The semantics of (explicit) equatives*

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This lecture series presents a case study with the aim of providing more insight into different morphosemantic strategies for comparison and similarity across languages, as well as formal analyses of several of these strategies. The specific goals are to:

- *better understand the nature of degree relations and degree relatives, by looking at how equatives are formed across languages* (**Lecture 1**)
- *better understand the nature of as-relatives and the semantic features of verbs and propositions, by looking at different types of similatives* (**Lecture 2**)

→ *better understand the role of degree quantification in the semantics of similarity, by investigating the semantics of quantifier-based equatives in contrast to comparatives and measure phrases* (**Lecture 3**)

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1 review: explicit equatives

A	(is)	more	tall	than	B	
A	(is)	as	tall	as	B	
A			danced	as	B	(did)
TARGET OF COMPARISON		PARAMETER MARKER	PARAMETER	STANDARD MARKER	STANDARD OF COMPARISON	

- many languages can form explicit equatives whose (sufficientive) parameter marker is a degree quantifier (data from Henkelmann, 2006, p385-6)

(1) a. Der Junge is (genau-) so gross wie die Frau.
the boy is (just-) as big as the woman
'The boy is (just) as big as the woman.' *German*

b. wǒ mèimei xiàng nǐ nème hǎokàn.
1.SG younger-sister be_like 2.SG so pretty
'My younger sister is as pretty as you.' *Chinese*

c. Maalia Ammaalia-tut ajur-tiga-aq.
Maalia Ammaalia-SM be_bad-PM-3.SG.IND
'Maalia is as bad as Ammaalia.' *West Greenlandic*

d. M-toto wa-ngu ni hodari sawa na wa-ko.
CL:1.SG-child CL:1.SG-POSS:1.SG COP:AFF clever equal:PM with CL:1.SG-POSS:2.SG
'My child is as clever as yours.' *Swahili*

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- beginning with Bresnan (1973) and Heim (1985): comparative and equative morphemes (=parameter markers) quantify over the degree associated with the adjectival parameter

(2) a. A likes some Australian foods. *individual quantifier*
b. A is more tall than B. *degree quantifier*

- individual quantifiers can be analyzed as relating individuals or sets...

(3) a. $[\![\text{all}]\!] = \lambda P \lambda Q \forall x\, [P(x) \rightarrow Q(x)]$ *individual-based*
b. $[\![\text{all}]\!] = \lambda P \lambda Q.\, P \subset Q$ *set-based*

- ...so too can degree quantifiers[1]

(4) a. $[\![\text{-er}]\!] = \lambda D \lambda D'.\, \textsc{max}(D') > \textsc{max}(D)$ *degree-based*
b. $[\![\text{-er}]\!] = \lambda D \lambda D'.\, D' \supset D$ *set-based*

(5) a. $[\![\text{as}]\!] = \lambda D \lambda D'.\, \textsc{max}(D') \geq \textsc{max}(D)$ *degree-based*
b. $[\![\text{as}]\!] = \lambda D \lambda D'.\, D' \supseteq D$ *set-based*

2 overview: today's lecture

- today's goal is to probe the consequences of the standard analysis of (sufficientive) explicit equatives
  - what predictions it makes about factor modification and NPI-licensing (Rett, 2010)

(6) a. He is as happy to lose his honor as he is to lose so much as a dime.
b. She is as happy now as ever before.

  - what predictions it makes about the 'exactly' interpretation and scalar implicature (Horn, 1972)

(7) A: B doesn't want a bodyguard who is shorter than he is. Is A a possibility?
B: Yes, A is as tall as B is (in fact, she's taller).

  - what can be said about the evaluativity difference between equatives and comparatives (Rett, 2015b)

(8) a. A is shorter than B. $\nrightarrow$ B is short.
b. A is as short as B. $\rightarrow$ B is short.

  - what can be said about 'at most' equatives (in particular, MP equatives, Rett 2015a)...

(9) a. Some barrel organs are as heavy as 100lbs.
b. Skunk cannabis potency is sometimes as high as 20%.

  - ...and what all of that can tell us about manner implicature, and (if we have time) modified numerals
- we'll learn about degree quantifiers in general, and conversational implicature in general

3 degree quantifiers and the equative quantifier

3.1 degree semantics

- gradable adjectives (Seuren, 1984; Cresswell, 1976; Hellan, 1981; Hoeksema, 1984; von Stechow, 1984)

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

[1] Where $\textsc{max}(D) = \iota d \in D[\forall d' \in D[d' \neq d \rightarrow d' < d]]$

- antonyms (e.g. *tall*/*short*) differ in their ordering (Seuren, 1984; von Stechow, 1984, a.o.).

  (11) A is taller than B. → B is shorter than A.

  (12) context: B is 5ft tall.
  a. λd.tall(b,d) = (0,5]
  b. λd.short(b,d) = [5,∞)

  - I'll be using standard interval notation, i.e.

