsf{tall}(x, d)$
   b. $[\![\text{6ft}]\!] = \textsf{6ft}$

c. $[\![\text{tall}(6\text{ft})]\!] = \lambda x.\text{tall}(x, 6\text{ft})$
d. $[\![(\text{tall}(6\text{ft}))(\text{John})]\!] = \text{tall}(j, 6\text{ft})$

Since MPs can also function as standards in comparison constructions, and since I've defined comparatives and equatives in terms of sets of degrees, we need to amend the account slightly to account for MP comparatives and equatives. Heim (2000) does this by defining the comparative morpheme, when it takes an MP standard, as a relation between a degree (the MP) and a set of degrees (denoted by the correlate), resulting in a true proposition if the maximum correlate value exceeds the MP. I will instead type-raise the type d characterization of MPs in (43b) to a set, as in (44).[8]

(44) a type-raised MP
$[6\text{ft}] = \lambda d.d = 6\text{ft}$

Because the comparative and equative morphemes, as defined in (33), relate the maxima of each argument, this approach is equivalent to Heim's. Both return truth conditions like those in (45) and (46) for MP comparatives and MP equatives, respectively.

(45) $[\![\text{John is taller than 6ft}]\!] = \text{MAX}(\lambda d.\text{tall}(j, d)) > 6\text{ft}$

(46) $[\![\text{John is as tall as 6ft}]\!] = \text{MAX}(\lambda d.\text{tall}(j, d)) \geq 6\text{ft}$

In line with the discussion in the previous section, (45) and (46) characterizes the equative as asymmetrically entailing the comparative.

I treat numerals like *three* as MPs without overt measure nouns because, for my purposes, they have the same distribution as MPs.[9] In order to maintain a consistent degree semantics for sentences like *John ate 3 pizzas*, I assume that the numeral functions as the degree argument for a null measure function μ, a relation between individuals and degrees (i.e. a null *many*; see Bartsch and Vennemann 1972; Cresswell 1976; Higginbotham 1993; Nerbonne 1995; Schwarzschild 2002, 2005; Nakanishi 2007; Rett 2007, 2008b, 2014; Champollion 2010).

Numerals and MPs are also often characterized as scalar, encoding an 'at least' semantics, pragmatically strengthened to mean 'exactly' (Horn

[8] Others, like Schwarzschild (2005) and Kotek (2011), have argued that MPs have an even higher type, $\langle\langle d, t\rangle, t\rangle$. This is motivated, in part, by the ability of MPs to function as differentials, in e.g. *John is 2ft taller than Sue*. These meanings can presumably all be related by type-shifting mechanisms along the lines of Partee (1987).

[9] For an explanation of their distributional differences given this assumption, see Schwarzschild (2006).

1972: Gazdar 1979: Levinson 2000; Spector 2007). The analysis of MPs in (43), repeated in (47a), is consistent with this characterization; (47a) requires that 6ft be in the set of degrees to which John is tall, but does not require that it be the highest degree to which he is tall. In this scalar account of MPs, the 'exactly' interpretation is due to a quantity implicature, arising from the fact that the speaker did not use a higher, more informative MP like 6′1″. Accordingly, the strengthened, 'exactly' interpretation can be thought of as in (47b).

(47) a. $[\![\text{John is 6ft tall}]\!] = \text{tall}(\text{j}, \text{6ft})$
b. $\rightsquigarrow_Q \text{tall}(\text{j}, \text{6ft}) \wedge \neg(\exists d[d > \text{6ft} \wedge \text{tall}(\text{j}, d)])$

Recent criticisms of this 'at least' semantics for MPs have shown that the situation is at least quite complicated (Koenig 1991; Geurts 2006; Breheny 2008; Kennedy 2013). The oddity of the continuations in (48) casts doubt on a standard, neo-Gricean approach to predicative MPs and numerals, for instance.

(48) a. This book costs \$20... #in fact, it costs \$40.
b. The walrus weighs 1,800lbs... #in fact, it weighs 2,200lbs.

Although I assign MPs and numerals an 'at least' semantics, I will argue in Section 3.2 that the decision is ultimately inconsequential for the approach to MPEs proposed here, which deals exclusively with the semantics of MP constructions only in contexts that would license their pragmatic strengthening from an 'at least' to an 'exactly' interpretation. (47) represents an attempt to deviate as little as possible from the status quo.

I'll end by discussing an important property of plural MP constructions receiving an 'exactly' interpretation: they carry a homogeneity presupposition. Given that the MP can in principle measure a punctual or range value, we predict that an 'at least' plural MP construction is true whenever each of the atomic members measure at least MP, whether or not the members differ in measure. This is illustrated in the informal truth conditions in (49a).

(49) The linguists are 5ft tall.
a. 'at least': the linguists are all d tall, for some $d \geq$ 5ft, or the shortest linguist is at least 5ft tall
b. 'exactly': the linguists are all exactly 5ft tall, ~~or the shortest linguist is exactly 5ft tall~~

Prima facie, we would expect the same for the 'exactly' interpretation of MP constructions. In other words, given that the MP can measure either

a punctual or correlate value, we would expect there to be two types of situations in which the linguists qualify as 'exactly 5ft tall': one in which they have the same height, and that height is exactly 5ft; and one in which they do not have the same height, but the shortest linguist is exactly 5ft tall. But this is not what we see, as illustrated in (49b). The 'exactly' interpretation of a plural MP construction is stronger than this; it additionally requires that all of the linguists have the same height.

I'll refer to this as the 'homogeneity presupposition (HP)' of plural MP constructions that receive an 'exactly' interpretation. The HP requires that predicates applied to a plurality are defined only if they hold of all or none of the members of a plurality.

The homogeneity presupposition is not unique to plural MP constructions; it has been proposed elsewhere to account for other behavior of plurals, including bare plurals, plural definites, plural pronouns, conjunctions, etc. (Löbner 1985; Lappin 1989; Schwarzschild 1994; Barker 1996; von Fintel l997; Szabolcsi & Haddican 2004). One illustration of the HP is the apparent variability of plurals receiving individual predication, as in (50) from Malamud 2012 (see also Fodor 1970).

(50) a. Peter saw the linguists. (all of the linguists)
b. Peter didn't see the linguists. (not any of the linguists)

The idea is that the HP can account for what is intuitively an exhaustive interpretation of the plural relative to each context. Others have discussed these data in terms of the 'Strong Meaning Hypothesis' (see especially Krifka 1996).

This test for the variable interpretation of plurals holds for plural MP constructions that receive an 'exactly' interpretation, too, as demonstrated in (51) for explicitly modified MP constructions.

(51) a. The linguists are exactly 5ft tall. (all of the linguists)
b. It's not the case that the linguists are exactly 5ft tall. (not any)

The intuition is that (51b) is false if one of the linguists is exactly 5ft tall.

Importantly, the homogeneity presupposition is carried by any 'exactly' MP construction measuring a range, not just those with syntactically plural subjects. This is demonstrated in (52).

(52) a. The baby wakes up exactly 5 times a night. (every night)
b. It's not the case that the baby wakes up exactly 5 times a night. (not any night)

This suggests that it would be a mistake to restrict the HP to syntactically plural subjects.

It is tempting to associate the HP with the pragmatically strengthened analysis of plural comparison constructions discussed in the previous section, exemplified in (42). But while plural MP constructions carry a homogeneity presupposition, plural equatives do not (regardless of whether their standard is an MP).

There are two sources of evidence for this claim. First, as discussed in Section 1.1.2, the correlates of plural MPEs can (and in some cases must) denote a range of values. Second, plural clausal equatives explicitly modified by 'exactly' do not behave like plural MP constructions when negated.

(53) It's not the case that the linguists are exactly as tall as John.
(not all)

The intuition is that (53), in contrast to (50b), can be rendered false by pointing out that Maria (one of the linguists) is not exactly as tall as John. In sum, while plural 'exactly' MP constructions carry the HP, plural MPEs do not, nor do other plural equatives.

There is no clear consensus on the source of the HP; von Fintel l997, for instance, encodes it in a covert GEN operator, as in (54) (p. 33).

