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More on *less*[*]

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1. Two observations

First observation. Seuren (1979) and Rullmann (1995) observed that *less* comparatives that contain an existential modal in the standard clause, such as the following,

(1) Lucinda drove less fast [than she was allowed to].

are ambiguous between two readings (see, e.g., Heim 2006a, Büring 2007, Beck 2013 for recent discussion). The first reading, which we will call the minimum-related reading, is that Lucinda drove less fast than the minimal required speed. This means that if you are required to drive between 50 and 70 mph, Lucinda drove slower than 50 mph and thus violated the law. The second reading, which we will call the maximum-related reading, conveys that Lucinda drove less fast than the maximal allowed speed, which corresponds to 70 mph in our scenario. This means that she may well have respected the law (see Beck 2013 on the accessibility of this reading). The existence of this ambiguity constitutes the first observation tackled in this paper.

(2) [Scenario: your speed is required to be between 50 and 70 mph.]
   a. Minimum-related reading: speed(Lucinda) $<$ 50 mph
   b. Maximum-related reading: speed(Lucinda) $<$ 70 mph

Second observation. Rullmann (1995) pointed out that the above ambiguity disappears in the presence of a Negative Polarity Item (NPI) in the standard clause (see also Heim 2006a for an extensive discussion). For example, the following sentence

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(3) Lucinda drove less fast [than anyone was allowed to].
Minimum-related reading ✓ Maximum-related reading #

is unambiguous: it conveys only the minimum-related reading. In the above scenario, on which everyone is subject to the 50-70 mph speed limit, (3) can only convey that Lucinda drove slower than 50 mph. The existence of this disambiguating effect of NPIs constitutes the second observation tackled in this paper.

(4) Summary of the two observations:
   i. *Less* comparatives with an existential modal in the standard clause are ambiguous between a maximum- and a minimum-related reading unless
   ii. the standard clause contains an NPI.

2. Preview

Much headway has been made in recent years in our understanding of the interpretation of comparatives, especially, of comparatives with quantified standard clauses (e.g., Schwarzschild & Wilkinson 2002, Heim 2006a,b, Beck 2012, 2013, 2014, Schwarzschild 2008, Alrenga & Kennedy 2014, Dotlačil & Nouwen 2016, among many others). A particularly fruitful approach to these issues has been one that allowed degree predicates to be shifted to pick out pluralities of degrees or intervals (Heim 2006b), or took them to have such denotations as basic (e.g., Schwarzschild & Wilkinson 2002, Beck 2012, Dotlačil & Nouwen 2016). In this paper, we show that if we take this shift from degrees to pluralities of degree (or intervals) (i) to be induced by a separate morpheme (as in Heim 2006b)[1] and (ii) to be optional (unlike in Heim 2006b), the observations in (4) fall out naturally.

Specifically, we propose that the ambiguity of (1) is due to the matrix clause being predicated either of the maximal allowed speed furnished by the standard clause (= maximum-related reading) or of all (and only) the allowed speeds furnished by the standard clause (= minimum-related reading). We show that these two predications can be effectively derived from structures that differ only in whether the degree shifting operation applies in their standard clause. This state of affairs is schematically represented in (5).

(5) a. [less [$_{standard}$ [MAX [◊ [... ~~SHIFT~~ ...]]]] [$_{matrix}$ ...]⇒ Maximum-related reading
   b. [less [$_{standard}$ [MAX [◊ [... SHIFT ...]]]] [$_{matrix}$ ...] ⇒ Minimum-related reading

An introduction of an NPI into the standard clause, as in (3), forces the standard clause to be disambiguated so that it furnishes all (and only) the allowed speeds – namely, only on this disambiguation is the NPI in a downward-entailing (DE) environment. Consequently, the sentence only has a minimum-related reading.

[1] Crnič & Fox (2017) provide another argument against adjectives having interval semantics along the lines of Schwarzschild & Wilkinson (2002) as basic. The argument is based on the distribution of downward-entailing operators in the standard clauses of Slovenian equative sentences.

