
When *Less* is *More* (And When It Isn't)

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1 Introduction

1.1 Preview

A natural view of *less*-comparatives like (2a) is that the morpheme *less* is in some sense the inverse of *more*. Thus, if (1a)'s meaning is schematized as (1b), (2b)'s meaning corresponds to (2b):

- (1) a. Phil played louder than David.
b. how loud Phil played > how loud David played 'more A⁺'
- (2) a. Phil played less loud than David.
b. how loud Phil played < how loud David played 'less A⁺'

The *(more)*-comparative of a negative adjective like (3a/b), then, has the the same general shape as that of a positive adjective, (1b), though by virtue of the meaning of the negative A, it actually means the same as (2b):

- (3) a. Phil played softer than David.
b. how soft Phil played > how soft David played 'more A⁻'

In this paper I argue that *less*-comparatives (of positive adjectives) are in fact ambiguous between a 'less A⁺' and a 'more A⁻' construal, but that the 'more A⁻' construal is marked. (I furthermore claim that *more*-comparatives

*Thanks to the audience at CLS for their comments, and to Roger Schwarzschild for sharing his wisdom and notes on comparatives.

of negative As are ambiguous in the same way, but that in this case the ‘less A⁺’ construal is marked.)

The arguments to be presented are complex. Evidently, if our semantics is set up right, *Phil played less loud than David* and *Phil played softer than David* will be synonymous. Any argument that one of the construals is possible and the other one isn’t (or is, but felt to be marked) therefore has to look at more complex examples in which the two construals differ in truth conditions. Sentences with modal verbs in the *than*-clause provide such environments. To see how, it is first necessary to say a little more about the semantics of the elements involved.

1.2 The Players

Gradable adjectives come in two flavors, which are often called ‘positive’ and ‘negative’, or for short, A⁺s and A⁻s (see e.g. Seuren, 1978). Representative examples are given in (4):

- (4) a. A⁺: tall, heavy, high, intelligent, long, wide, hot, popular...
 b. A⁻: short, light, low, stupid, short, narrow, cold, unpopular...

I assume, following e.g. Kennedy (2001), that an A⁺ and its antonymous A⁻ are inter-definable using an operator called LITTLE (Heim, 2006a, see also Kennedy (1997); Rullmann (1995); Seuren (1984); von Stechow (1984)):

$$(5) \quad \text{for any A, } \llbracket \text{LITTLE A} \rrbracket = \lambda d_d. \lambda x. \neg \llbracket A \rrbracket (d)(x)$$

For all intents and purposes, we can think of LITTLE as a negation for gradable adjectives. If, for example, $\lambda d. \llbracket \text{tall} \rrbracket (d)(\mathbf{Emma})$ denotes the set of all degrees to which Emma is tall (say, 5’5”, 5’4”, ... 4’... etc.), $\lambda d. \llbracket \text{LITTLE tall} \rrbracket (d)(\mathbf{Emma})$ denotes the set of all degrees to which Emma *isn’t* tall (roughly: 5’6”, 5’7”, ..., 8’, ... etc.), which is the same as the set $\lambda d. \llbracket \text{short} \rrbracket (d)(\mathbf{Emma})$, and the same as $\lambda d. \neg \llbracket \text{tall} \rrbracket (d)(\mathbf{Emma})$.

In the discussion to follow, I will refer to the negation contributed by LITTLE as the *adjectival negation*, and write it as \neg_A . Obviously, \neg_A means the same as \neg , but it will be useful to be able to distinguish them in our logical forms.

A regular (*more*)-comparative like (1) takes two sets of degrees and claims that the one derived from the main clause is ‘more’ than the one derived

from the *than*-clause, which here simply means, a proper superset:

- (6) X is more A than Y is A
 $\lambda d. \llbracket A \rrbracket(d)(X) \supset \lambda d'. \llbracket A \rrbracket(d')(Y)$
 e.g.: ‘the set of degrees d s.t. X is d -tall is a proper superset of the set of degrees d' s.t. Y is d' -tall’

Before we go on, note that (6) is equivalent to (7) (if $A \supset B$, there must be at least one element in A that is not in B):

- (7) $\exists d[\llbracket A \rrbracket(d)(X) \text{ and } \neg_C[\llbracket A \rrbracket(d')(Y)]]$
 e.g.: ‘(there is a degree d s.t.) X is d -tall and Y is not d -tall’

Since it is much easier to read for our purposes, I will henceforth use the ‘negation semantics’ (7) rather than the ‘superset semantics’ in (6) (the official implementation of my proposal in section 7 below will use the superset semantics).

I refer to the negation contributed by the comparative as *comparative negation* and write it as \neg_C as in (7).

Turning to *less*-comparatives like (2), their regular ‘less A^+ ’ construal is like the (*more*)*re*-comparative, except with \subset instead of \supset (cf. (6)). Phrased in terms of negation this yields (8):

- (8) X is less A than Y
 $\exists d[\neg_C[\llbracket A \rrbracket(d)(X)] \text{ and } \llbracket A \rrbracket(d)(Y)]$
 e.g.: ‘($\exists d$ s.t.) X is not d -tall and Y is d -tall’

Finally, a *more* A^- -comparative like (3) on its ‘more A^- ’ construal has the logical form in (9), which is, unsurprisingly, the same as (7) with ‘LITTLE A’ in place of ‘A’:

- (9) X is more A^- than Y
 $\exists d[\llbracket \text{LITTLE A} \rrbracket(d)(X) \wedge \neg_C[\llbracket \text{LITTLE A} \rrbracket(d)(Y)]]$
 e.g.: ‘(there is degrees d s.t.) X is d -LITTLE(tall) and Y is not d -LITTLE(tall)’

Now, knowing that to be d -LITTLE(tall) is the same as to be not d -tall, we can simplify (9) further to (10a) and then, by double negation cancellation (of $\neg_C[\neg_A]$, to (10b):

- (10) a. $\exists d[\neg_A[[A](d)(X)] \wedge \neg_C[\neg_A[[A](d)(Y)]]]$
 b. $\exists d[\neg_A[[A](d)(X)] \wedge [A](d)(Y)]$
 e.g.: ‘(there is degrees d s.t.) X is not d -tall and Y is d -tall’

One can see that (10) is equivalent to (8), that is, ‘more A^- ’ and ‘less A^+ ’ (where A^- and A^+ are direct antonyms) yield equivalent truth conditions. But they get there in different ways. In the ‘more A^- ’ construal (10), both A s start out with adjectival negation \neg_A . The *than*-clause meaning is subsequently combined with the meaning of *more*, which adds a comparative negation \neg_C on top of it. The two negations then cancel each other out. In the ‘less A^+ ’ construal, there is only one negation to start with, namely the \neg_C attached to the main clause meaning.