(54) $[\![\text{GEN}]\!](f)(p)(q)$ is only defined for w if
$[\forall x \in f(w)(p) : q(w)] \vee [\forall x \in f(w)(p) : \neg q(w)]$

But because the HP is clearly not restricted to generic environments, I will take as a background assumption a broader semantic account of these presuppositions, for instance the one recently proposed in Malamud 2012 (in which the restriction is derived from a decision-theoretic drive to maximize optimal alternatives). As a consequence, the theory proposed here will assume, but not compositionally encode, the homogeneity presupposition for strengthened ('exactly') plural MP constructions. When relevant, I will encode it in a similar way as implicatures, using $\rightsquigarrow_{HP}$. I will thus represent but not explain the HP of plural 'exactly' MP constructions in this account.

This section has drawn on existing degree-semantic theories to provide a baseline semantics for an account of MPEs. I've analyzed gradable adjectives as denoting relations between degrees and individuals, and I've analyzed the comparative and equative morphemes as denoting degree quantifiers encoding the relations $>$ and $\geq$, respectively. I've adopted an existential treatment of plural comparision constructions and I've analyzed MPs (and numerals) as denoting degrees that can be type-raised to denote singleton sets. In Section 3.2, the particular semantics of MP constructions will be of particular importance, so I will revisit many of these issues there.

3 A NEW SCALE FOR MPEs

In this section, I present an analysis of MP equatives in which they carry multiple implicatures, resulting from their uninformativeness relative to comparatives (a quantity implicature) and their markedness relative to MP constructions (a manner implicature). I'll begin by introducing manner implicatures and proposals for treating them (McCawley 1978; Horn 1984). In Section 3.2 I present the core of the proposal, the argument that the difference between clausal and MP equatives is that MPEs also compete with MP constructions, while clausal equatives have no such competitor. In Section 3.3 I'll discuss some additional predictions and consequences.

3.1 *A background on manner implicatures*

Grice's Manner maxim compels speakers to be brief and orderly, among other things. McCawley (1978) uses the Manner maxim to informally treat what he perceives to be a systematic correlation between marked form and marked meaning. He takes the two VPs in (55) to be synonymous, at least in principle, but to differ in morphological complexity. (55a) is formed with a periphrastic causative, and is thus more complex, while (55b) is formed with a lexical causative.

(55) a. He caused the sheriff to die.
b. He killed the sheriff.

McCawley argues that, as the result of the Manner maxim, the the periphrastic causative carries an implicature that the situation described is unusual. The lexical causative, in contrast, is used to describe usual situations. In (55a), specifically, the use of the periphrastic carries the implicature that the act was unintentional. He says, 'It would be more correct to say [(55a)] than [(55b)] of someone who has tampered with the sheriff's gun with the result that in a shoot-out with an outlaw the sheriff's gun fails to fire and the outlaw is thus able to shoot the sheriff to death' (p. 249).

In part to account for the nature of manner implicatures, Horn (1984) groups Grice's maxims into two competing forces (this approach has been adopted into Game Theory in van Rooij 2004). His 'Q Principle' is effectively the first component of Grice's Quantity maxim ('Make your contribution as informative as is required'). His 'R Principle' subsumes Grice's Relation and Manner maxims as well as the second component of the Quantity maxim ('Do not make your contribution more informative than is required'). Together, they are

intended to strike an 'equilibrium' between markedness and informativity, described by Horn's 'Principle of Least Effort'.

(56) **The Q Principle (Hearer-based)**: (Horn 1984: 13)
Make your contribution sufficient
Say as much as you can (given R)

(57) **The R Principle (Speaker-based)**: (ibid.)
Make your contribution necessary
Say no more than you must (given Q)

Quantity or Q-implicatures are calculated based on relative informativity (holding fixed markedness), via the Q Principle. Manner or M-implicatures are calculated based on relative markedness (holding fixed informativity), via the R Principle (when a marked form is used) or the Q Principle (when an unmarked form is used).

This perspective on Gricean maxims makes it easier to characterize relevant competitors for the purposes of calculating implicatures. The determination of competitors for both types of implicature requires a precise characterization of scales of complexity and informativity. To constrain what counts as a competitor for the Q and R Principles, I draw from work in Katzir 2007, who calculates levels of complexity on parse trees, as in (58).

(58) Structural complexity:
Let ϕ, ψ be parse trees. If we can transform ϕ and ψ by a finite series of deletions, contractions, and replacements of constituents in ϕ with constituents of the same category taken from $L(\phi)$, we will write $\psi \lesssim \phi$. If $\psi \lesssim \phi$ and $\phi \lesssim \psi$ we will write $\phi \sim \psi$. If $\psi \lesssim \phi$ but not $\phi \lesssim \psi$ we will write $\psi < \phi$.

He uses the notion of strict subsets, or generalized entailment, to capture differences in informativity, coupled with a particular definition of 'weak assertability' (p. 672): '[a] structure ϕ is said to be weakly assertable by a speaker S if S believes that ϕ is true, relevant, and supported by evidence.' With these in place, we can recast Horn's (1984) Q- and R-Principles in terms of clear alternative sets (see also Rett to appear).

(59) Q alternatives
Let ϕ be a parse tree. The set of Q alternatives for ϕ, written as $A_{Qstr}(\phi)$, is defined as $A_{Qstr}(\phi) := \{\phi' : \phi' = \phi\}$[10].

(60) The Q Principle

[10] Katzir defines structural alternatives more weakly, as $A_{str}(\phi) := \{\phi' : \phi' \lesssim \phi\}$. The discussion here does not require this flexibility.

Do not use ϕ if there is another sentence $\phi' \in A_{Qstr}(\phi)$ such that both:
a. $[\![\phi']\!] \subset [\![\phi]\!]$, and
b. ϕ' is weakly assertable.

Parallel treatment of the R Principle requires a corollary to (59), as in (61), which is my adaptation of Katzir's suggestions for R-implicatures (p. 680).

(61) R ALTERNATIVES
Let ϕ denote a semantic object of type $\langle \omega, t \rangle$. The set of R alternatives for ϕ is defined as $A_{Mstr}(\phi) := \{\phi' : [\![\phi']\!] = [\![\phi]\!]\}$.

(62) THE R PRINCIPLE
Do not use ϕ if there is another sentence $\phi' \in A_{Mstr}(\phi)$ such that both:
a. $\phi' \lesssim \phi$, and
b. ϕ' is weakly assertable.

Equatives are thought of as carrying a quantity implicature relative to comparatives; I will also argue that they can carry manner implicatures, particularly in the case of equatives with MP standards. In the next section, I'll use these Q and R Principles to motivate an implicature-based treatment of MPEs.

3.2 *MPEs and MP constructions*

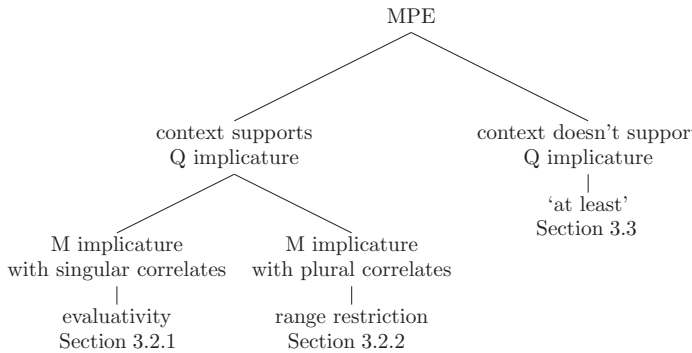
My goal is to maintain a compositional semantic analysis of the equative in (33b), repeated in (63b), by using manner implicature to explain the idiosyncratic interpretation and distribution of MPEs.

(63) a. $[\![\text{er}]\!] = \lambda D' \lambda D.\text{MAX}(D) > \text{MAX}(D')$
b. $[\![\text{as}]\!] = \lambda D' \lambda D.\text{MAX}(D) \geq \text{MAX}(D')$

According to this account, the equative is still the weaker, less informative member on a Q scale with the comparative, so we predict that the use of the equative will still trigger a Q-implicature negating a comparative counterpart. I'll also argue that, in cases in which the correlate value is punctual, MPEs are marked M-alternatives to MP constructions, and their use carries an M-implicature that results in evaluativity. Because of the homogeneity presupposition, MPEs whose correlate value is a range are not M-alternatives to MP constructions, and the result is the range restriction. I'll show that this combination of equative semantics with Horn's Q and R Principles can predict the idiosyncratic

'inclusive at most' interpretation and distribution of MPEs, as modeled in (64).