(6) a. *[less [$_{standard}$ [MAX [NPI [◇ [... ~~SHIFT~~ ...]] [$_{matrix}$ ...] ~~⇒ Max.-related reading~~
b. [less [$_{standard}$ [MAX [NPI [◇ [... SHIFT ...]] [$_{matrix}$ ...] ⇒ Min.-related reading

In addition to deriving the observations in (4), we argue that this proposal fits well with certain other facts involving the interpretation of modals in comparatives, including *more* comparatives. While we have to stop short of providing a complete account of the interpretation of comparatives with quantified standard clauses (e.g., we leave out the discussion of neg-raising modals, non-universal nominal quantifiers, etc.), we do hope to pursue such an account at a future occasion.

The paper is structured in the following way. Section 3 introduces our assumptions about degree semantics. Section 4 discusses how comparatives are put together on the basis of these assumptions. We build here especially on the important contributions and insights of Beck, Heim, and Dotlačil & Nouwen. Section 5 introduces an analysis of antonyms, where we adopt the approach of Rullmann (1995) and Sassoon (2010). The first observation in (4) is derived in Section 6. Section 7 discusses the conditions under which NPIs are licensed in comparatives. Section 8 shows how these conditions conspire to yield the second observation in (4). Section 9 discusses the interpretation of modals in *more* comparatives. We conclude the paper by briefly attending to issues raised by occurrence of nominal quantifiers in standard clauses of comparatives in Section 10.[2]

3. Degrees and their pluralities

Schwarzschild & Wilkinson (2002), Beck (2012), Dotlačil & Nouwen (2016), and others, propose to assign interval- or plurality-based semantics to degree predicates, while Heim (2006b) assumes that an interval-based semantics is induced by a separate morpheme that is mobile at LF. For example, Dotlačil & Nouwen assign adjectives the semantics in (7), where the adjective picks out a relation between individuals and pluralities of degrees.

(7) $[\![\text{fast}]\!](d)(x) = 1$ iff $\text{speed}(x) \sqsubseteq d$

Accordingly, in a scenario in which John drove 50mph, the predicate of degrees *d* such that John drove *d* fast has the form in (8), where the plurality of 50 mph and 51 mph is represented with '50⊕51mph', the plurality of all the degrees between, say, 25 mph and 50 mph is represented with '[25, 50mph]' (a closed interval), etc.

(8) [Scenario: John drove exactly 50mph fast.]
$\lambda d.\ [\![\text{fast}]\!](d)(\text{John}) = \{50\text{mph}, 50 \oplus 51\text{mph}, [25, 50\text{mph}], (48, 200\text{mph}), ...\}$

A different way of getting the meaning in (8) is by assuming that there is an operator in syntax that shifts the more standard adjectival meaning in (9) (e.g., Hellan 1981, von

[2]Due to space limitations, we unfortunately cannot pursue a detailed comparison of our approach to (4) to the existing alternatives in this paper (esp., Heim 2006a, Büring 2007, Beck 2013). However, we intend to do so in the longer version of the paper, not least since these alternatives provide invaluable insights into, and perspectives on, the issues discussed in the main text.

Stechow 1984, Heim 1985), which we assume holds only of atomic degrees, to a pluralized one. We represent this operator with SHIFT and define it in (10) (cf. Heim's Π operator).[3]

(9) $[\![\text{fast}]\!](d)(x) = 1$ iff $\text{speed}(x) \geq d$

(10) $[\![\text{SHIFT}]\!](d)(D)(x) = 1$ iff $\max(\lambda d.D(d)(x)) \sqsubseteq d$

The operator combines first with the degree argument of the adjective and then the adjective, returning a predicate of plural degrees that contain the maximal degree that we obtain by applying the adjective to an individual, as given in (11). Clearly, SHIFT can be interpreted *in situ* and cannot QR at LF (this is different for Heim's Π operator).