To preview the kind of argument to be made in the following sections, consider (11):

- (11) a. Phil played louder than he was allowed (to play).
 ($\exists d$) Phil played d -loud and \neg_C [it is allowed [Phil play d -loud]]
 b. Phil played less loud than he was allowed (to play).
 ($\exists d$) \neg_C [Phil played d -loud] and it is allowed [Phil play d -loud]

Intuitively, (11a) means that Phil played too loud, and that’s what we predict (cf. the paraphrase). (11b), on the other hand, means (or at least can mean) that he played neither too loud nor too soft, but simply didn’t play as loud as he could have. The paraphrase in (11b) is the one derived from the ‘less A^+ ’ construal, and it correctly renders that meaning. Since here the *less A^+* comparative receives the ‘less A^+ ’ construal, I will call this a *matching construal*.

But, I claim, (11b) can alternatively be construed as ‘more A^- ’, yielding the logical form in (12):

- (12) ($\exists d$) Phil played $\neg_A d$ -loud and \neg_C [it is allowed [Phil play $\neg_A d$ -loud]]
 ($\equiv d$ -soft) ($\equiv d$ -soft)

(12) is true if Phil played too soft. Since here *less A^+* is interpreted via the ‘more A^- ’ construal, I will call this the *re-analyzed construal*. My claim in this paper, to reiterate, is that (11b)’s most natural interpretation is the matching construal (given in the paraphrase in (11b)), but that it does have the re-analyzed construal (12) as a secondary, less available interpretation.

Phil played softer than he was allowed, on the other hand, has (12) as its matching construal, but can also be interpreted as synonymous with (11b), its re-analyzed construal.

Why is it that the ‘less A^+ ’ and ‘more A^- ’ construals assign distinct truth conditions in a case like (11b), when previously they were shown to be equivalent? In the simple cases, the equivalence hinged on the fact that, on the ‘more A^- ’ construal, \neg_C and \neg_A in the *than*-clause cancel each other out, as in (10). But in (12), the modal *allowed* intervenes between the two negations, and obviously $\neg_C \diamond \neg_A$ is not equivalent to \diamond . In other words, the ‘less A^+ ’ and the ‘more A^- ’ construal are only equivalent if the *than* clause has a simple, non-quantificational predicate like *be*, *play* etc.

1.3 Structure of this Paper

In the following sections, I discuss four classes of modals in English. For each class, I establish the modals’ scopal behavior in simple *(mo)re A^\pm* -comparatives and then explore the readings they trigger in *less A^+* - as well as *more A^-* -comparatives, using naturally occurring examples. Two generalizations emerge:

- Interpreting *less A^+* as ‘less A^+ ’ and *more A^-* as ‘more A^- ’ (the matching construals) uniformly predicts the most natural reading of these sentences.
- Where the truth conditions predicted by the two construals differ (as they did above for *allowed*), we can observe a second, if somewhat dispreferred reading of the sentence, corresponding to their re-analyzed construal.
- For two of the four modal classes, however, the two construals predict the same truth conditions, and in those cases the sentence is factually observed to be unambiguous.

I take this state of affairs to provide strong evidence in favor of the claim that these are the two ways in which *(mo)re A^\pm* and *less A^+* can be interpreted, and that the re-analyzed interpretation is in some sense marked. In particular, I submit that the resulting picture corresponds to the observed facts better than the theories proposed in Rullmann (1995) and Heim (2006a), which I briefly discuss in section 6.

Section 7 provides a compositional semantics that allows us to derive both construals from the same lexical material, but on which the re-analyzed construal involves a more complex mapping from syntax to morphology; this, I submit, corresponds to the intuitive markedness of that reading.

2 *Can/Could/May/Allowed*: $\neg\Diamond$

2.1 Readings

We have already looked at one example from the first class, which — for reasons that will become clear immediately — I refer to as *high negation possibility modals*. To reconfirm our base-line, we note that the only possible reading with *allowed* in a *more A⁺* comparative is one where the comparative negation scopes above the modal (*can*, *could* and *may* behave the same way and won't be discussed here). This is of course what we expect, given that the negation is ostensibly contributed by the comparative morpheme (*more*) in the main clause, and *allowed* sits in the *than*-clause:

- (13) He's taller than he's allowed to be.
- a. he's *d*-tall, and he isn't allowed to be that tall
 - b. *he's *d*-tall, and he's allowed to be not *d*-tall

Turning to the (*more*) *A⁻* case, then, we observe an ambiguity that was absent in (13). In addition to reading (14a) (the matching construal), many speakers, especially after some reflection, also detect a reading as in (14b) (the re-analyzed construal); I use % to mark readings that are harder to get, judged as less acceptable, and/or acceptable only for some speakers — what I called *marked* before:

- (14) He's shorter than he's allowed to be.
- a. he's *d*-short, and he isn't allowed to be *d* short 'too short'
 - b. %he's not *d*-tall, and he is allowed to be *d*- tall 'could be taller'

In the *less A⁺* cases, we find the preferred (matching) reading to be (15a), but speakers also accept the sentence as expressing (15b), the re-analyzed construal:

- (15) He's less tall than he's allowed to be.

- a. he's not *d*-tall, and he is allowed to be *d*-tall 'could be taller'
- b. %he's *d*-short, and he is not allowed to be *d* short 'too short'

Note that (15a)≡(14b), and (15b)≡(14a). In other words, the ambiguities are predicted if it is possible to interpret *(more) A⁻* as 'less A⁺' and *vice versa*; the preferences for (14a) and (15a) are predicted, too, since these are the matching construals.