(64)



I'll begin with the left branch of the tree, the predictions of a multiple implicature account in contexts that support the Q implicatures of MPEs.

3.2.1 *M-implicature for singular correlate MPEs* A context that supports an MPE's Q-implicature is one in which the hearer assumes that the speaker is knowledgeable and is behaving according to Grice's maxims (or something like them). In such a context, the MPE in (65) will have the semantic value in (65a) and will carry the Q implicature in (65b), resulting in the strengthened interpretation in (65c).

(65) Danny Gibbons is as tall as 6′3″.
  a. $\textsc{Max}(\lambda d.\mathsf{tall}(\mathsf{dg}, d)) \geq 6'3''$
  b. $\neg(\textsc{Max}(\lambda d.\mathsf{tall}(\mathsf{dg}, d)) > 6'3'')$
  c. strengthened interpretation: $\textsc{Max}(\lambda d.\mathsf{tall}(\mathsf{dg}, d)) = 6'3''$

I will return in Section 3.3 to discuss contexts that don't support this Q implicature.

Importantly, contexts that support this Q implicature are also contexts in which MP constructions receive an 'exactly' interpretation. This is trivially true in a semantic account in which MPs are assigned an 'exactly' semantics. It is also true in an 'at least' semantic account like the one proposed in Section 2.2. In a context in which the hearer assumes that the speaker is knowledgable and cooperative, the Q-implicature associated with an MPE is licensed, and so is the Q-implicature associated with a MP construction.

This means that, in these contexts and once the implicature is calculated, a particular subset of MPEs are synonymous with a corresponding

MP construction: those MPEs with punctual correlate values, as in (16), repeated below. (MPEs with range correlate values, unlike plural MP constructions, lack a homogeneity presupposition, and so the relationship between the two constructions is slightly different, as I'll argue in Section 3.2.2.)

(66) a. Danny Gibbons is as tall as 6′3″.
b. Danny Gibbons is 6′3″ tall.

(67) a. One DJ is as old as 55 (years old).
b. One DJ is 55 (years old).

(68) a. Hutchison hasn't always scored a zero on the Scorecard. [S]he once scored as high as 50.
b. Hutchinson hasn't always scored a zero. She once scored 50.

(69) a. [T]he 27-year-old owns as many as 100 pairs of Louboutin heels.
b. The 27-year-old owns 100 pairs of Louboutin heels.

I will first demonstrate that the two constructions are synonymous in these contexts. I will then argue that punctual correlate value MPEs are marked R-alternatives to their MP construction counterparts, and therefore that the MPEs carry a manner implicature.

The meaning of the constructions in (66), provided a context that licenses Q-strengthening, are repeated in (70) (see (65) and (47), respectively).

(70) a. $[\![\text{Danny Gibbons is as tall as } 6'3'']\!] = \textsc{Max}(\lambda d.\mathsf{tall}(\mathsf{dg}, d)) = 6'3''$
b. $[\![\text{Danny Gibbons is } 6'3'' \text{ tall}]\!] = \mathsf{tall}(\mathsf{dg},6'3'') \wedge \neg(\exists d[d > 6'3'' \wedge \mathsf{tall}(\mathsf{dg},d)])$

These are the same truth conditions; any situation in which an individual's maximum degree of tallness is 6′3″ is a situation in which he is 6′3″ and no taller.

If an MPE and its corresponding MP construction are synonymous then they are R-alternatives, according to the definition in (59). The MP construction is the unmarked alternative because its parse tree is more simple than that of the MPE; in this case, because its morphemes form a strict subset of those in the MPE.

When I claim MP constructions are R-alternatives to MPEs, I take this to include any sentence with an unmodified MP, not just an MP construction of the form 'X is MP Adj'. The latter can only be formed with a small subset of a language's measure adjectives (Lehrer 1985;

Kennedy & Svenonius 2006), and usually only the positive ones, as shown in (71).

(71) a. Bowling balls are (*20lbs) heavy.
b. Lamborghinis are (*$500,000) expensive.
c. She scored (*50 points) high.

In such cases, the relevant MP competitor for an MPE would not include the adjective, as in (72).

(72) a. Bowling balls are 20lbs (*heavy).
b. Lamborghinis are $500,000 (*expensive).
c. She scored 50 points (*high).

In contrast, clausal and DP equatives have no such unmarked alternatives.

(73) a. Danny Gibbons is as tall as Joe DiMaggio (is).
b. *Danny Gibbons is Joe DiMaggio tall.

(74) a. One DJ is as old as my mother (is).
b. *One DJ is my mother old.

(75) a. Hutchinson once scored as high as Jones (did).
b. *Hutchinson once scored Jones high.

(76) a. The 27-year-old owns as many pairs of Louboutin heels as her mother (does).
b. *The 27-year-old owns her mother (many) pairs of Louboutin heels.

This is the crucial difference between clausal and DP equatives, on the one hand, and MPEs on the other: only the latter have unmarked synonymous alternatives, so only MPEs can carry a manner implicature. Consequently, the relevant scales for clausal equatives still looks like it did in Figure 1, but there are two different relevant scales for MPEs, as modeled in Figure 2 (repeated below).

So a context that supports an MPE's Q implicature is one in which MPEs with punctual correlate values are synonymous with their

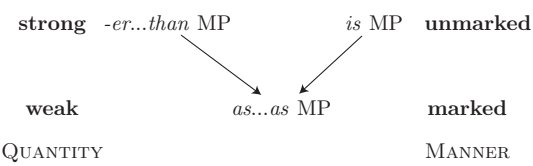


Figure 2 The proposed scale for measure phrase equatives.

corresponding MP construction. I follow Rett (to appear) in assuming that this markedness competition results in evaluativity as a manner implicature. This accounts for one disjunct of the distributional restriction introduced in Section 1.1.2: that MPEs whose correlate values are not ranges have an evaluative interpretation. I'll briefly review the proposal here, then I'll turn in Section 3.2.2 to explain the second disjunct, the range restriction.

In Rett (to appear), I draw on earlier distinctions (Rett 2008a,b) to argue that evaluativity—the requirement that a degree exceed a contextually valued standard—arises as the result of a generalized manner implicature. The core data are the contrast in evaluativity between (77) and (78):

(77) a. John is taller than Bill. $\not\rightarrow$ John/Bill is tall.
b. John is shorter than Bill. $\not\rightarrow$ John/Bill is short.

(78) a. John is as tall as Bill. $\not\rightarrow$ John/Bill is tall.
b. John is as short as Bill. $\rightarrow$ John/Bill is short.

The comparatives in (77) are not evaluative—they do not entail the corresponding positive construction—regardless of the antonym. Neither is the positive-antonym equative in (78a). In contrast, the negative-antonym equative in (78b) is evaluative. It requires that John and Bill be short relative to the salient contextual standard.

Rett 2008a,b observes that evaluativity only arises in degree constructions when a) the non-evaluative interpretation is uninformative (i.e. in the positive construction); or b) the marked negative antonym is used when the unmarked positive antonym would have resulted in the same meaning. The equative is a construction which allows for potential synonymy, while the comparative is not, which explains the contrast above.

In Rett (to appear), I argue that the best way of accounting for the distribution of evaluativity across degree constructions is by treating it as a conversational implicature. In positive constructions, where the degree construction would be trivially true without it, evaluativity arises as a Q-implicature, as it does in Grice's tautology *War is war*. In negative antonym equatives like (78b), evaluativity arises as a M-implicature. I argue that the difference in the at-issue status of evaluativity between positive constructions and equatives tracks its ability to address the Question Under Discussion in a given discourse.

Relevant to the present discussion of MPEs is the extension of an implicature account to the difference in evaluativity between synthetic and analytic comparatives, e.g. (79).[11]

[11] This same contrast in evaluativity occurs in other languages, including Russian (Pancheva 2006; Krasikova 2009) and Navajo (Boga-Allbritten 2011).