(11) $[\![[[\text{SHIFT } d]\ \text{fast}]]\!](x) = 1$ iff $\max(\lambda d'.\ \text{speed}(x) \geq d') \sqsubseteq d$ iff $\text{speed}(x) \sqsubseteq d$

Finally, and crucially for the purposes of this paper, the insertion of SHIFT is optional (again, this is different from Heim's Π). In the case of a simple sentence like (12), for illustration, the insertion of SHIFT yields an 'exactly' interpretation of the sentence, given in (13): Lucy's speed is part of the (trivially plural) degree 50 mph.

(12) Lucy drove 50mph fast.

(13) a. [Lucy [drive [[SHIFT 50mph] fast]]]
b. $\text{speed}(\text{Lucy}) \sqsubseteq 50\text{mph}$ (⇔ Lucy drove exactly 50mph)

On a parse of the sentence without SHIFT we get an 'at least' interpretation:

(14) a. [Lucy [drive [50mph fast]]]
b. $\text{speed}(\text{Lucy}) \geq 50\text{mph}$ (⇔ Lucy drove at least 50mph)

4. Composition of comparatives

The possible parses and meanings of the standard clause of a simple comparative sentence like (15) are provided in (16) and (17) (see, e.g., Chomsky 1976 about movement of degree *wh*). In (16) the degrees are atomic, while in (17) at least some of the degrees are plural.

(15) John drove faster [than Lucy did].

(16) a. [wh [λd [Lucy drove [d fast]]]]
b. $\lambda d.\ \text{speed}(\text{Lucy}) \geq d$

[3] We assume that the *max* operator in the definition of SHIFT is information-sensitive: a degree d is maximally informative with respect to D if D holds of it, and D holding of it is more informative than D holding of any other degree d' of which D holds (see Fox & Hackl 2006 for details). This choice is important due to our assumptions about antonymy in Section 5.

(17) a. [wh [λd [Lucy drove [[SHIFT d] fast]]]]
b. λd. speed(Lucy) ⊑ d

The matrix clause contains the comparative morpheme *er*, which we define as in (18): it picks out the 'bigger than' relation between degrees (e.g., Heim 2006b, Beck 2013).

(18) ⟦er⟧(d)(d') = 1 iff d'>d.

The question is now how the standard clause and the comparative morpheme are combined with the matrix clause. One way of doing this is to derive degree arguments from the standard and the matrix clause, and to feed them to the comparative operator. We get these degrees by an application of a maximality operator, defined in (19): the operator takes a degree predicate *D* as an argument and returns the (potentially plural) degree that consists of every degree of which *D* holds (which we represent with '$^{\vee}$D(d)') that is not less informative with respect to *D* than any other degree of which *D* holds (cf. Beck 2014).[4]

(19) ⟦MAX⟧(D) = ⊕{d | $^{\vee}$D(d) ∧ ¬∃d'($^{\vee}$D(d') ∧ d≠d' ∧ ($^{\wedge}$D(d') ⇒ $^{\wedge}$D(d)))}
(= *the sum of degrees d such that for each d: the property D holds of d and there is no degree d' of which D holds that is more informative with respect to D*)

Although this definition of the maximality operator is more baroque than its more widespread alternatives (e.g., Fox & Hackl 2006), it yields identical results for simple cases like (15). For example, the standard clause of (15) has one of the structures in (20). The two structures have the same meaning: Lucy's speed. This is computed explicitly for the structure in (20b) in (21).

(20) a. [MAX [wh λd [Lucy drove [d fast]]]]
b. [MAX [wh λd [Lucy drove [SHIFT d fast]]]]
c. ⟦(20a)⟧ = ⟦(20b)⟧ = ⊕{speed(Lucy)} = speed(Lucy)

(21) ⟦MAX⟧(λd. speed(Lucy)⊑d)=⊕{λd. speed(Lucy)⊑d ∧ ¬∃d'(speed(Lucy)⊑d' ∧ d≠d' ∧ ($^{\wedge}$speed(Lucy)⊑d' ⇒ $^{\wedge}$speed(Lucy)⊑d))}=⊕{speed(Lucy)}=speed(Lucy)

The sentence in (15) thus has the representation in (22a). The meaning that we obtain for this structure is provided in (22b). (We do not represent SHIFT in the matrix clause for readability and because it does not affect the meanings of the sentences under discussion.)