2.2 Attested Examples

Since the data are rather subtle, this subsection provides a number of examples found in the British National Corpus and using Google. Examples are given only for the *less A⁺* and *(more) A⁻* cases; *more A⁺* is neither predicted nor judged to be ambiguous; *less A⁻* cases (*less soft that... allowed* etc.) are predicted to be ambiguous as well, but I found that they stretch the boundaries of naturalness on either reading and hence won't explore them here. Considerations of space prohibit detailed discussion of each example, but paraphrases are provided in some cases to aid comprehension.

It should be noted that many of the *less*-cases discussed involve bare *less*, i.e. the antonym of the comparative of *much*. This is partly an artifact of the search queries I used, but I also suspect that it is easier to re-interpret plain *less* (=less much) as 'little-er (=more un-much)' than it is to re-interpret *less A* as 'more un-A' (let alone *less A N* as 'more un-A N'). My intuition is that this should follow from the nature of the syntax–morphology mapping, but investigation of this matter has to await a future occasion.

2.2.1 *Less A⁺*

- (16) matching: not A⁺(d) and ◇A⁺(d)
 'less than the allowed maximum'/'not as A⁺ as possible'
- a. "Iraq's crude oil production has increased by about 2 million barrels per day since late 1996. However, we feel that they are currently producing at full capacity since their oil revenues are significantly **less than allowed** and would produce more if they could, and that their oil production capacity is not expected to increase substantially through 2000."¹

¹Statement of Jay Hakes, administrator, energy information administration department of energy before the subcommittee on energy and power

- ‘they don’t produce *d*-much, and they’re allowed to produce *d*-much’
- b. “Industry emitted **less than allowed** in 2005 ; but that isn’t good news.”²
- (17) re-analyzed: $A^-(d)$ and $\neg\Diamond A^{--}(d)$
 ‘less than the allowed minimum’/‘not as A^+ as necessary’
- a. “The Crown’s first submission, therefore, is that the sentence imposed by the Justice of the Peace is obviously **less than allowed** by law and must be altered to at least a minimum fine of One Hundred Dollars.”³
- b. “If a time limit of this plan is **less than allowed** by the laws of the State where you live, the limit is extended to meet the minimum time allowed by such law.”⁴

2.2.2 *More A^-*

- (18) matching: $A^-(d)$ and $\neg\Diamond A^-$
 ‘more than the allowed maximum’/‘not as A^+ as necessary’
- a. “The original surgical lasers had a pulse operating mode that allowed the operator to set a pulse time **shorter than he could** turn the laser On and Off using his foot pedal.”⁵
 ‘the pulse is *d*-short, and he it was not possible to turn the laser on and off in that short a time’
- b. “George estimates that image-stabilized lenses enable him to shoot at about two shutter speeds **slower than he could** with a conventional lens.”⁶
 ‘he can shoot with *d*-slow a shutter, and it was not possible to shoot with that slow a shutter with a conventional lense’

committee on commerce U.S. house of representatives, March 26, 1999; <http://tonto.eia.doe.gov/FTPROOT/presentations/hrtest326/hrtest326.html>

²*Nature* Magazine web site: <http://www.nature.com/news/2006/060515/full/060515-1.html>

³<http://library2.usask.ca/native/cnlc/vol06/394.html>; 394 Regina v. Itsi.

⁴minutes of the workshop meeting of mayor and board of trustees of the village of Woodridge, Illinois held on October 23, 2003; <http://www.tripmate.com/PDFs/IL-Insert.pdf>

⁵<http://renewvo.com/phototherapy.htm>

⁶www.photosafaris.com/Articles/HighFlyingPhotography.asp

- (19) re-analyzed: $\neg A^+(d)$ and $\diamond A^+$
 ‘less than the possible maximum’/‘not as A^+ as possible’
- a. “But the key to Murphy’s Georgian-style townhouses’ affordability is that the three-storey houses — **shorter than he could** have built as of right — include a rental property below.”⁷
 ‘he didn’t built it d -tall, and he could have built it d -tall’
 - b. “A tailback (like, say, Patrick Pass) runs out of bounds a full 6 yards **shorter than he could’ve** in order to avoid getting hit.”⁸
 ‘he didn’t run d -far, and it was possible for him to run d -far (before being out of bounds)’
 - c. “However, progress is perhaps **slower than it could** be as not all carbon nanotubes are created equal — some conduct electricity better than others.”⁹
 ‘Progress isn’t d -fast and it is possible that it be d -fast’

3 *might*: $\diamond\neg$

Our second modal class has one member only: *might*. What is of special interest is that already in simple (*more*) A^+ comparatives, *might* shows the opposite pattern of the modals discussed in section 2 above. (20) for example only has a reading paraphrasable as ‘might not’, (20a), which wasn’t available with *allowed*. The reading parallel to *allowed*’s (13a) above is clearly absent (I did what I could to form a paraphrase with *might* that would illustrate that reading):

- (20) He plays louder than I might.
- a. he plays d -loud and I might play not d -loud
 ‘I might play less loud/softer than he does’
 - b. *he plays d -loud and its false that I might play d -loud
 ‘he plays louder than I could’

⁷<http://www.thecoast.ca/1editorialbody.lasso?-token.folder=2007-04-12&-token.story=150451.113118&-token.subpub=>

⁸gunslingers.blogspot.com/2006_10_01_archive.html

⁹www.nature.com/nnano/journal/v1/n1/full/nnano.2006.85.html

For this reason, I call *might* a *low negation existential modal*. This reading is unexpected under any simple theory of (*more*) comparatives (‘less=more’ or not). To accommodate it, we have to assume that (21a) rather than (21b) (which corresponds to the *allowed* sentences in (14)) is the logical form for this example (cf. section 7 below):

- (21) a. $[\lambda P_{dt}.\exists d[\text{playloud}(d)(he)\wedge\neg[P(d)]]] \in \lambda D_{dt,t}.\diamond[D(\lambda d'_d.\text{playloud}(d')(he))]$
 b. $[\lambda P_{dt}.\exists d[\text{playloud}(d)(he)\wedge\neg[P(d)]]](\lambda d'_d.\diamond[\text{playloud}(d')(he)])$

Why *might* needs to outscope the comparative negation (as in (21a)) while the other existential modals don’t allow it is a mystery. As Schwarzschild and Wilkinson (2002) point out, it seems suggestive that *might* also seems to be the only existential modal that takes logical scope above a clause mate negation (i.e. *might not* means $\diamond\neg$, whereas, say, *cannot*, *not allowed to* and *could not* mean $\neg\diamond$) — which is why the paraphrases in (20a) works so well to bring out the meaning. That scopal preference of *might* however is itself unexplained (to the best of my knowledge), and it is therefore unclear if and how it would provide a rationale for the comparative case.