  (13) a. **open**: $(a, b) = \{x : a > x > b\}$
  b. **upper closed**: $(a, b] = \{x : a > x \geq b\}$
  c. **lower closed**: $[a, b) = \{x : a \geq x > b\}$
  d. **closed**: $[a, b] = \{x : a \geq x \geq b\}$

- degree semantics has a specialized type-shifter that is sensitive to the direction of its scales (Heim, 2000)

  (14) $\textsc{max}(D_{+/-}) = \iota d \forall d'[d' \neq d \rightarrow d' <_{+/-} d]$

- MPs can be type-shifted to denote sets of degrees (Schwarzschild, 2005; Kennedy, 2015)

  (15) $[\![6\text{ft}]\!] = \lambda d.d \leq 6\text{ft}$ or = (0,6ft]

- a note of later importance: MPs with plural subjects that receive an 'exactly' interpretation carry a homogeneity presupposition[2]

  (16) 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~~

3.2 the semantics of comparatives and equatives

- two types of comparatives (and equatives):

  1. **clausal** comparatives are those whose internal argument is a clause (has overt tense morphology) or a plausible clausal source ('Reduced Clausal Approach' to e.g. *John is taller than Sue*).
  2. **phrasal** comparatives have no plausible clausal source

  (17) a. He doesn't look older than 23 (*is/*looks).
  b. No man is stronger than himself (*is). (Hoeksema, 1983)

- the semantics of the comparative and equative (von Stechow, 1984; Heim, 2000):

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

[2] 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. (Lappin, 2000; Barker, 2002). One illustration of the HP is the apparent variability of plurals receiving individual predication, as in (i) from Malamud (2012).

(i) 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).

(19) A is as tall as/taller than B (is).
   a. $\textsc{max}(\lambda d.\textsf{tall(a,d)}) > \textsc{max}(\lambda d'.\textsf{tall(b,d')})$ *comparative*
   b. $\textsc{max}(\lambda d.\textsf{tall(a,d)}) \geq \textsc{max}(\lambda d'.\textsf{tall(b,d')})$ *equative*

- NPIs are licensed in the targets of comparatives and equatives (Ladusaw, 1979; Seuren, 1984; von Stechow, 1984; Hoeksema, 1983, 1984; Heim, 2003)

(20) a. She is happier now than ever before.
   b. He would rather die than lift a finger. Heim (1985)

(21) a. He is as happy to lose his honor as he is to lose so much as a dime.
   b. She is as happy now as ever before.

  - the *any* in targets of comparatives appears to be free-choice *any*; perhaps DE degree quantifiers and individual quantifiers license different NPIs (Hoeksema, 1983)

(22) a. This girl is smarter than almost any boy.
   b. One diamond is more valuable than almost any number of bricks.

- this is predicted given two assumptions (cf. Hoeksema, 1983):

1. that the standard clauses of comparatives are downward-entailing (DE)

(23) A function f of type $\langle e, \langle d, t\rangle\rangle$ is **downward-monotonic** iff
$\forall x, d, d'[f(x)(d) \wedge d' < d \rightarrow f(x)(d')]$ Heim (2000)

2. that the comparative and equative are degree quantifiers, which means we have to test for downward entailingness in their degree arguments

(24) context: A is 6ft tall, B is 5ft tall, C is 4ft tall.
   a. A is taller than B. → B is taller than C.
   b. A is taller than B. ↛ B is taller than A.
   c. C is shorter than B. → C is shorter than A.
   d. C is shorter than B. ↛ B is shorter than C.

(25) context: A is 6ft tall, B is 5ft tall, C is 4ft tall.
   a. A is as tall as B. → B is as tall as C.
   b. A is as tall as B. ↛ B is as tall as C.
   c. C is as short as B. → C is as short as A.
   d. C is as short as B. ↛ B is as short as C.

  - the equative entailment patterns only go through on the 'at least' interpretation of equatives; more in §3.3
  - the negative-antonym entailment patterns only go through in a context in which all relevant individuals are considered short because equatives formed with negative relative adjectives are evaluative; more in §3.4

- it also has the capacity to account for the fact that sufficientive-based explicit equatives are modifiable, just like comparatives are

(26) a. A is much/totally/two times taller than B.
   b. A is exactly/at least/twice as tall as B.

  - the semantics of *at least*/*exactly*, especially given our equative denotation, is tricky (Buring, 2007)
  - the semantics of factor modifiers like *twice* is also tricky, for different reasons (Croft and Cruse, 2004)

(27) a. A is half as tall as B.↛ A is twice as tall as B.
b. A is half as short as B. ↔ A is twice as short as B.

- the degrees some of these words modify are differential degrees (Bale, 2008), not any of the two core degree arguments themselves; to account for this, we need to add a differential degree argument

3.3 the weak reading

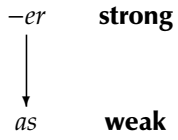
- in general, clausal equatives are ambiguous between a weak ('at least') and strong ('exactly') interpretation

(28) A is as tall as B (is)...
a. ...so you were wrong to say he is taller. èxactly'
b. ...in fact, he's taller. 'at least'

- since Horn (1972), this ambiguity has been characterized just like the inclusive/exclusive ambiguity for *or*: as the result of a quantity implicature
  - *as* lexically encodes the weak, ≥ interpretation
  - and equatives come to have the strong, = interpretation via a quantity implicature due to the competition between equatives and comparatives
  - (this takes for granted that equatives and comparatives are on the same Horn scale, or have identical parse trees (Katzir, 2007), but that there is an asymmetric entailment relationship between them)

(29) a. A is taller than B. → A is as tall as B.
b. A is as tall as B. ↛ A is taller than B.