(79) a. John is taller than Bill. $\not\rightarrow$ John/Bill is tall.
b. John is more tall than Bill. $\rightarrow$ John/Bill is tall.

For adjectives that allow either the synthetic *-er* comparative or an analytic one (*more*), the two constructions differ in evaluativity. Coupled with a theory in which the analytic strategy is more marked than the synthetic one (e.g. Katzir's theory that (79a) and (79b) are R-alternatives to one another), this contrast provides independent evidence that markedness in comparison constructions correlates with evaluativity.

If a difference in markedness in comparison constructions like those in (79) results in evaluativity for the marked strategy, and if MPEs are marked R-alternatives to MP constructions, we expect, too, that MPEs will be evaluative whenever they are marked R-alternatives.[12]

The idea that evaluativity can arise in marked MP constructions also raises the issue of other types of comparison strategies; Nouwen (2008) observes that negated comparatives like *John invited no fewer than 50 people* receive an 'exactly' interpretation, and uses Q-implicatures to account for this fact. But they are also evaluative, which suggests that they too carry M-implicatures (perhaps relative to synthetic, non-negated comparatives, similar to the contrast in (79)).

To sum up this section: in contexts that support an equative's Q-implicature, MPEs with punctual correlate values are synonymous to their MP construction counterparts. Since they are additionally more complex than these MP constructions, MPEs in these contexts are marked R-alternatives to MP constructions. As a result, the utterance of an MPE in these contexts carries with it an M-implicature—evaluativity—independently observed to be a property of marked degree constructions.

I represent this M-implicature as $\rightsquigarrow_M$ in (80c). The resulting strengthened interpretation in (80d) predicts that the sentence is acceptable in such a context iff Danny Gibson is 6′3″ tall and that counts as tall in the context (e.g. for a baseball player).

(80) Danny Gibbons is as tall as 6′3″.
a. $\textsc{Max}(\lambda d.\mathsf{tall}(\mathsf{dg}, d)) \geq 6'3''$

[12] There is also an interesting parallel with spatiotemporal equatives, exemplified in (i):

(i) a. The vote could take place as early as Wednesday evening.
b. This train will take you as far as Berkeley.

These equatives each have a PP counterpart, shown in (ii).

(ii) a. The vote could take place on Wednesday evening.
b. This train will take you to Berkeley.

Both sentences in (i) are evaluative, and they both seem to have an 'exactly' interpretation.

b. $\rightsquigarrow_Q \neg \textsc{Max}(\lambda d.\mathsf{tall}(\mathsf{dg}, d)) > 6'3'')$
c. $\rightsquigarrow_M 6'3'' > s_{\mathrm{tall}}$
d. strengthened: $\textsc{Max}(\lambda d.\mathsf{tall}(\mathsf{dg}, d)) = 6'3'' \wedge 6'3'' > s_{\mathrm{tall}}$

In Section 1.1.1, I argued that MPEs with range correlate values receive an 'inclusive at most' interpretation. But MPEs with punctual correlate values, as (80d) predicts, receive an 'exactly' interpretation.[13] This is true for all of the examples above; (66a), for instance, is incompatible with 'at least' or 'at most' continuations.

(81) Danny Gibbons is as tall as 6′3″...
a. #...He is, in fact, 6′4″. '*at least*'
b. #...He is, in fact, 6′2″. '*at most*'

Additionally, MPEs with punctual correlate values can be overtly modified by *exactly*, as (82) shows.

(82) a. Danny Gibbons is exactly as tall as 6′3″.
b. One DJ is exactly as old as 55.
c. Hutchinson once scored exactly as high as 50.
d. The 27-year-old owns exactly as many as 100 pairs of shoes.

This analysis accounts for these two properties of MPEs with punctual correlate values: they receive an 'exactly' interpretation, and they are evaluative. Next I discuss predictions for MPEs whose correlate value is a range.

3.2.2 *M implicature for plural correlate MPEs* In contexts that support the Q-implicature in (65b), MPEs with range correlate values are, in contrast, **not** synonymous with their MP construction counterparts. This is due entirely to the homogeneity presupposition that MP constructions carry: in contexts that support strengthening to 'exactly,' MP constructions are only defined over punctual values, while MPEs are not so restricted.

That MPEs do not have a homogeneity presupposition is evident in their range restriction, presented in Section 1.1.2, which can be thought of as a complement to the homogeneity presupposition. I will continue assuming here that MP constructions carry a homogeneity presupposition for independent reasons, but if there were any doubt that the HP is a general phenomena, it might be tempting to treat the HP as the unmarked, stereotypical interpretation and the range restriction as the marked, atypical situation, as McCawley and Horn do for *kill* and *cause to die*.

[13] Here is a naturally occurring example: *[Y]ou write a story that is exactly as long as 55 words, post it to our wall, get all your friends to like it, and win prizes!* Later, the requirement is paraphrased, under the 'Guidelines' section: *Stories must be 55 words EXACTLY. No more. No less. Flouting this rule disqualifies your story!*†

Since 'exactly' MP constructions carry a homogeneity presupposition, MPEs with plural correlates are R-alternatives to their MP construction counterparts only when their correlate value is punctual. The account in the previous section thus predicts that such MPEs receive an evaluative 'exactly' interpretation. If on the other hand the correlate value of a plural MPE is a range, the HP rules out its corresponding MP construction as an R-alternative.

For example: because the MP construction in (83a) carries the HP, (83b) will count as its more marked R-alternative only in a context in which the linguists are equally tall. In this case, we predict that an utterance of the MPE will result in evaluativity, as in Section 3.2.1.

(83) a. The linguists are 5ft tall.
b. The linguists are as tall as 5ft.

In contrast, whenever the linguists are tall to different degrees, the MP construction in (83a) is undefined and will therefore not count as an unmarked R-alternative to (83b). In this case, it carries a Q-implicature (in (84b), calculated relative to the comparative) and a M-implicature that the linguists are different heights (i.e. that the correlate value corresponds to a range), represented in (84c). This R-implicature follows from a) the fact that (83b) was uttered in contrast to the simpler (83a) and b) the fact that (83a) carries a homogeneity presupposition (but equatives do not).

(84) The linguists are as tall as 5ft.
a. $\exists x[x \Subset \sigma y.{*}\mathsf{linguist}(y) \wedge \textsc{Max}(\lambda d.{*}\mathsf{tall}(x, d)) \geq 5\text{ft}]$
b. $\rightsquigarrow_Q \neg(\exists x[x \Subset \sigma y.{*}\mathsf{linguist}(y) \wedge \textsc{Max}(\lambda d.{*}\mathsf{tall}(x, d)) > 5\text{ft}])$
c. $\rightsquigarrow_M \neg(\forall x[x \subset \sigma y.{*}\mathsf{linguist}(y) \rightarrow {*}\mathsf{tall}(x,5\text{ft})])$
d. strengthened: $\exists x[x \Subset \sigma y.{*}\mathsf{linguist}(y) \wedge \textsc{Max}(\lambda d.{*}\mathsf{tall}(x, d)) = 5\text{ft}] \wedge \neg(\forall x[x \subset \sigma y.{*}\mathsf{linguist}(y) \rightarrow {*}\mathsf{tall}(x,5\text{ft})])$

The resulting truth conditions in (84d) can be read as, 'The members of a representative subgroup of the linguists is exactly 5ft tall, but not all of the linguists are tall to that degree.' This is the 'inclusive at most' interpretation demonstrated in Section 1.1.2; it requires that at least one member of the representative subgroup of the plurality measure MP, that not all members measure MP, and that those who don't have smaller measures.

Importantly, because the truth conditions in (84) deal in part with representative subgroups, the analysis predicts that the 'inclusive at most' interpretation allows of exceptions in certain contexts (e.g. for a linguist not in the representative subgroup to be taller than 5ft). This is a

	S_1	S_2	S_3	S_4	S_5
linguist 1	4ft	6ft	4ft	5ft	4ft
linguist 2	4ft	6ft	$4\frac{1}{2}$ft	5ft	5ft
linguist 3	4ft	6ft	5ft	5ft	6ft
TCs: MAX $\geq$ 5ft	**F**	**T**	**T**	**T**	**T**
$\rightsquigarrow_Q$: $\neg$(MAX) $>$ 5ft)	**T**	**F**	**T**	**T**	**F**
$\rightsquigarrow_M$: $\neg(\forall x \subset y[\mathsf{tall}(x,5\text{ft})])$	**F**	**F**	**T**	**F**	**T**
MPE acceptability	✗	✗	✓	✗	✗

Table 1 Evaluating the MPE *The linguists are as tall as 5ft across scenarios*.

direct consequence of the relatively weak approach to plural comparison constructions adopted in Section 2; it remains to be seen (in the absence of clear data or an explicit pragmatic account) how accurate this prediction is.