So I will simply take it as a given that *might* takes logical scope above comparative negation. Assuming as much, we can make sense of the (*more*) A^- case:

- (22) He plays softer than I might
 a. he plays *d*-soft and I might not_C play *d*-soft
 ‘I might play less soft/louder than he does’
 b. *he plays *d*-soft and it’s false_C that I might play *d*-soft
 ‘he plays softer than I could’

The example is unambiguous, displaying only a reading parallel to (20a). This, too, differs from the case of *allowed* (and its kin) in (14) above, which was ambiguous.¹⁰

(22a) is the reading we get from the matching construal, assuming, as we did, that *might*, for reasons of its own, has to scope above comparative negation. It is, however, also the reading we expect under the re-analyzed construal. This is so because *might* now scopes over both the adjectival and the comparative negation, which means the two again cancel each other out.

¹⁰Although the second reading for *allowed* in (14b) was harder to get for many speakers, I think there is a clear difference between that case and the complete absence of a second reading in (22).

So (22) may technically be ambiguous, but the ambiguity is spurious.

So as a consequence of the special scopal behavior of *might*, both construals yield the same truth conditions for (22), namely (22a). (22b) is not predicted under either construal, preferred or marked.

But the same logic, we predict that the *less A⁺* case, too, only has one reading (though ostensibly two different LFs), namely the same as (22). This appears to be the case:

- (23) He plays less loud than I might.
he doesn't play *d*-loud, and I might play *d*-loud
'I might play louder than he does'

It is again worth noting that this is different from the pattern observed with *less A⁺ than... allowed* in section 2 above, which showed an ambiguity. The difference falls out from the present account, given the independently observed (though unexplained) scopal behavior of *might*.

Given that all *might* examples are clearly unambiguous, there is no need to provide naturally occurring examples in this section. Suffice it to say that I did not find any examples in which *more A than... might* was ostensibly intended to have the $\diamond\neg$ reading.

4 *have/need to*: $\neg\Box$

In this section and the next, we repeat the procedure from the previous two sections, only with universal rather than existential modals. The resulting picture will be one of comforting parallelism: There is one class of modals, discussed in the present section, that scope below comparative negation (as well-behaved modals should). With these, *less A⁺* and *(more) A⁻* comparatives are ambiguous, with shifting preferences between the two cases, just like with *allowed*. A second class of universal modals, to be discussed in section 5 below scopes above comparative negation, just like *might*, and yields unambiguous comparatives in all cases.

4.1 Readings

Starting with *have to* (representative of *have to*, *need to*, *be necessary*, *be required* and sometimes *must*), (24) establishes that it scopes below compar-

ative negation:

- (24) He is taller than he has to be.
- a. he is *d*-tall and he doesn't have to be *d*-tall
 - b. *he is *d*-tall and he has to be not *d*-tall
'he's taller than he's allowed to be'

Unsurprisingly, the same is true for the modals in this class when they occur with clause-mate negation (i.e. *he doesn't have to* can only mean $\neg\Box$).

We thus predict that the prominent reading for (*more*) A^- is one where comparative negation scopes above the modal (and adjectival negation below it), (25a), but that there will also be a re-analyzed construal in which *more* A^- is interpreted as *less* A^+ , yielding the appearance of a wide scope modal:

- (25) He is shorter than he has to be.
- a. he is *d*-short and he doesn't have to be *d*-short
'he doesn't have to be as short as he is'
 - b. %he is not *d*-tall and he has to be *d*-tall (=he has to be not *d*-short)
'he is too short'

The predicted pattern for *less* A^+ , then, is the mirror image of that:

- (26) He is less tall than he has to be.
- a. he is not *d*-tall and he has to be *d*-tall 'too short'
 - b. %he is *d*-short (not *d*-tall), and he doesn't have to be *d*-short

Once again, (26b) \equiv (25a), and (25b) \equiv (26a). That is, *have to* always scopes below comparative negation, but in the 'less A^+ '-readings, it scopes over the adjectival negation, yielding a reading equivalent to *allowed/may*.

4.2 Attested Data

4.2.1 *More* A^-

- (27) matching: $A^-(d)$ and $\neg\Box[A^-(d)]$
'above the A^- -minimum'/'more A^- than required'/'not as A^+ as possible'
- a. "Our failure or inability to act costs people their lives and makes the lives of those who survive more difficult and **shorter than**

- they need to be.**¹¹
- b. “And since these false deadlines are always **shorter than they need to be**, they often result in lower-quality work and unnecessary expenses.”¹²
 - c. “This is what keeps countries like India **poorer than they have to be.**”¹³
- (28) re-analyzed: $\neg[A^+(d)]$ and $\Box[A^+(d)]$
‘more A^- than possible’/‘not as A^+ as required’
- a. “The bathroom curtains, for example, are a foot and a half **shorter than they need to be.**”¹⁴
 - b. “They are, in length, only slightly **shorter than they need to be** for him to stretch his entire lanky frame full out.”¹⁵
 - c. “If the spray becomes fully evaporated substantially prior to reaching the exit of the GCT, then the spray droplets are **smaller than they have to be** and, thus, the spray has been over atomized.”¹⁶

4.2.2 *Less A^+*

- (29) matching: $\neg[A^+(d)]$ and $\Box[A^+(d)]$
‘below the A^+ -minimum’/‘not as A^+ as required’
- a. “They are **less fit than they need to be** if they are to become international juniors.”¹⁷
 - b. “As it was, RTD received far **less investment than it needed** to improve reception.”¹⁸
 - c. “But in total, entrepreneurs can give up **less than they had to** a couple years ago.”
- (30) re-analyzed: $A^{--}(d)$ and $\neg\Box[A^-(d)]$
‘below the A^- -maximum’/‘not as A^+ as possible’