Figure 1: *The traditional Horn scale for comparatives and equatives*



3.4 comparison constructions and evaluativity

- a degree construction is evaluative iff it requires that some degree exceed a contextually-valued standard
- since positive constructions are evaluative, a good test for evaluativity is whether or not a construction entails its positive-construction counterpart (Bierwisch, 1989)

(30) a. A is shorter than B. ↛ B is short.
b. A is as short as B. → B is short.

- with respect to evaluativity, there are three types of degree constructions:

1. constructions that are always evaluative

(31) a. B is tall/short. *positive constructions*
b. Is B tall/short? *polar degree questions*
c. A is more tall/short than B. *analytic comparatives*

   - also any construction with an 'extreme' adjective (Paradis, 2001), which lexicalize evaluativity
   - also any construction with an 'evaluative DP,' e.g. *some amount of* (Bolinger, 1972)
   - analytic comparatives are only evaluative if there is a synthetic counterpart (Matushansky, 2001)

2. constructions that are never evaluative (when formed with relative adjectives)

   (32) a. B is 5ft tall. *measure phrase constructions*
   b. A is taller/shorter than B. *positive or negative synthetic comparatives*

   - for an interesting exception to the MP construction claim, see Doetjes (2012)

3. constructions that are evaluative with negative antonyms (or are marked for other reasons, see §4.1)

   (33) a. How tall is B? *positive-antonym degree questions*
   b. B is that tall (too). *positive-antonym degree demonstratives*
   c. A is as tall as B. *positive-antonym equatives*
   d. Bs are as tall as 100ft. *MP equatives*

- traditionally, the puzzle of evaluativity has been discussed exclusively in terms of the contrast between the evaluative positive construction (31-a) and the never-evaluative constructions in (32):
  - the puzzle being, how can we possibly account for a semantic property that pops up in the absence of explicit degree morphology (i.e. the positive construction), but goes away in the presence of explicit degree morphology (i.e. the comparative or MP constructions)?
  - a traditional solution (Cresswell, 1976): a null morpheme

    (34) POS $\rightarrow \lambda G_{\langle e,\langle d,t\rangle\rangle}\lambda x\exists d[G(x,d) \wedge d > s]$, for some contextual standard s

    > "As far as I can tell, there is no independent justification for introducing POS; it is merely a device for fixing up the semantics." (Klein, 1980, 3)
    >
    > "The operator "positively," call it POS, is invisible, which made E. Klein think that it doesn't exist." (von Stechow, 1984, 59)

  - it also doesn't exist in overt form in any natural language we've seen (Grano, 2012)...
  - ...and anyway, the prediction that evaluativity only crops up in the absence of overt degree morphology is false, as demonstrated in (33)

- my proposal (Rett, 2015b): evaluativity comes about as a conversational (Gricean) implicature
  - in positive constructions (and evaluative DPs), it arises as a uninformativity-based quantity implicature
    - Grice used this sort of implicature to explain the interpretation of tautologies, like *War is war*
    - unlike scalar implicature, this type of quantity implicature is not cancelable or detachable
    - but it is sensitive to discourse status, like other conversational implicatures (van Kuppevelt, 1995)
    - and, like other types of conversational implicature, it's embeddable

      (35) A: C seems unfazed by the fact that he is a victim of a pyramid scheme.
      B: Well, you know, C has always believed that bankers will be bankers.

      (36) A believes that B is tall.

  - in all other cases, it arises as a markedness-based manner implicature
    - x is more marked than y iff they share an identical parse tree (Katzir, 2007) and are mutually entailing but one is more marked than the other
    - negative antonyms are more marked than positive ones (Lehrer, 1985; Heim, 2007), and so the forms in (33) are otherwise mutually entailing (aside from evaluativity considerations)[3]
    - this is also why analytic comparatives are evaluative when a synthetic one is possible (cf. (31-c))
    - with manner implicatures, we get the same non-cancelability as with non-scalar quantity implicatures (Huitink and Spenader, 2004)...

[3] This is only true of the strengthened, 'exactly' interpretation! So I have to stipulate that quantity implicatures are calculated before manner implicatures, or say something about generalized conversational implicatures.

(37) a. I am not ignorant of this... #in fact, I am unaware of it. *litote*, Horn (1991)
b. B caused the sheriff to die... #in fact, he killed him outright. *periphrasis*
c. A is as short as B... #in fact, neither of them are short at all.