This 'inclusive at most' interpretation has arisen automatically given the degree semantics in Section 2 and relatively standard assumptions about quantity and manner implicatures.[14] The effects of each implicature on a plural correlate MPE are modeled in Table 1.

Importantly, this account does not predict that MPEs with punctual correlate values are unacceptable; it just predicts that they must, like MPEs with singular correlates, be evaluative. This is generally the case, as suggested by (21) (repeated in (85)), although judgments on these cases are hard to elicit.

(85) The Watts Towers are as tall as 30m. #They are in fact all 30m tall, which makes them very short towers indeed.

The relevance of the homogeneity presupposition in the licensing of MPEs paves the way for an explanation of why universal DPs are unacceptable in MPEs, as was demonstrated in Section 1.1.2. Heim (2000) investigates the scopal properties of a number of different scope-taking elements in comparision constructions (primarily, the comparative and equative). She concludes, in line with Kennedy (1999), that DP quantifiers (e.g. *some, all*) necessarily scope outside of the degree quantifier, while they can but need not scope over the quantifiers encoded in modals and intensional verbs. ('DegPs are mobile, but they are not allowed to cross over quantificational DPs', Heim 2000: p. 237.)

This means that the only available interpretation for an MPE with a universal DP (but not a necessity modal) is in (91).

[14] In contrast, in the analysis in Rett (2010) derived the 'at least'/'at most' contrast between clausal and MP equatives semantically, but could not account for the distributional restrictions of MPEs.

(86) *Every linguist is as tall as 5ft.
  a. $\forall x[\textsf{linguist}(x) \rightarrow \textsc{Max}(\lambda d.\textsf{tall}(x,d)) \geq 5\text{ft}]$
  b. $\rightsquigarrow_Q \neg(\forall x[\textsf{linguist}(x) \rightarrow \textsc{Max}(\lambda d.\textsf{tall}(x,d)) > 5\text{ft}])$
  c. strengthened: $\forall x[\textsf{linguist}(x) \rightarrow \textsc{Max}(\lambda d.\textsf{tall}(x,d)) = 5\text{ft}]$

In a context that licenses the Q implicature, we predict that the sentence is in competition with its MP construction counterpart *Every linguist is 5ft tall*. But in this case, the truth conditions of the equative are incompatible with the negation of the homogeneity presupposition, resulting in unacceptability. Importantly, given Heim's observations, this prediction does not extend to universal modals and other non-DP quantifiers, which appear to be able to scope under the DegQ, as in (87).

(87) John must be as tall as 5ft.
  a. $\textsc{Max}(\lambda d \forall w \in \text{Acc}: \textsf{tall}_w(\text{j}, d)) \geq 5\text{ft})$
  b. $\rightsquigarrow_Q \neg(\textsc{Max}(\lambda d \forall w \in \text{Acc}: \textsf{tall}_w(\text{j}, d)) \geq 5\text{ft})$
  c. strengthened interpretation: $\textsc{Max}(\lambda d \forall w \in \text{Acc}: \textsf{tall}_w(\text{j}, d)) = 5\text{ft}$

In contrast to (86c), the truth conditions in (87c) are not incompatible with the range restriction; they require that John's tallest possible height be 5ft, which is compatible with John's height varying across accessible possible worlds.

To sum up this section: clausal equatives have to compete in terms of informativity with clausal comparatives, but MP equatives have to compete with both MP comparatives and MP constructions. I've argued that this perspective of the data, supplemented with a Horn-style treatment of manner implicature, can account for the disjunctive distributional restrictions on MPEs: they have to have correlate values that are ranges (in contrast to plural MP constructions) or they have to have standard values that are evaluative (in contrast to MP constructions). I've also suggested a way of reducing the prohibition on universal DP subjects in MPEs to Heim's previous observations about scopal properties of comparison constructions.

3.3 *The M-implicature in the absence of the Q-implicature*

I have so far only discussed the behavior of MPEs in contexts that support strengthening from the semantic, 'at least' interpretation of MPs and equatives to the 'exactly' interpretation. In this section, I discuss the predictions of this theory in contexts in which the constructions receive an 'at least' interpretation. I also discuss the relative cancelability of scalar Q-implicatures and M-implicatures.

It is possible to felicitously utter an MP construction in a context in which the Q-implicature is not supported, arguably resulting in an 'at least' interpretation of the sentence. (88) is a typical example of such a context; (89) provides a parallel example with an MP.

(88) A: I'm conducting a survey to see how many residents are eligible for the new 'big family' tax deduction. Do you have three kids?
B: Yes, I have three kids, in fact I have 5.

(89) A: I'm conducting a survey to see if our cashiers can reach the new cash registers. Are you 5 feet tall?
B: Yes, I'm 5 feet tall, in fact I'm 5′6″.

Crucially, in contexts in which MP constructions receive an 'at least' interpretation, they are not subject to the homogeneity presupposition. In such contexts, MPEs are always more marked than their MP construction counterparts. This is true if the MPE has a punctual correlate value or a range correlate value; both constructions will mean 'at least MP', as illustrated in (90)

(90) a. ⟦[The linguists are 5ft tall]⟧
$= \exists x[x \Subset \sigma y.{*}\textsf{linguist}(y) \wedge {*}\textsf{tall}(x,5\text{ft})]$

b. ⟦[The linguists are as tall as 5ft tall]⟧
$= \exists x[x \Subset \sigma y.{*}\textsf{linguist}(y) \wedge \textsc{Max}(\lambda d.{*}\textsf{tall}(x, d)) \geq 5\text{ft}]$

The result is the prediction that MPEs, in certain contexts, can receive an 'at least' interpretation; but in these cases, the MPE is predicted to be evaluative, because it is a marked R-alternative to its MP construction counterpart.

While I characterized MPEs in Section 1.1.1 as generally receiving an 'at most' interpretation, they are sometimes able to receive an 'at least' interpretation, in which case they are evaluative. I'll review two types of data: those in which MPEs are overtly modified by *at least*; and those in which context seems to bring out the 'at least' interpretation.

The first type of evidence that the Q-implicature associated with MPEs can be canceled is their ability to be overtly modified by *at least*, as (91) shows.

(91) a. [T]here were little old ladies, probably at least as old as 70, who were on the machines.†
b. The temperature has to be at least as low as 20 degrees to make snow. On a cold day, the snow machines are going full blast at Sunset Ski Area.†

c. This should all remind us that the blogfather of this website, Jim Gilliam, is in need of lungs. Being 6′5″ he needs a person at least as tall as 5′11″.†

And, as predicted, these examples seem to be evaluative.

Context, too, can prevent the calculation of an MPE's Q-implicature. This is especially easy to see in the examples in (92), in which an MPE is disjoined with a comparative. These sentences, too, are evaluative.

(92) a. Having a deluxe hot chocolate could be as much as 500 or more calories. . . .†
b. The knot count can vary from as few as 20 to as high as 500 or more knots per square inch.†
c. Failure rates of thrombolytics can be as high as 20% or higher.†
d. Most of them are at least as tall as 6′4″ or taller. . . .†
e. What is the probability that W would be as low as 5 or lower if H_0 were true?†

This prediction also seems to be supported by plural MPEs in downward-entailing contexts, which receive an 'at least' interpretation, and which are also evaluative.