(22) a. [er [MAX [λd [Lucy drove d fast]]]] [MAX [λd' [John drove d' fast]]]
b. speed(John) > speed(Lucy)

[4] MAX(D) corresponds to applying the sum operator, ⊕, to m-inf(D) in Beck 2014.

A difference in the interpretation of two parses of a standard clause emerges when the standard clause contains a quantificational element, such as an existential modal, that intervenes between MAX and the degree predicate abstracted over.[5] Consider (23).

(23) Lucy drove faster [than she was allowed to.]

According to our above assumptions, the standard clause of the sentence has two possible representations, given in (24): one with and one without an occurrence of SHIFT.

(24) a. [MAX [wh λd [◇ [Lucy drove d fast]]]]
b. [MAX [wh λd [◇ [Lucy drove SHIFT d fast]]]]

The interpretations of these structures are not identical. The former corresponds to the maximally informative (atomic) degree of which the degree predicate holds, that is, the maximal allowed speed, given in (25a). The latter corresponds to the sum of degrees of which the predicate holds such that there are no more informative degrees of which it does, that is, it consists of the sum of all (and only) the allowed speeds, given in (25b).

(25) [Scenario: your speed is required to be between 50 and 70 mph.]
a. $[\![\text{MAX}]\!](\{d \mid \Diamond_w(\text{speed}_w(\text{Lucy}) \geq d)\}) = 70$ mph
b. $[\![\text{MAX}]\!](\{d \mid \Diamond_w(\text{speed}_w(\text{Lucy}) \sqsubseteq d)\}) = \oplus\{50 \text{ mph}, ..., 70 \text{ mph}\} = [50,70 \text{ mph}]$

However, this difference in the interpretation of the standard clauses is obscured at matrix level in (23). This is due to how 'bigger than' relation is defined for pluralities of degrees (cf. Beck 2014, Dotlačil & Nouwen 2016): a degree is greater than another degree iff all the atomic parts of the former are greater than all the atomic parts of the latter:

(26) $d > d'$ iff $\forall d^* [d^* \sqsubseteq_{at} d \rightarrow \forall d'^* [d'^* \sqsubseteq_{at} d' \rightarrow d^* > d'^*]]$

This means that the interpretations of the two structures of sentence (15), provided in (27) and (28), are equivalent: John drove faster than, respectively, the maximal allowed speed and all (and only) the allowed speeds. (See Section 9 for further discussion.)

(27) a. [er [MAX [λd [◇ [L drove d fast]]]]] [MAX [λd [L drove d fast]]]
b. $\text{speed}_@(\text{Lucy}) > 70$ mph

(28) a. [er [MAX [λd [◇ [L drove SHIFT d fast]]]]] [MAX [λd [L drove d fast]]]
b. $\text{speed}_@(\text{Lucy}) > [50,70 \text{ mph}]$

[5] A more standard characterization of MAX would be undefined in (23), where a quantifier with multiple witnesses intervenes between MAX and the abstracted over degree (see Dotlačil & Nouwen 2016, Sect. 7).

While this is a desirable result, it makes our decision to complicate the structures of comparatives by admitting SHIFT moot (as well as our decision to complicate the lexical entry for MAX). In the remainder of the paper, we show that this additional complexity allows us to derive the two observations in (4). However, before we do that, we need to introduce our assumptions about how we intend to analyze antonymy.