- but, also like other conversational implicatures, this (non-)cancelability is subject to discourse constraints (van Kuppevelt, 1995)

(38) A: I'm a little worried about the actor playing me in the movie. Is she tall or short?
B: (*to the casting agent*) How short is Susan again? (cf. *How tall..?*)
A: That's fine, as long as she's short. (cf. *#as long as she's tall*)

- and manner implicatures are also (optionally) embeddable[4]

(39) The judge believes that B caused the sheriff to die.
a. B was only indirectly responsible for the sheriff's death *local*
b. The speaker is being indirect for reasons of politeness or delicacy *global*

(40) C believes A is as short as B.
a. C is confused about heights, but she believes B is short, and she believes A and B are equally tall *local*
b. C knows A and B are both 5ft tall, but she doesn't know that counts as short (but the speaker does) *global*

- see the appendix for some formal detail, if you're into that sort of thing
- the original proposal didn't include a compositional analysis, but there is an RSA-based account outlined in Bumford and Rett (2021)

FORMAL TOOLBOX

1. a formal analysis of *as* as a relativizer (ideally one that doesn't require it be base-generated in its argument's position)
2. a type-general notion of predicate modification
3. existential closure, a way to bind variables that aren't overtly bound
4. a way to associate predicates with optional non-arguments, e.g. times, manners (homomorphism τ)
5. a way to λ-abstract over non-lexicalized arguments in matrix clauses (a type-raiser)
6. the Quantity maxim, to predict the weak/strong ambig. and the evaluativity of positive constructions
7. the Manner maxim, to predict the evaluativity of marked degree constructions

3.5 interim summary

- it should be no surprise, at this point, that (sufficientive-based) explicit equatives, like explicit comparatives, are formed with degree quantifiers (encoded in the parameter-marking *as* and *-er*, respectively)
- in this section we've reviewed some lesser-known consequences of this stance, including:
  - we make the right predictions about the licensing of NPIs in (sufficientive-based) explicit equatives
    - notably, there is a prediction from Lecture 1 that NPIs are <u>not</u> licensed in implicit equatives or demonstrative-based explicit equatives
    - is there any typological survey or discussion of this sort?
  - we make the right predictions (for the most part, more soon) about the weak/strong meaning alternation if we assume something like the Maxim of Quantity

[4] So there is no reason to encode scalar implicatures in a null operator, there's nothing special about their embeddability (Rett, 2020)!

- and we can account for the evaluativity patterns of equatives (especially in contrast to comparatives) if we assume the Maxim of Manner and Quantity

- but it is unfortunately simply not true that explicit equatives only receive an 'at least' or 'exactly' interpretation: the fact is that some equatives can receive 'at most' interpretations, making their compositional semantics significantly more complicated

4 'at most' interpretations

- there are is one apparent problem for the relatively straightforward analysis presented above: some equatives receive what seems to be an 'at most' interpretation

(41) a. A can eat as many calories as B without putting on weight. *'at most,' 'at least,' or 'exactly'*
b. B may attend as many courses as C. *'at most,' 'at least,' or 'exactly'*

- the same 'at most' readings crop up for numerals – which are also generally characterized as ambiguous between an 'at least' and 'exactly' interpretation – in the same contexts (Carston, 1988; Geurts, 2006)

(42) a. A can have 3,000 calories without putting on weight. *'at most,' 'at least,' or 'exactly'*
b. B may attend six courses (and must attend three). *'at most,' 'at least,' or 'exactly'*

- however, these readings only arise in weak modal contexts

(43) a. B must attend as many courses as C. *'at least' or 'exactly'*
b. B must attend six courses. *'at least' or 'exactly'*

- the 'at most' interpretation in (41) and (42), then, can be explained as follows (Breheny, 2008):

  - numerals and equatives can (but need not) have an 'exactly' interpretation under weak modals
  - then (42-b) means 'There's a world, compatible with the rules, in which B attends exactly six courses'
  - in some contexts, this is consistent with the rule setting a lower bound, yielding the 'at most' reading

- so these 'at most' readings are only apparent, i.e. arise as the result of predictable structural considerations

- but there is one final type of equative that receives an 'at most' interpretation, and accounting for that is a little more complicated

4.1 measure phrase equatives

- it turns out that, in English, explicit comparatives and explicit equatives can have MP standards[5]

(44) **MP comparison constructions**
a. Some barrel organs are heavier than 100kg. *comparative*
b. Some barrel organs are as heavy as 100kg. *equative*

- relative to MP comparatives and clausal equatives, MP equatives (MPEs) have a restricted distribution.

  - the target value must be a range (**the range restriction**); inclusive-or
  - the standard value must count as high (**the evaluativity restriction**)

[5] I know of no language other than English that allows MPEs, although some dialects of Spanish seem to tolerate them. In order to have MPEs, a language would need to i) have a degree-quantifier equative strategy, ii) which doesn't require that the target and standard be of the same syntactic category; iii) which doesn't require that the standard be a clause; and iv) which doesn't require that its standard denote an individual (cf. genitive-marking constructions, Haspelmath and Buchholz 1998).

term	**definition**	**example from (44)/??**
target	external argument	*some barrel organs*
standard	internal argument	*100kg/the organ grinder*
parameter	dimension of measurement	heaviness
target value	parameter measure of the target	example: [20kg,100kg]
standard value	parameter measure of the standard	examples: 100kg, 200kg

Figure 1: Some terminology

- the range restriction is typically satisfied by a plural or modal target

  (45) 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 1,000 meters.

- the evaluativity restriction is shown for these 'punctual-target' examples[6]:

  (46) a. I know 5 other DJs personally, one is as old as 55 and he doesn't even use vinyl any longer.¶
  b. Hutchison hasn't always scored a zero. In fact, she once scored as high as 50.¶
  c. 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.¶

- additional evidence for these distributional restrictions:
  - punctual-target MPEs without evaluative standards are unacceptable:

    (47) a. ??A hexagon has as many sides as 6.
    b. ??This hamburger is as cheap as $40.
    c. ??Sue leaves her house as often as once a year.