¹¹www.crs.org/about_us/newsroom/speeches_and_testimony/releases.cfm?ID=34

¹²www.leanblog.org/search/label/WSJ

¹³voluntaryxchange.typepad.com/voluntaryxchange/webtech/index.html

¹⁴www.five.tv/programmes/hownottodecorate/thisweek/20051117/

¹⁵findarticles.com/p/articles/mi_qa3687/is_199601/ai_n8755849

¹⁶<http://www.patentstorm.us/patents/5922103-description.html>

¹⁷Tennis World. Sussex: Presswatch, 1991

¹⁸Graham Mytton: *Mass communication in Africa*. Sevenoaks, Kent: Edward Arnold (Publishers) Ltd, 1983

- a. “In the late 90s, most towns didn’t need all that money so they taxed **less than they had to**. As things got bad, they cranked it into the red and started collecting every last tax dollar they could.”¹⁹
- b. “The landlord was really nice to me. [...] He’s old Brooklyn, Italian. It seemed too good to be true. [...] When the rent was supposed to go up, he raised it **less than he had to**.”²⁰
- c. “If you choose a mystery shopping company that does not allow you and your team secure and remote access to data 24/7, you will be settling for much **less than you have to**.”²¹
- d. “Let’s face it: you are probably working for far **less than you need to**.”²²

5 *Ought to/Should*: $\square\neg$

We now turn to our fourth and last modal class, which includes *ought to*, *supposed to* and *should*. These are like *might* in that they take wide scope relative to comparative negation, and in that they only allow one reading with each comparative type. This is illustrated in (31):

- (31) He is taller than he ought to be.
- a. he is *d*-tall and he ought to be not *d*-tall
‘he ought to be shorter’
 - b. *he is *d*-tall and it’s not the case that he ought to be *d* tall
‘he is taller than he needs to be’

These verbs are also like *might* in that they take scope above a clause-mate negation (e.g. *shouldn’t*= $\square\neg$), which is to say the situation is entirely parallel: We don’t know why they behave this way, but once we model this scope preference in comparatives, it follows that it doesn’t make a difference whether the *than*-clause contains two negation or none, since either way, the modal scopes above both and the result is a non-negated reading.

Given that, the data in *(more) A⁻*- and *less A⁺*-comparatives are as expected: The matching and re-analyzed construals for each converge on the

¹⁹<http://www.bluemassgroup.com/showDiary.do?diaryId=4905>

²⁰<http://www.villagevoice.com/nyclife/0550,schlesinger,70894,15.html>

²¹<http://www.coylehospitality.com/mystery-shopping/mystery-shopping-service.asp>

²²http://www.articlecity.com/articles/business_and_finance/article_8365.shtml

same reading, which is furthermore the same in both constructions:

- (32) He is shorter than he ought to be.
 a. he is d -short and he ought not to be d -short ‘too short’
 b. *he is d -short and it’s not the case that he ought to be d -short
 ‘he’s shorter than he has to be’
- (33) He is less tall than he ought to be.
 he is not d -tall, and he ought to be d -tall ‘too short’

As with *might*, I didn’t find any examples that seemed to be intended on a $\neg\Box$ -reading, so no naturally occurring examples will be given here.

6 Discussion

6.1 Summary

In the previous four sections we have seen that two of the four modal classes yield ambiguities with *(more) A⁻* and *less A⁺* comparatives (we predict they also do with *less A⁻* comparatives but elected not to investigate these here). The modal classes that do, *may*, *allowed*, *could* and *necessary*, *have to*, *need to* are exactly the ones that take scope below a clause-mate negation, as well as below comparative negation in plain *(more)*-comparatives. This pattern is as expected: The two construals yields distinct truth conditions — (34a) $\not\equiv$ (34b) and (35a) $\not\equiv$ (35b)— and each construction’s matching construal is equivalent to the other’s re-analyzed construal — (34a) \equiv (35b) and (34b) \equiv (35a):

- (34) less A⁺
 a. matching: $\exists d[\neg_C A(d) \wedge MOD[A(d)]]$
 b. %re-analyzed: $\exists d[\neg_A A(d) \wedge \neg_C[MOD[\neg_A A(d)]]]$
- (35) (mo)re A⁻:
 a. matching: $\exists d[\neg_A A(d) \wedge \neg_C[MOD[\neg_A A(d)]]]$
 b. %re-analyzed: $\exists d[\neg_C A(d) \wedge MOD[A(d)]]$

In each case, the truth conditions derived by the re-analyzed construal appear to be less readily available.

For modals that (mysteriously) scope above comparative negation, only one reading emerges. This is as expected, too, since the truth condition's for the two construals converge:

- (36) less A^+
- a. matching: $\exists d[\neg_C A(d) \wedge MOD[A(d)]]$
 - b. re-analyzed: $\exists d[\neg_A A(d) \wedge MOD[\neg_C[\neg_A A(d)]]]$
- (37) (mo)re A^- :
- a. matching: $\exists d[\neg_A A(d) \wedge MOD[\neg_C[\neg_A A(d)]]]$
 - b. re-analyzed: $\exists d[\neg_C A(d) \wedge MOD[A(d)]]$

I now briefly discuss an alternative account for these data and explain why I think the present one is preferable.

6.2 Comparison With Heim (2006a)

Heim (2006a) proposes what we may call a ‘radical less=more’ view, that is, both *less* A^+ -comparatives as well as *more* A^- comparatives are always interpreted as ‘more A^- ’. Obviously, that alone is not sufficient, since it would derive only one reading per modal class.

Heim therefore allows the adjectival negation in the *than*-clause to scope freely w.r.t. the modal. As a consequence, if the adjectival negation stays low, we get the ‘more A^- ’ reading for either comparative, and if the adjectival negation scopes above the modal, we get the ‘less A^+ ’ readings for either comparative.

It is thus clear that the proposal in Heim (2006a) can derive all the readings I discussed in this paper. Yet I believe there are reasons to prefer the present analysis.