(93) a. Wolters was about 6-foot-1 as a high school sophomore, and he became even more effective under the boards as he added a few inches, Jordan added. Wolters said his height has helped him lead South Dakota State's offense. 'Most point guards aren't as tall as 6′4″, and I can definitely see over the defense a little better than smaller guards can', he said.†
b. 'How many (cicadas) you have will depend on how long your trees have been there', said Nixon. 'If your trees are as old as 100 years you will have more and if your trees are 50 years or less you probably won't have many.'†

There is one final context in which the Q-implicature typically associated with an MPE is not calculated: contexts in which the standard value (the MP) is salient in the discourse. These seem to be direct parallels of the census data in (88) and (89), where the interpretation B's response is affected by the fact that A has made a particular numeral or MP salient. In these contexts, the MPE receives an 'at least' interpretation, and is evaluative.

(94) A: I just finished watching a nature documentary, and it left me truly terrified of snakes. Is it true that they grow as long as 40 feet?†

B: Yes, snakes grow as long as 40 feet... in fact, they grow to be 42 feet!
B′: Yes, snakes grow as long as 40 feet... #in fact, they grow to be 38 feet!

In sum, my account predicts that the 'inclusive at most' interpretation of MPEs is a symptom of competition between plural-correlate MPEs and plural MP constructions in a context in which these constructions are strengthened to mean 'exactly'. In contexts which do not support this strengthening, we predict that MPEs can receive an 'at least' interpretation. And, because the 'at least' interpretations of MP constructions do not carry a homogeneity requirement, we predict that these 'at least' MPEs are only licensed, given their relative markedness, if they are evaluative. This seems to in fact be what we see.

While the Q-implicature associated with an MPE can thus be canceled or not calculated, its M-implicature is not similarly cancelable. This is illustrated in (95), modeled on the data in (16) from Section 1.1.2.

(95) a. One of the DJs I know is as old as 55 and even he doesn't use vinyl any longer. #He's one of the youngest DJs I know.
b. Hutchinson once scored as high as 50 on the Scorecard. #That is a very low score.

As I argue in Rett (to appear), this uncancelability is not surprising given the behavior of other M-implicatures (and non-scalar Q-implicatures, like those that accompany tautologies like *War is war*). This is because while scalar implicatures are associated with the information communicated given a particular linguistic form, manner implicatures are associated with the form itself.

Levinson (2000) defends this point explicitly (p. 116), arguing that manner implicatures 'are not just more informative [than what is said] in the sense that they entail what is said (that is equally true of most Q-implicatures): they introduce semantic relations absent from what is said, and in that sense can be said to reshape the proposition expressed (whereas Q-implicatures of the scalar type only introduce a negative bound from within the same semantic field).'

I've argued that we can attribute the idiosyncratic interpretation and distribution of MPEs relative to clausal equatives to the fact that the former, but not the latter, have a clear and systematic R-alternative: MP constructions. This assumption, coupled with an independent explanation of the fact that plural MP constructions carry a homogeneity presupposition, can account for why plural MPEs receive a range

interpretation: they carry two implicatures, a Q-implicature strengthening their interpretation to 'exactly,' and an M-implicature, causing them to be licensed only in contexts in which their correlate value is a range. And it can explain why singular MPEs or MPEs that receive an 'at least' interpretation are evaluative: they acquire a marked, evaluative interpretation because their less marked R-alternatives are also licensed.

While there hasn't been much work on the semantics of MPEs, they can be seen as a subspecies of the better-examined phenomenon of modified numerals, for example *John bought at least/no more than 5 books*. Some modified numerals, like MPEs, overlap in meaning with their MP construction counterparts. I will thus end the article by exploring the extent to which the present analysis of MPEs can carry over to modified numerals more generally.

4 MODIFIED NUMERALS AND IMPLICATURES

I argue here that the relationship between MP comparatives and MP equatives posited above can be extended to similar distinctions between Class A and Class B numeral modifiers. I'll first present the Class A/B distinction; in Section 4.2 I will suggest how the account in Section 3 can be generalized to account for the broader class of phenomena.

4.1 *A brief history of modified numerals*

Geurts and Nouwen (2007) and Nouwen (2010) observed that, despite being in principle logically equivalent, the comparative and superlative numeral modifiers *more than 3 and at least 4* mean slightly different things and have slightly different distributions. For instance, the comparative—but not the superlative—is acceptable in cases in which the speaker knows the exact value of the measured entity (96) (see also Geurts *et al.* 2010)

(96) I know exactly how many sides sides a hexagon has ...
  a. A hexagon has more than 3 sides.
  b. #A hexagon has at least 4 sides.

The comparative and superlative also behave differently in the scope of permission modals (97).

(97) a. You may have fewer than three beers ... but of course, you may have four.
  b. You may have at most three beers... #but of course, you may have four.

class A	class A
more/fewer/less than n (comparative)	*at least/most n* (superlative)
many/no more than n (differential)	*n or more/fewer/less* (disjunctive)
between n and m, over/under n (locative)	*from n to m, from/up to n* (directional)
	maximally/minimally n, n tops (other)

Table 2 Nouwen's (2010) Class A and Class B modified numerals

In (97a), the comparative seems to be granting permission for a particular amount of beer without prohibiting other amounts; (97b), in contrast, seems to additionally prohibit a higher quantity.

Nouwen (2010) argues that this distinction is quite general; he dubs modifiers that behave like the comparative 'Class A' and those that behave like the superlative 'Class B'. His list of these modifiers are in Table 2.

While this classification of numeral modifiers seems to be relatively robust, recent work has shown that the superlative doesn't belong in either class. The superlative is clearly not a Class A modifier, but it differs from Class B modifiers in its ability to modify implicit scales (98); its ability to act as a sentential adverb (99); and its sensitivity to focus (100).[15]

(98) a. She is at least an assistant professor.
b. ??She is up to an assistant professor.

(99) a. Betty had three martinis {at most/*up to}.
b. {At least/*Up to}, Betty had three martinis.

(100) a. We should at least invite the $[\text{postdoc}]_F$ to lunch.
b. We should at least invite the postdoc to $[\text{lunch}]_F$.

Schwarz *et al.* (2012) additionally observe that other Class B modifiers (but not the superlative) are subject to 'bottom-of-scale' effects, wherein they cannot modify a number if it is considered low in the context.

(101) a. At most one person died in the crash.
b. #Up to one person died in the crash.

Cummins *et al.* (2012) are careful to argue that this 'bottom of scale' value varies across contexts, depending on the scale and the level of accuracy required by the context. So, for example, in a context in which a minimum egg purchase is two dozen, the contrast in (102) holds.

[15] See also Krifka 1999 and arguments in Szabolcsi (1986); Heim (1995); Sharvit and Stateva (2002) that the superlative is significantly more semantically complex than the comparative.

(102) a. John bought at most two dozen eggs at the dairy store.
b. #John bought up to two dozen eggs at the dairy store.

Based on these distinctions, Schwarz *et al.* (2012) and recently Coppock and Brochhagen (2013) have offered accounts of the superlative modifier in which it is distinct from other Class B modifiers (see also Krifka 1999; Büring 2007). Since it is my goal to address the Class A/B distinction, I will not have anything more to say about the superlative; interested readers should consult the analysis in Coppock and Brochhagen 2013. My claim in Section 4.2 is that, once the superlative is discounted in the Class A/B distinction, the multiple implicature account of the differences between MP comparatives and MP equatives proposed in Section 3 can be extended to the Class A/B distinction generally.

Nouwen (2010) presents an influential account of the Class A/B distinction. Like my account of MPEs, Nouwen's proposal has two components: an account of how Class A modifiers differ from Class B modifiers; and a markedness-based account of the difference between Class B modifiers and their MP construction counterparts. While the first component is significantly different from the one in Section 3, the second component is similar in many respects.

Nouwen (2010) proposes that Class A and B modifiers differ in that that the former place a bound on a measure, while the latter identify the measure. This is demonstrated abstractly in (103) for downward-entailing (↓) modifiers of both classes for a degree predicate M ('*like being a number n such that Jasper invited n people to his party*', p. 7).

(103) a. $[\![\text{MOD}^{\downarrow}_{A}]\!] = \lambda d \lambda M.\text{MAX}_n(M(n)) > d$
b. $[\![\text{MOD}^{\downarrow}_{B}]\!] = \lambda d \lambda M.\text{MAX}_n(M(n)) = d$

Nouwen assumes that these degree predicates are formed when a numeral combines with the denotation of a noun via two different null *manys*. These *manys* play roughly the same general semantic role as the μ or M-OP operator suggested in Section 3, but they are crucially different from μ in that they existentially bind the individual argument. Additionally, one null *many* is more strict than the other: it carries a uniqueness presupposition, as shown in (104b), ensuring that $many_2$ measures only the maximal individual satisfying the predicate.