  - the evaluativity in MPEs, as that discussed in §3.4, can have at-issue status, depending on the QUD

    (48) Australian: It gets 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!

- when licensed, MPEs are interpreted differently than clausal and phrasal equatives: they receive an 'at most' interpretation instead of an 'at least' interpretation

  (49) The kids dove as deep as their parents (did). *clausal equative*
  a. ...Each parent dove 15m and their kid dove 20m. *'at least'*
  b. #...Each kid dove 15m and their parent dove 20m. *#'at most'*

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

  (51) (Over the course of the day,) The kids dove as deep as 20m. *MP equative*
  a. #...For instance, Michael dove 25m. *#'at least'*
  b. ...For instance, Michael dove 15m. *'at most'*

- additional evidence for this 'at most' interpretation:

[6] ¶ indicates examples that have been taken with minimal modification from the internet.

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

(53) 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**.¶

(54) 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**.¶

(55) The details... let us know that Sarah is **as old as 60** and no younger than 40 when they marry.¶

- crucially, since the 'at most' interpretation is present for all of the MPEs, we can't offer a mononicity-based account for the reading like we did for 'at most' modal equatives above
- these data pose the following challenges to the analysis of explicit equatives outlined above:
  - how does the 'at least' interpretation disappear?
  - what is the source of the 'at most' interpretation?
  - what is the source of the other distributional restrictions?
  - why do MPs condition these differences?

4.2 a manner-implicature analysis of MPEs

- central claims:
  - all (sufficientive-based) explicit equatives are formed from *as*, which encodes a non-strict linear ordering ≥ (nothing new here)
  - in addition to being the weak member on a quantity scale with the corresponding MP comparative, MPEs are weak members on a manner scale with the corresponding MP construction, as in (56)[7]

    (56) a. The linguists are taller than 6ft. → The linguists are as tall as 6ft.
    b. The linguists are 6ft tall. ↔ The linguists are as tall as 6ft.

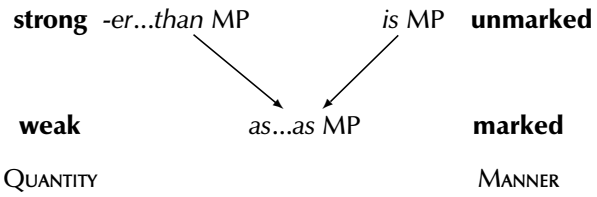


Figure 2: The proposed scale for measure phrase equatives

  - crucially, clausal equatives have no such unmarked alternatives:

    (57) a. *Hutchison is Jones tall. (cf. *Hutchison is as tall as Jones.*)
    b. *Hutchison once scored Jones high. (cf. *...as high as Jones*)

  - this additional manner implicature (relative to MP comparatives, clausal equatives) explains the distributional restrictions on MPEs as well as their tendency to receive an 'at most' interpretation

[7] While not all adjectives can form an MP construction (**Bowling balls are 20lbs heavy*, **She scored 50 points high*, Lehrer 1985), MP constructions without adjectives (*Bowling balls are 20lbs, She scored 50 points*) also count as less marked alternatives.

4.2.1 some technical details

- there are complications with plurals in comparison constructions (Stateva, 2005; Fitzgibbons et al., 2009);

(58) a. The linguists are taller than the philosophers.
b. The linguists are as tall as the philosophers.

  - they can receive maximal ("all of") interpretations
  - they can receive non-maximal ("some of") interpretations
  - this is expected given their behavior outside of comparison constructions (Malamud, 2012)

- I use Link's (1983) star operator $*$ to signify a predicate that is closed under sum formation: it maps a set P to a predicate that applies to any sum of things that each count as P
- I use Link's (1983) supremum operator σ and a context-sensitive relation $\sqsubset$ to approximate the analysis in Fitzgibbons et al. 2009
  - this allows us to use context to fix a representative subgroup of the denoted plural, whether it's the maximal plural group or something less than that
  - '$x \sqsubset \sigma y$' means 'x is a representative subgroup of the maximal plurality of y'

(59) The linguists are as tall as A.
a. $\exists$x[x $\sqsubset$ σy.*linguist(y) $\wedge$ MAX(λd.*tall(x,d)) $\geq$ MAX(λd'.tall(a,d)]
b. strengthened: $\exists x[x \sqsubset \sigma y$.*linguist($y$) $\wedge$ MAX(λd.*tall(x,d)) = MAX($\lambda d'$.tall(a,d))])

4.2.2 the influence of manner implicature

- an MPE's Q- and M-implicatures interact to create three possible uses: i) evaluative 'exactly'; ii) range 'at most'; or iii) 'at least' (see Figure 3)