First, in the present analysis, we not only derive ambiguities, but also a pattern of markedness: whenever *less* A^+ is interpreted as ‘more A^- ’ or *(mo)re* A^- is interpreted as ‘less A^+ ’, a marked reading is predicted. Crucially, the marked reading of a *less* A^+ comparative is the unmarked reading for a *(mo)re* A^- comparative, and *vice versa*. According to Heim (2006a), both comparative types are underlyingly ‘more A^- ’-comparatives. Heim (2006a) contains no discussion of markedness of readings, but suppose we added to that theory the claim that one of the two negation construals is marked, say, for the purpose of illustration, the high one (since the negation that ‘really belongs to’ the A in that case has to climb above the modal).

This would predict that that reading is marked, regardless of its surface realization. For example, *less A⁺ than... allowed* and *more A⁻ than... allowed* would be predicted to have the same preferred reading ($MOD\neg_A$), and the same marked reading ($\neg_A MOD$). We could switch the preference in general (by calling the other placement of \neg_A the marked one), but it is not clear at all how we could make the markedness pattern of the *(more) A⁻-comparative* be the mirror image of that of the *less A⁺-comparative*.

This argument against the proposal in Heim (2006a) hinges on my claims about what is and what is not a marked reading in each case. But these claims are based on informal surveys and anecdotal evidence only — surprisingly strong and uniform, but informal and anecdotal nevertheless. Unless these judgements are investigated using a more systematic methodology, the argument as a whole seems suggestive, but not decisive.

My second argument in favor of the present proposal is based on more solid data, namely the absence of any ambiguity, marked or not, in the case of *might* and *ought to/should/supposed to*. Heim (2006a) does not discuss these modals. But recall that on that analysis, the ambiguity with *can*, *allowed*, *have to*, *need to* etc. is due to the adjectival negation scoping above the modal. We would expect, then, that the same is possible for *might*, *should* and company. To block this option would seem to require a stipulation to the effect that modals that scope above comparative negation (or its counterpart in any given theory of comparatives, such as the Π -operator of Schwarzschild and Wilkinson (2002) and Heim (2006b)) must also scope above adjectival negation.

On the present account, no such stipulation is needed: adjectival negation never scopes above any modal (since it's part of the adjective). The availability of $\neg MOD$ readings is a direct function of whether or not MOD can scope above comparative negation.

6.3 Conclusion

In this paper I have argued that *less*-comparatives on their basic meaning are the inverse of *more*-comparatives (*pace* Heim, 2006a). I have also argued that in addition, *less A⁺*-sentences can be re-analyzed as ‘more A⁻’ comparatives, and *(more) A⁻*-sentences as ‘less A⁺’-comparatives. For any given sentence though, the interpretation resulting from such a reanalysis is less readily available for many speakers, and/or judged less acceptable even then.

While this analysis might at first seem equivalent to one that lets some

quantificational element (e.g. comparative negation) scope freely in the *than*-clause, I have argued that this is not the case, since such an alternative analysis would fail to predict the markedness patterns, as well as the absence of ambiguity with modals that scope above comparative negation.

7 Appendix: How *less* Becomes *more*

The discussion in this paper was cast in terms of a negation-semantics for comparatives. I find the logical forms assigned by such a semantics by far the easiest to comprehend (if you read them aloud you generally intuitively get the truth conditions they express). My claims about the semantic nature of these comparative constructions, however, are, or at any rate should be, independent of the actual choice of implementation. In this appendix I will give an implementation of the analysis proposed here that is actually based on a subset-semantics for comparatives, which lends itself more easily to a (semi-)compositional implementation of my proposal, and is more in line with current discussions of comparatives in the literature.

I adopt an ontology that includes individuals of type \mathbf{d} , degree points, as well as various linear orderings among disjoint subsets of these:

- (38) types
- a. \mathbf{d} : the type of degree points (comes with various orderings \leq_i)
 - b. \mathbf{i} : the type of degree intervals

The type \mathbf{i} of degree intervals has as its domain a subset of $D_{(\mathbf{d},\mathbf{t})}$; that is, any interval is a set of degree points, but in addition is non-empty and convex under some ordering:

- (39) for any $i \subseteq D_{\mathbf{d}}$, $i \in D_{\mathbf{i}}$ iff $i \neq \emptyset$ and for some ordering \leq , $\forall d, d', d''$, if $d, d'' \in i$, and $d \leq d' \leq d''$, then $d' \in i$

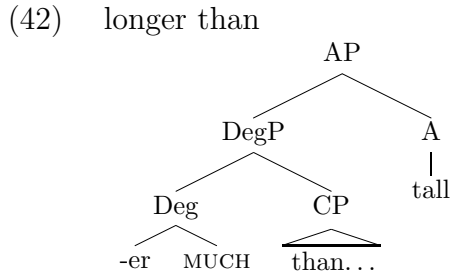
Representative lexical meanings are given in (40):

- (40) a. $\llbracket \text{tall} \rrbracket = \lambda d_{\mathbf{d}}. \lambda x_e. d \leq \text{HEIGHT}(x)$
 b. $\llbracket \text{short} \rrbracket = \lambda d_{\mathbf{d}}. \lambda x_e. \text{HEIGHT}(x) < d$
 c. $\llbracket \text{MUCH} \rrbracket = \lambda i_{\mathbf{i}}. i$
 d. $\llbracket \text{-er} \rrbracket = \lambda m_{i,\mathbf{i}}. \lambda i_{\mathbf{i}}. \lambda i'_{\mathbf{i}}. m(i) \subset m(i')$
 e. $\llbracket \text{LITTLE} \rrbracket = \lambda i_{\mathbf{i}}. \lambda d_{\mathbf{d}}. i(d) = 0^{23}$