(104) a. $[\![\text{many}_1]\!] = \lambda d \lambda P \lambda Q \exists x[\#x = d \wedge P(x) \wedge Q(x)]$
b. $[\![\text{many}_2]\!] = \lambda d \lambda P \lambda Q \exists! x[\#x = d \wedge P(x) \wedge Q(x)]$

The claim is that the application of Class A modifiers to [n many_1] and [n many_2] result in distinct truth conditions, while the application

of Class B modifiers to each results in equivalent truth conditions. This difference explains the difference in meaning between Class A and B modifiers.

The 'awkwardness of a lot of examples with class B quantifiers' (Nouwen 2010: p. 14) is briefly explained using Horn's (1984) Division of Pragmatic Labor. Nouwen assumes that Class B modifiers are marked relative to their MP counterparts, but the two constructions are only equivalent when the set of degrees measured is a singleton set. This is similar to the proposal in Section 3.

If it is possible to extend a multiple implicature account in Section 3 to the Class A/B distinction to at least some of the Class A/Class B modifiers, as I'll explore in the next section, it would have an advantage over Nouwen's account in at least two respects. First, the semantic treatment of Class B modifiers would have clear compositional ties to their degree-quantifier counterparts, which arguably encode non-strict orderings like $\geq$ instead of equating a measure to a degree. Second, the multiple implicature account doesn't rely on more than one null measure operator (i.e. on two distinct null *manys*). Nouwen predicts that the Class A/B asymmetries demonstrated above would occur only in languages whose Class B modifiers diverge in meaning from their degree quantifier counterparts in a particular way, and only in languages that have two null *manys*. This is, arguably, not an attractive prediction.

Additionally, because Nouwen's focus was on numeral modifiers (instead of MP modifiers or degree quantifiers generally), his proposal was developed in such a way that it is crucially tied to measures of quantity, via the two null *manys* in (104). In order for the account to be extended to e.g. the MP comparisons in (105) and (106), it would need to postulate a similar ambiguity for every adjective (e.g. *tall*).

In the following section I'll outline how a multiple implicature account, based on one aspect of Nouwen's proposal, could be extended to the Class A/B distinction generally—or at least a substantial subset of these modifiers—while avoiding these worries.

4.2 *A multiple implicature approach*

Extending the proposal in Section 3 to the Class A/B distinction means characterizing Class A modifiers as encoding strict orderings and Class B modifiers as encoding non-strict orderings. Geurts & Nouwen (2007) reject this characterization outright (p. 553):

> [I]t is highly unlikely that the differences between *at least n* and *more than n-1* are merely a matter of conversational implicature, for the simple reason that, if they were semantically equivalent,

> the two expressions should license the same implicatures. [. . .] In other words, the naive view that the comparative and superlative modifiers stand to each other as '≤' stands to '<' is untenable in view of the puzzles presented [here].

In contrast, Cummins and Katsos (2010) present experimental evidence for what they call 'the disjunctive nature of non-strict comparison' and extend the account of *at least* in Büring 2007 to the *at least n*/*more than n* distinction (see also Krifka 1999). Schwarz & Shimoyama (2011) propose an analysis of the comparative/superlative distinction along these lines. In extending the multiple implicature account to the Class A/B distinction, I am endorsing a characterization of Class B modifiers as weak relative to their Class A counterparts.

Under this approach, Class A modifiers have Class B counterparts that are equally morphologically complex but informationally weaker. Table 3 is a version of Nouwen's typology from Table 2, adjusted from this perspective.[16]

Recall that, in the approach above, numerals are treated as a subspecies of MP. This correctly predicts that the relevant generalizations of Class A/B modifiers aren't restricted to quantities, as illustrated below.

(105) **Class A**
- a. The kids are more than 6ft tall.
- b. The kids are between 5 and 6ft tall.
- c. The kids are over 6ft tall.
- d. The kids are 5ft tall and taller.

(106) **Class B**
- a. The kids are as tall as 6ft.
- b. The kids are from 5 to 6ft tall.
- c. The kids are up to 6ft tall.
- d. The kids are 5ft tall or taller.

class A (strict)	**class B (non-strict)**
more/fewer/less than n (comparative)	*as many/few/much/little as* (equative)
between n and m (open interval)	*from n to m* (closed interval)
over/under n (locative)	*beginning with/up to n* (directional)
n and more/higher/less (conjunctive)	*n or more/higher/less* (disjunctive)

Table 3 A new perspective on modified numerals

[16] I've omitted *maximally n* from this list. Schwarz *et al.* (2012) treats it as similar to the superlative—and thus distinct from Class B modifiers—but Coppock and Brochhagen (2013) do not. I will have to remain agnostic about it.

I must emphasize that I can only address a strict subset of the modifiers listed in Table 2. This is in part because some of them seem relatively unacceptable in English, at least to me, including *beginning with n* (??*John owns beginning with 10 shoes*) and *from n to m* (?*John owns from 5 to 8 pairs of shoes*). It's also due to the fact that, as a reviewer points out, it's not clear that there is a less marked MP construction counterpart to interval modifiers like *between n and m* and *from n to m*. In what follows, I'll restrict the discussion to negative locative modifiers (*under n* and *up to n*) and connective modifiers (*n and more* and *n or more*).

For these pairs, the Class A modifiers asymmetrically entail Class B modifiers, as demonstrated below.

(107) **negative locative modifiers**
(I'm not sure exactly how many shoes John owns, but...)
a. John owns under 15 pairs of shoes. → John owns up to 15 pairs of shoes.
b. John owns up to 15 pairs of shoes. ↛ John owns under 15 pairs of shoes.

(108) **connective modifiers**
(I'm not sure exactly how many shoes John owns, but...)
a. John owns 15 and more pairs of shoes. → John owns 15 or more pairs of shoes.
b. John owns 15 or more pairs of shoes. ↛ John owns 15 and more pairs of shoes.

Additionally, the Class B modifiers (but not the Class A modifiers) overlap in meaning with their MP construction counterparts. When an MP construction receives an 'exactly' interpretation (or is modified by *exactly*, as below), it asymmetrically entails the Class B modifiers—but not the Class A modifiers—formed with that MP.

(109) John owns exactly 5 pairs of shoes.
a. ↛ John owns more than 5 pairs of shoes. *Class A comparison*
b. ↛ John owns under 5 pairs of shoes. *Class A locative*
c. ↛ John owns 5 and more pairs of shoes. *Class A connective*

(110) John owns exactly 5 pairs of shoes.
a. → John owns as many as 5 pairs of shoes. *Class B comparison*
b. → John owns up to 5 pairs of shoes. *Class B locative*
c. → John owns 5 or more pairs of shoes. *Class B connective*

These facts suggest that the Class A/B distinction could fall under a multiple implicature account like the one proposed above for MPEs.

I'll present evidence that this is a happy result by showing that the previously observed differences between these Class A and B modifiers can be explained in terms of the 'inclusive at most' interpretation and the range and evaluativity restrictions.

Ignorance implicature The ignorance implicature observed by Nouwen (2010), arguably, amounts to the range restriction. The contrast is presented below:

(111) I know exactly how many sides a hexagon has ... *Class A*
  a. A hexagon has under 7 sides.
  b. A hexagon has 5 sides and more.
(112) I know exactly how many sides a hexagon has ... *Class B*
  a. #A hexagon has up to 7 sides.
  b. #A hexagon has 5 sides or more.

Class A modifiers, but not Class B modifiers, are acceptable in a context in which the speaker knows the precise value being measured.

In these examples, the entity being measured corresponds to a punctual value—the number of sides a hexagon, when the speaker is sure of the number—so the multiple implicature account predicts that the Class A modifiers, but not Class B modifiers, will be acceptable in these contexts. It additionally predicts that the difference will be neutralized if a) the speaker is unsure of the amount (so the value corresponds to an epistemic range), (113); or b) the speaker is sure of the measure of multiple, heterogenous individuals (so the value corresponds to a range), (114). This seems to be the case.