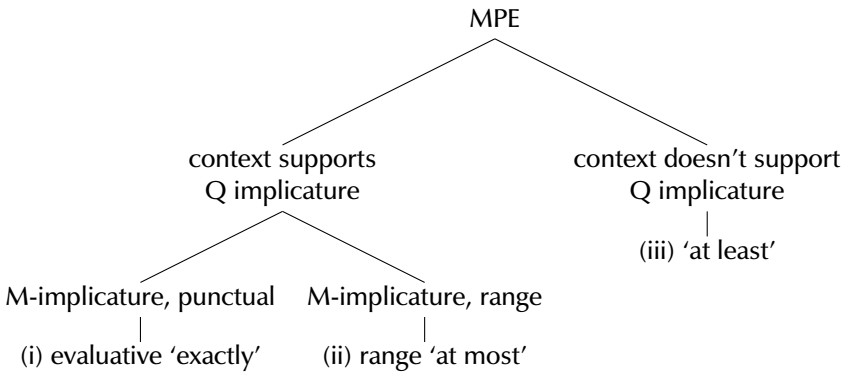


Figure 3: Possible implicatures calculated for MPEs

- **scenario 1**: punctual MPE uttered in a Q-implicature-supporting context
  - in these contexts, the punctual MPE has a strengthened, 'exactly' interpretation due the Q-implicature

(60) $[\![$B is as tall as 6'3''$]\!]$ = MAX(λd.tall(b,d)) $\geq$ 6'3''
a. $\neg$(MAX(λd.tall(b,d)) > 6'3'') Q-implicature
b. strengthened: MAX(λd.tall(b,d)) = 6'3''

- and so will a corresponding MP construction.

(61) $[\![$B is 6'3'' tall$]\!]$ = tall(b,6'3'') (Q-strengthened: *and no taller*)

- because the MPE and MPC are M-alternatives, the use of the complex alternative triggers the implicature that the marked construction describes a marked scenario; evaluativity results (Rett, 2015b)
- like other Manner implicatures (Levinson, 2000), the evaluativity associated with MPEs isn't cancelable: it's tied to the form, not the content

(62) 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. Hutchison once scored as high as 50 on the Scorecard. #That is a very low score.

- **scenario 2**: speaker utters a range MPE in a Q-implicature-supporting context
  - plural or range MP constructions with an 'exactly' reading carry a homogeneity presupposition...

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

(64) a. The linguists are exactly 5ft tall. (*all the linguists*)
b. It's false that the linguists are exactly 5ft tall. (*not any*)

  - ...but plural or range MPEs receiving an 'exactly' interpretation don't (recall the range restriction).

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

(66) a. The linguists are exactly as tall as 5ft. (*all the linguists*)
b. It's false that the ling. are exactly as tall as 5ft. (*not all*)

  - so plural MP constructions and range MPEs are not M-alternatives:
    - if the linguists are equally tall, (63) and (65) are licensed, but the MPE is marked, so evaluative
    - if the linguists are not equally tall, (63) isn't licensed, so (65) doesn't have a less marked alternative
  - option 1: stipulate the HP for MP constructions, derive the range restriction for MPEs accordingly
  - option 2: assume the HP is the unmarked, stereotypical interpretation and the range restriction is the marked, atypical situation (cf. McCawley 1973; Horn 1984 on periphrasis, e.g. *kill* and *cause to die*)
  - either explains why universal quantifiers (but not strong modals) make bad MPE targets: universal DPs must scope outside DegPs (Kennedy, 1999; Heim, 2000), requiring a homogenous interpretation

(67) a. ??Every linguist is as tall as 5ft.
b. ??All mature labradors are as heavy as 30lbs.

  - they also both derive the 'inclusive at most' interpretation
    - the truth conditions require that the tallest be at least 5ft;
    - the Q-implicature prevents the linguists from exceeding 5ft;
    - and the M-implicature requires that they differ in height

(68) The linguists are as tall as 5ft.
a. $\exists x[x \sqsubset \sigma y.$*linguist$(y) \wedge$ Max$(\lambda d.$*tall$(x,d)) \geq$ 5ft]
b. $\rightsquigarrow_Q \neg(\exists x[x \sqsubset \sigma y.$*linguist$(y) \wedge$ Max$(\lambda d.$*tall$(x,d)) >$ 5ft])
c. $\rightsquigarrow_M \neg(\forall x[x \sqsubset \sigma y.$*linguist$(y) \rightarrow$*tall$(x,$5ft$)])$

	$\mathbf{S}_1$	$\mathbf{S}_2$	$\mathbf{S}_3$	$\mathbf{S}_4$	$\mathbf{S}_5$
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	✗	✗	✓	✗	✗

Figure 4: Interpretive possibilities, *The linguists are as tall as 5ft*

- **scenario 3**: Q-implicature is not supported
  - in contexts that don't promote Q-implicature calculation:
    - neither MP constructions nor MPEs mean 'exactly'; but
    - MPCs don't have a homogeneity presupposition, so they're always M-alternatives for MPEs
  - the analysis predicts that, in such contexts, MPEs will be evaluative...
  - ...but will have an 'at least' interpretation! These are unusual but attested.

(69) with overt *at least*:
  a. [T]here were little old ladies, probably at least as old as 70, 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.¶

(70) disjoined with a comparative:
  a. A deluxe hot chocolate could be as much as 500 or more calories....¶
  b. Most of them are at least as tall as 6'4'' or taller....¶

(71) when MP is salient:
  A: I just saw 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! *at least*
  B': Yes, snakes grow as long as 40 feet... #in fact, they grow to be 38 feet! *#at most*

(72) in DE environments:
  a. 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 won't have many."¶

5 an extension to modified numerals

5.1 the standard data

- the above account is based on:

a) the observation that MPEs can be formed with any dimension of measurement and MP, not just quantity and numerals; and
b) independent evidence that the equative is the weak, non-strict counterpart of the comparative.