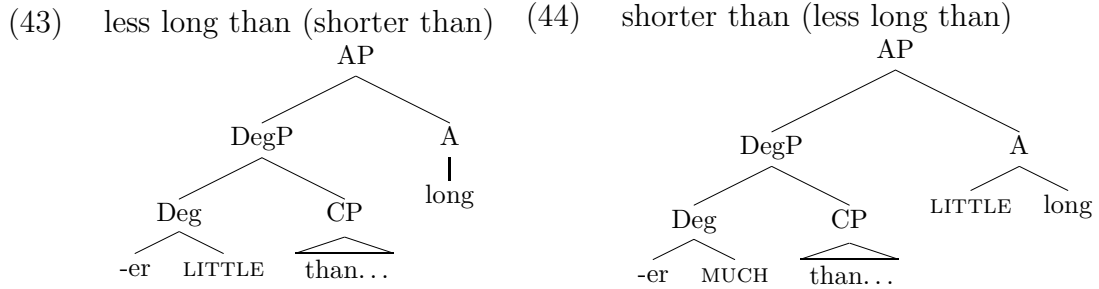
It can easily be seen that, given these assumptions, e.g. (41) holds:

$$\begin{aligned}
 (41) \quad \llbracket \text{short} \rrbracket &= \llbracket \text{LITTLE high} \rrbracket \\
 &= [\lambda i_i. \lambda d_d. i(d) = 0](\lambda d_d. \lambda x_e. d \leq \text{HEIGHT}(x)) \\
 &= \lambda x_e. \lambda d_d. [\lambda d'. d' \leq \text{HEIGHT}(x)](d) = 0 \quad (\text{see discussion below}) \\
 &= \lambda x_e. \lambda d_d. d \leq \text{HEIGHT}(x) = 0 \\
 &= \lambda x_e. \lambda d_d. d \not\leq \text{HEIGHT}(x) \\
 &= \lambda x_e. \lambda d_d. \text{HEIGHT}(x) < d
 \end{aligned}$$

A representative (*more*)-comparative has the syntactic structure in (42):



Less-comparatives look like in (43), but can be re-analyzed as (44). (*More*) A^- -comparatives have the structure in (44), but can be reanalyzed as (43):



Note that the unmarked readings for (*more*) A^- - and *less* A^+ -comparatives result if *-er* LITTLE in (43) is spelled out as *less* and LITTLE *long* in (44) is spelled out as *short*. For the marked readings, non-constituents have to

²³The actual definition of LITTLE is more complicated since LITTLE, when applied to an interval, must return only those points that are on the same scale as that interval. This is guaranteed by the more complex definition in (i):

- (i) $\llbracket \text{LITTLE} \rrbracket = \lambda i_i. \lambda d_d. i(d) = 0$, and there is some ordering \leq and some $d' \in i$ s.t. $d \leq d'$ or $d' \leq d$.

be morphologically rearranged: *-er* LITTLE . . . *long* becomes *shorter* and *-er* MUCH . . . LITTLE *long* becomes *less long*. Although I can't provide a theory of the syntax–morphology mapping here, I believe that this state of affairs holds some promise for deriving the markedness facts.

In order to interpret the structures above, we need the following interpretation rule:

$$(45) \quad \text{if } A \text{ is of type } \langle \tau_1, \langle \tau_2, \mathbf{t} \rangle \rangle \text{ (with } \tau_{1/2} \text{ any type) and the domain of } B \text{ is } D_{\langle \tau_1, \mathbf{t} \rangle}, \text{ then } \llbracket A B \rrbracket = \llbracket B A \rrbracket =_{\text{def}} \lambda v_{\tau_2}. \llbracket B \rrbracket (\lambda v'_{\tau_1}. \llbracket A \rrbracket (v')(v))$$

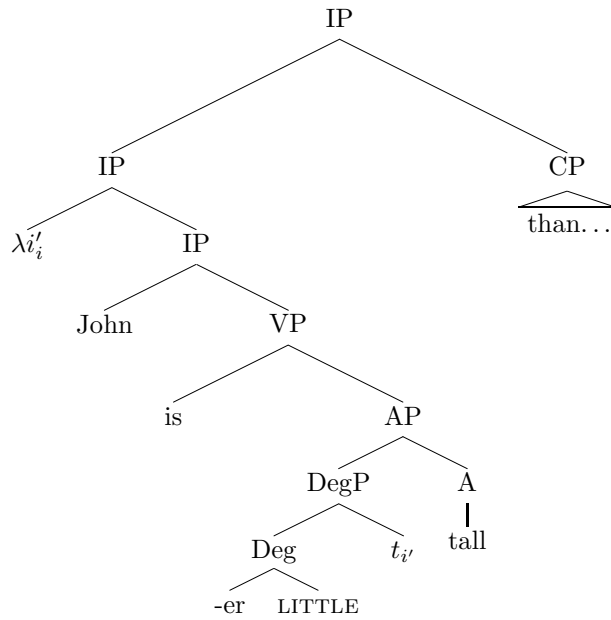
This popular rule can be used for example to combine a generalized quantifier with a transitive verb meaning. In our case, we get e.g. (46) for (44), where TC stands in for the interval denoted by the *than*-clause:

$$(46) \quad \begin{aligned} \text{a.} \quad & \llbracket \text{LITTLE long} \rrbracket = \lambda x. \llbracket \text{LITTLE} \rrbracket (\lambda d. \llbracket \text{long} \rrbracket (d)(x)) && \text{(by (45))} \\ & = \lambda x. \text{HEIGHT}(x) < d \\ \text{b.} \quad & \llbracket \text{-er MUCH} \rrbracket = \llbracket \text{-er} \rrbracket (\llbracket \text{MUCH} \rrbracket)^{24} && \text{(F(unction) A(pplication))} \\ & = \lambda i_i. \lambda i'_i. \llbracket \text{MUCH} \rrbracket (i) \subset \llbracket \text{MUCH} \rrbracket (i') \\ & = \lambda i_i. \lambda i'_i. i \subset i' \\ \text{c.} \quad & \llbracket \text{-er MUCH than. . .} \rrbracket = \llbracket \text{-er MUCH} \rrbracket (\llbracket \text{than. . .} \rrbracket) && \text{(FA)} \\ & = \llbracket \text{-er MUCH} \rrbracket \text{(TC)} \\ & = \lambda i'_i. \text{TC} \subset i' \\ \text{d.} \quad & \llbracket \text{-er MUCH than. . . LITTLE long} \rrbracket = \\ & \lambda x. \llbracket \text{-er MUCH than. . .} \rrbracket (\lambda i. \llbracket \text{LITTLE long} \rrbracket (i)(x)) && \text{(rule (45))} \\ & = \lambda x. \text{TC} \subset [\lambda d. \text{HEIGHT}(x) < d] \end{aligned}$$

As is usual, I assume that the *than*-clause is extraposed, giving us the structures like (47a) with interpretations like (47b):

²⁴As you might have guess from inspecting (40c), MUCH doesn't contribute anything to this derivation. It is merely there to fill the slot necessary to interpret LITTLE *-er* in (43).