(113) I'm not sure exactly how many sides a hexagon has, but...
  a. I think it has up to 7 sides.
  b. I think it has 5 sides or more.
(114) I know how many players a volleyball team can have...
  a. A team can have up to 6 players.
  b. A team can have 2 players or more.
(115) You can go on holiday for a certain amount of time, I think it is up to 10 days. You should check.†

BOS effects and evaluativity The sentences in (116) show that Class B modifiers are generally subject to Schwarz *et al.*'s (2012) bottom-of-scale effects. Imagine a context in which the minimum purchase of eggs is two dozen.

(116) a. #John bought two dozen eggs or more at the dairy store.
  b. #John bought two dozen eggs or fewer at the dairy store.

This is, effectively, the evaluativity restriction in action: while it is hard to determine what counts as significant in a given context, the bottom of the scale never does.

If Class B modifiers are like MPEs in that they are evaluative, we would predict that Class B constructions can be used metalinguistically, in Barker's (2002) sense, i.e. to inform the interlocutor about the standard itself. And this seems to be the case.

(117) a. Each person reviewing the applications reads more than 50 files. That's a lot of personal statements to read.†
b. [My blood pressure] has also been up to 120/103 which is mind blowing.†
c. It certainly makes me think that if these ordinary, everyday people can lose 100 pounds or more, I should be able to lose a few pounds myself.†

A multiple implicature account could explain this evaluativity restriction on Class B modifiers in terms of a manner-implicature competition with MP constructions, as outlined in Section 3.2.1.

Interaction with modals We can explain observed differences between Class A and B modifiers if we characterize Class B (but not Class A) modifiers as carrying a Q-implicature.

These sentences show a contrast between Class A and B modals in terms of their interpretations under permission modals (based on the examples in Geurts & Nouwen 2007).

(118) **Class A**
a. You may have 3 beers and more ... but of course you may have (just) 2.
b. You may have under 3 beers ... but of course you may have 4.

(119) **Class B**
a. You may have 3 beers or more ... #but of course you may have (just) 2.
b. You may have up to 3 beers ... #but of course you may have 4.

These sentences show that the Class A modifiers seem to be granting permission without prohibiting other options, while Class B modifiers describe constraints on all possible scenarios.

This is difference can be treated in terms of the difference between Class A and B modifiers with respect to a Q-implicature. Assuming that the Q-implicature is calculated at the VP level (Chierchia *et al.* 2009,

among others), we correctly predict that the sentence in (121) is less permissive than its Class A counterpart in (120). While (120) permits a range (200 pages and longer) but does not prohibit anything outside of that range, the strengthened interpretation of (121) permits a point (200 pages) and prohibits anything longer.[17]

(120) The book may be longer than 200 pages.
$\exists w \in \text{Acc}\ [\text{MAX}(\lambda d.\mathsf{long}_w(\mathsf{b}, d)) > 200]$

(121) The book may be as long as 200 pages.
a. $\exists w \in \text{Acc}\ [\text{MAX}(\lambda d.\mathsf{long}_w(\mathsf{b}, d)) \geq 200]$
b. $\rightsquigarrow_Q \neg(\exists w \in \text{Acc}\ [\text{MAX}(\lambda d.\mathsf{long}_w(\mathsf{b}, d)) > 200])$
c. strengthened interpretation, informally:
The book can be 200 pages but it cannot be longer.

That this implicature is not cancellable in this context might be the result of additional manner implications resulting from a competition between the MPE and the MP construction *The book may be 200 pages long*. The account is replicable for the negative locative and connective modifiers.

There is another way in which Class B modifiers interact with modals. Büring (2007) observed that the superlative modifier can receive an 'authoritative reading' under necessity modals. His observation can be reproduced for other Class B modifiers, as in (122). These data appeared to run contrary to claims that Class B modifiers carry ignorance implicatures.

(122) a. The paper has to be as many as 50 pages long.
b. The paper has to be up to 50 pages long.
c. The paper has to be 50 pages long or more.

These sentences are acceptable in a context in which the speaker knows the exact page requirement, in contrast to the sentences in (112).

The availability of these readings could be explained in a multiple implicature account with the observation that necessity modals are non-monotonic in this argument. (Recall the assumption that scalar implicatures are calculated locally, at the VP level; this suggests that, in contrast to the permission modal data above, the implicature is calculated in the scope of the modal.) We cannot reliably infer from *The paper has to*

[17] The truth conditions in (120) and (121) are equivalent to ones in which the modal scopes under the DegQ, for which the strengthened interpretation of (121) is:
$\text{MAX}(\lambda d \exists w \in \text{Acc}[\mathsf{long}_w(\mathsf{b}, d)]) \geq 200\ \wedge\ \neg(\text{MAX}(\lambda d \exists w \in \text{Acc}\ [\mathsf{long}_w(\mathsf{b}, d)]) > 200)$

be 50 pages long to either *The paper has to be 60 pages long* or *The paper has to be 40 pages long*.

Arguably, then, the Q-implicature that is in principle associated with these Class B modifiers relative to their Class A counterparts is not calculated in these contexts; they retain their weak, $\geq$ interpretation. In non-monotonic contexts, then, Class B modifiers cease to be R-alternatives to MP constructions. The resulting prediction is that Class B modifiers retain their weak, non-evaluative interpretation under necessity modals and in other non-monotonic contexts.

I have not, for reasons of space, presented an extension of the multiple implicature approach to the Class A/B distinction in nearly as much detail as I did for MPEs. My goal here is to only suggest that an extension of the multiple implicature account to modified numerals could gain some traction in noted empirical puzzles surrounding modified numerals. If the account of MPEs in Section 3 is plausible, there is much more work to be done to explain the the consequences of the theory on different types of scales, different types of modifiers, and in different types of contexts.

For instance, Cohen & Krifka (2011) argue that superlative modifiers are unacceptable in downward-entailing contexts, but I have found several naturally occurring examples of superlative and Class B modifiers under negation and in the antecedents of conditionals, e.g. *You have entered a password that is not at least 8 characters in length*† (see also Coppock & Brochhagen 2013). I suspect that, like MPEs, these modifiers are possible in DE environments but have a very restricted distribution. Much more work needs to be done here to determine where Class B modifiers can occur, what they mean, and what this says about implicature calculation.

5 CONCLUSION

The main goal of this article has been to show that we can maintain an 'at least' semantics for the equative morpheme in the face of evidence that MP equatives tend to receive 'at most' interpretations (contra Rett 2010). I have argued that the 'at most' interpretation arises in MPEs because they carry two distinct implicatures: (i) a quantity implicature that strengthens their meaning to something like 'exactly'; and (ii) a manner implicature that requires the MPE be used in a marked context: one in which the correlate value is a range (in which case they do not compete with MP constructions) or is high on the scale, i.e. evaluative. The first implicature is common to all equatives (including clausal and

phrasal equatives). The second implicature is specific to MPEs, because only they have less marked but equally informative counterparts, namely MP constructions.

I've assumed a particular framework for the semantics of MP and comparison constructions; I have also made certain assumptions about the calculation of implicature. I believe that the sort of analysis presented above is consistent with both grammatical and neo-Gricean characterizations of quantity implicatures and with an 'at least' or 'exactly' semantics of numerals and MP constructions.

It remains to be seen how to best capture the non-maximal interpretations of plural comparison constructions (although see Malamud 2012). The account presented here appears to rely heavily on an existential distributive semantics for e.g. *The linguists are as tall as John;* it is not immediately clear to me how to replicate the effects of the M-implicature within a stronger, universal approach. At the very least, this paper highlights the need for a better understanding of the relationship between plurals and degree constructions (and the role and distribution of the homogeneity presupposition). I am optimistic that closer studies of plural degree constructions (including plural comparison constructions) can supplement the account presented here.

I've ended by suggesting that the problems MPEs pose to the semantics of comparison constructions is actually part of a larger phenomenon that has been characterized in terms of modified numerals. If the proposal here is on the right track, we might be able to account for fairly widespread restrictions on one of two prima facie equivalent degree constructions by supplementing our compositional semantics with a robust and multi-faceted system of implicature.

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