Class A	**Class B**
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)

Figure 5: Nouwen's (2010) original modified numeral typology

- question: to what extent can we extend a manner-implicature approach to the differences between Class A and B modifiers generally (especially given considerations in Westera and Brasoveanu, 2014)?
- some of the observed differences:
  - compatibilty with exact knowledge (i.e., ignorance implicature cases, Geurts and Nouwen 2007)

    (73) I know exactly how many sides sides a hexagon has...
    a. A hexagon has more than 3 sides. *Class A*
    b. #A hexagon has up to 4 sides. *Class B*

  - compatibility with permission modals (Geurts and Nouwen, 2007)

    (74) a. You may have fewer than three beers... but of course, you may have four.
    b. You may have up to three beers... #but of course, you may have four.

  - context-sensitive 'bottom-of-scale effects' (Cummins et al., 2012; Schwarz et al., 2012)

    (75) a. More than one person died in the crash. *Class A*
    b. #Up to one person died in the crash. *Class B*

5.2 a new perspective

- I can only address a subset of Geurts and Nouwen (2007)'s modified numerals:
  - some of them seem relatively unacceptable in English: *??John owns beginning with 10 shoes*;
  - the superlative has been argued to behave distinctly from other Class B modifiers, thus requiring an independent treatment (Coppock and Brochhagen, 2013). It:
    - can modify implicit scales (Krifka, 1999);
    - can act as a sentential modifier (Coppock and Brochhagen, 2013);
    - is more semantically complex than the comparative and other modified numerals (Heim, 1995; Sharvit and Stateva, 2002)
    - doesn't display BOS effects (cf. (75)): *At most one person died...*
- claim: the superlative aside (although see Coppock and Brochhagen, 2013), Class A and B modifiers differ in strictness, like the comparative and equative

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)	*up to n* (directional)
n and more/higher/less (conjunctive)	*n or more/higher/less* (disjunctive)

Figure 6: A new perspective on the Class A/Class B distinction

- Class A modifiers asymmetrically entail Class B modifiers

  (76) (I'm not sure how many shoes John owns, but...)
  a. He owns under 15 pairs. → / ↛ He owns up to 15 pairs.
  b. He owns 15 and more pairs. → / ↛ He owns 15 or more...

- Class B (but not A) modifiers overlap in meaning with MP constructions

  (77) John owns exactly 5 pairs of shoes.
  a. ↛ John owns {5 and more/under 5} pairs of shoes. *Class A*
  b. → John owns {5 or more/up to 5} pairs of shoes. *Class B*

- notice: while they've been called 'modified numerals' and traditional examples only involve the dimension of quantity, these constructions are compatible with any dimension of measurement and MP

  (78) a. Sue is over/up to 6ft tall.
  b. John weighs between/from 150lbs and/to 200lbs.
  c. Mary scored 50 points and/or higher.

- so it's unappealing to encode the difference semantically, in e.g. null quantity adjectives (Nouwen, 2010)
- an approach to the difference that appeals to M-implicature is pragmatic and therefore appropriately broad (Westera and Brasoveanu, 2014)
- it also follows (in spirit) a major aspect of the approach in Nouwen 2010: the idea that Class B modifiers compete with their MP construction counterparts
- the restrictions on MPEs subsume those for Class B modified numerals
  - the ignorance implicature as the range restriction
    - the observation is that Class B modifiers are unacceptable in contexts in which the speaker knows the precise value... these are contexts in which the target value is punctual
    - the manner implicature account correctly predicts that Class B modifiers are compatible with speaker knowledge if the target value is a range for other reasons (Buring, 2007):

      (79) I know how many players a volleyball team can have...
      a. A team can have up to 6 players. *directional Class B*
      b. A team can have 2 players or more. *connective Class B*

  - bottom-of-scale effects as the evaluativity restriction
    - Class Bs cannot modify a relatively low number (Schwarz et al., 2012)
    - if this were evaluativity (instead of some similar restriction), the manner-implicature account would predict that Class B modifier constructions could have a metalinguistic interpretation

      (80) a. [My blood pressure] has also been up to 120/103 which is mind-blowing.¶
      b. 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.¶

  - permission modals and the Q-implicature
    - a typical generalization: Class A modifiers seem to be granting permission without prohibiting other options, while Class B modifiers describe constraints on all possible scenarios.
    - the Class B Q-implicature is calculated at the VP level (Chierchia et al., 2009); so the Class B version is less permissive semantically[8]

[8] This Q-implicature doesn't seem cancelable; this is plausibly the result of additional manner implications arising from competition with the MP construction *The book may be 200 pages long*.

(81) ⟦The book may be longer than 200 pages⟧
$= \exists w \in \text{Acc}\,[\textsc{Max}(\lambda d.\mathsf{long}_w(\mathsf{b}, d)) > 200]$

(82) ⟦The book may be as long as 200 pages⟧
$= \exists w \in \text{Acc}\,[\textsc{Max}(\lambda d.\mathsf{long}_w(\mathsf{b}, d)) \geq 200]$

a. $\rightsquigarrow_Q \neg(\exists w \in \text{Acc}\,[\textsc{Max}(\lambda d.\mathsf{long}_w(\mathsf{b}, d)) > 200])$
b. strengthened: The book can be 200p but it not longer.