(47) a.

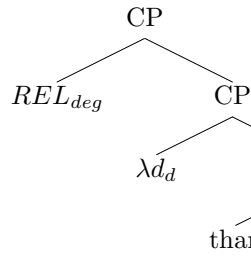


b. $\lambda i'.i' \subset [\lambda d.HEIGHT(John) < d]$

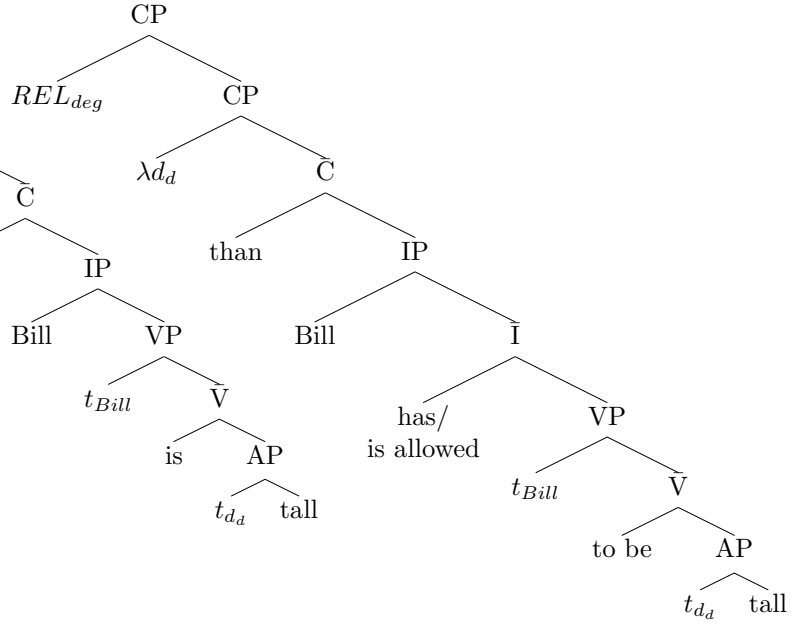
Finally, we need to interpret the *than*-clause. Following standard practice again, I assume that a degree predicate is formed by a relative operator over degrees. For the simple cases this operator can either be semantically empty, or be the identity function on intervals; what is important is that it leave a trace of type **d**:

(48) $[[REL_{deg}]] = \emptyset / \lambda \psi_{\tau}.\psi$

(49) than Bill is tall

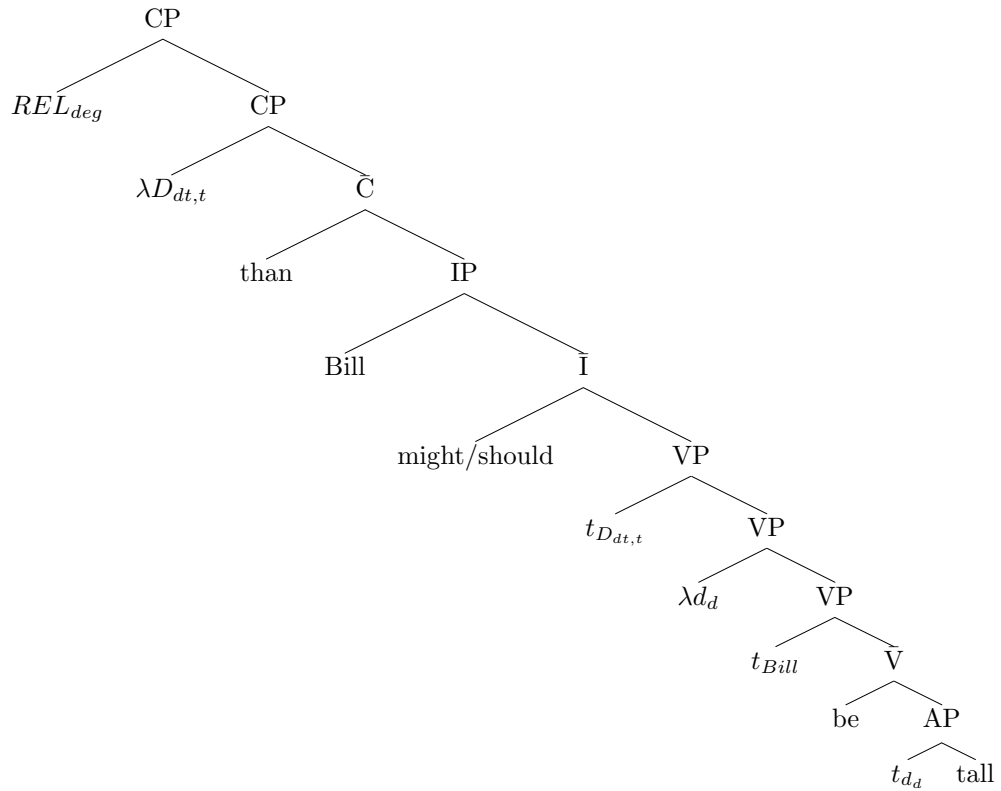


(50) than Bill has/is allowed to be tall



For modals like *might*, *ought to*, *supposed to* and *should*, which scope above comparative negation, we scope the entire main clause predicate inside of the *than*-clause. Technically, we do this by allowing REL_{deg} to form a generalized quantifier over degrees (following Schwarzschild and Wilkinson, 2002; Heim, 2006b):

(51) than Bill might/should be tall



The *than*-clause will now take the meaning of a main clause like (47) as its argument, resulting in logical wide scope for the modals. As I confessed repeatedly, I don't know what forces an LF like (51) for these modals, but (50) for the others (nor, it seems, does anyone else), but I think chances are good that whatever is the deeper reason, and hence the correct formal treatment, of these cases will interact with the rest of the analysis given here in the same way as (51) does.

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