∗ note that we don't predict a similar complication with necessity modals (Buring, 2007), because these are non-monotonic, and thus don't trigger scalar implicature

6 conclusions

6.1 local conclusions

- sufficientive-based explicit equatives seem like the counterpart to explicit comparatives...
- ...and it does in fact seem like they denote degree quantifiers
  - they license NPIs, in contrast to other types of equatives
  - they're modifiable by factor modifiers in a way e.g. demonstrative-based explicit equatives aren't
  - they're evaluative in a different way than positive constructions, and so require a different analysis
  - they are weak/strong ambiguous, predictable given their relationship to explicit comparatives
- explicit equatives with weak modals in the main clause appear to have 'at most' interpretations, but are really just imposing an 'exactly' restriction on an existential modal claim
- measure phrase equatives (MPEs) also seem to have 'at most' interpretations, in addition to 'at least' and 'exactly' interpretations, how is this possible?
  - MPEs in contexts that don't support Q-strengthening have an 'at least' interpretation and a range restriction (a non-homogeneity requirement)
  - MPEs with punctual target values and Q-strengthening receive an evaluative 'exactly' interpretation
  - MPEs with range target values and Q-strengthening receive an 'at most' interpretation
- this explains some noted differences (e.g. the 'ignorance implicature') between classes of modified numerals

6.2 global conclusions

- there are so many ways to grammatically encode similarity!
- in addition to versions of each type of comparative strategy (e.g. predicative, coordinate), equative or similative strategies are possible with correlativization, or with relativization and predicate modification
  - there seems to be a difference in what sorts of semantic objects (i.e. lexicalized, non-lexicalized) can be assimilated with what type of morphological strategy
  - but while a few strategies must be modeled using degrees, only one must be modeled using a degree quantifier, so equatives are a good place to test the difference between these two capabilities
  - and while comparatives and equatives share a lot of semantic properties (e.g. the ability to derive degree interpretations from parameters that don't lexicalize degree arguments)...
  - ...the relative-clause nature of (some) equative strategies allows for hypothetical comparison, while comparatives do not (cf. *She acted more if she was injured*
- so we can't overlook equatives in our study of degree constructions! they're arguably more sophisticated and informative than comparatives

appendix: Manner implicature formalism

- Horn (1984) recasts Grice's maxims into a Q Principle (Make your contribution sufficient, say as much as you can) and an R Principle (Make your contribution necessary; say no more than you must). This "division of pragmatic labor" results in an equilibrium, namely:

(83) **Horn's Principle of Least Effort** (Horn, 1984, 22) The use of a marked (relatively complex [...]) expression when a corresponding unmarked (simpler, less "effortful") alternate expression is available tends to be interpreted as conveying a marked message (one which the unmarked alternative would not or could not have conveyed).

(84) **Quantity implicatures**
   a. involve Q scales, which hold fixed markedness and order elements wrt informativity
   b. are calculated relative to the Q Principle

(85) **Manner implicatures**
   a. involve M scales, which hold fixed informativity and order elements wrt markedness
   b. are calculated relative to the R Principle (when a marked form is used) or the Q Principle (when an unmarked form is used)

- (Katzir, 2007) defines Q-alternatives based on 'parse trees': effectively trees with explicit morphology; he redefines the Q Principle accordingly, with $<, \sim$ denoting relations of structural complexity

(86) Q-alternatives (Katzir, 2007, 679, modified slightly): Let ϕ be a parse tree. The set of **Q-alternatives** for ϕ, written as $A_Q(\phi)$, is defined as $A_Q(\phi) := \{\phi' : \phi' \sim \phi\}$.

(87) The Q Principle: Don't use ϕ if there is another $\phi' \in A_Q(\phi)$ such that ϕ' is weaklyassertable[9] sentence $\phi' \in A_{Qstr}(\phi)$ such that $[\![\phi']\!] \subset [\![\phi]\!]$. and $[\![\phi']\!]$ asymmetrically entails $[\![\phi]\!]$.

- we can define M-alternatives and the M Principle as effective duals of these, à la Horn:

(88) M-alternatives: Let ϕ be a parse tree. The set of **M-alternatives** for ϕ, written as $A_M(\phi)$, is defined as $A_M(\phi) := \{\phi' : [\![\phi']\!] \leftrightarrow [\![\phi]\!]\}$.

(89) The M Principle: Don't use ϕ if there is another $\phi' \in A_M(\phi)$ such that ϕ' is assertable and $\phi' < \phi$.

- we can formalize Horn's Principle of Least Effort ("Marked forms are associated with marked meaning"):

(90) **The Marked Meaning Principle**: For parse trees ϕ, ϕ' such that $\phi' \in A_M(\phi)$ and $\phi' < \phi : \phi$ carries the Manner implicature: "$[\![\phi]\!]$ is atypical".

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[9] ϕ is weakly assertable by a speaker S iff *S* believes ϕ is true, relevant, and justified.

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