5. Antonymy

We assume that antonyms consist of an adjective and an ANT operator, defined in (29), which reverses the ordering of the degrees of which the adjective holds (see, esp., Sassoon 2010 for the advantages of this approach to antonyms).[6]

(29) $[\![\text{ANT}]\!](P)(d)(x) = 1$ iff $P(\text{-}d)(x) = 1$

For example, if John drove 70 mph fast, the set of degrees such that John drove slow to those degrees would consist of the negatives of all the degrees below or equal to 70 mph, as given in (30a). If SHIFT is applied to the degree argument of the adjective, we get all the pluralites that have the negative of John's speed as a part, as given in (30b). (Recall that our characterization of *max*, which features in the meaning of SHIFT, is information-sensitive, as discussed in footnote 3. A simple 'largest degree' characterization of *max* would yield an undefined meaning in (30b) since there is no largest negative real number below 0.)

(30) [Scenario: John drove exactly 70 mph.]

a. $\lambda d.\ [\![\text{ANT}]\!]([\![\text{fast}]\!])(d)(\text{John}) = \{\text{-70mph, -20mph, ...}\}$
b. $\lambda d.\ [\![\text{SHIFT}]\!](d)([\![\text{ANT}]\!]([\![\text{fast}]\!]))(\text{John}) = \{[\text{-80,-70mph}], \text{-70mph}\oplus\text{5mph, ...}\}$

A *less* comparative like (31) may thus have the representation(s) in (32), where *less fast* is analyzed as consisting of ANT applied to *fast* both in the standard and the matrix clause (see Heim 2006b, Büring 2007 for discussion).

(31) John drove less fast [than Lucy did].

(32) [er [MAX [λd [L drove [(SHIFT) d] ANT fast]]]] [MAX [λd' [J drove d ANT fast]]]

The interpretation of the structures with and without SHIFT is again identical, given in (33), since the maximally informative degrees in both cases correspond to the negative of Lucy's speed: John's speed is lower than Lucy's speed.

[6] A maximality-based analysis of comparatives is incompatible with treating antonymy as involving negation (e.g., *little* in Heim 2006a). This is because, at least on the most straightforward combinations of the two, we would obtain pathological meanings for the standard clause (e.g., von Stechow 1984, Rullmann 1995). It is, of course, incumbent on us to show that the achievements of a negation-based analysis of antonyms can be reproduced in the framework for antonyms adopted in the main text.

(33) -speed(John) > -speed(Lucy)
⇔ speed(Lucy) > speed(John)

Importantly for what follows, the interpretations that we obtain for *less* comparatives on the above construal of antonyms are equivalent to what we would obtain if we left the meaning of the degree predicates untouched and modified the meaning of *less* to be the reverse of the meaning of *more*, given in (34b) (cf. Beck 2013). We adopt this way of representing *less* comparatives in the following since it allows us to have simpler representations; the exact same conclusions are reached if we employ the proper representations with ANT.

(34) a. $[\![\text{er}]\!](\text{d})(\text{d'}) = 1$ iff d'>d.
b. $[\![\text{less}]\!](\text{d})(\text{d'}) = 1$ iff d>d'.

6. Rullmann-Seuren ambiguity

So far the ambiguity in standard clauses did not lead to an ambiguity in the interpretation of the matrix sentence. This changes once we look at *less* comparatives with quantified standard clauses. In this section, we focus on the following example from above:

(35) Lucinda drove less fast [than she is allowed to].

A parse of the sentence in (35) without SHIFT in the standard clause is provided in (36). Its meaning is computed in (37): the maximal allowed speed (= the maximal degree in the set of degrees *d* such that there is a possible world in which Lucy's speed is at least as great as *d*) is greater than Lucy's speed in the actual world. This is the maximum-related reading, say, that Lucy drove less fast than 70 mph in our scenario from above.

(36) [less [MAX [λd [$\Diamond$ [Lucy drove d fast]]]]] [MAX [λd' [Lucy drove d' fast]]]

(37) $\max(\lambda \text{d}.\ \Diamond_w(\text{speed}_w(\text{Lucy}) \geq \text{d})) > \text{speed}_@(\text{Lucy})$
⇔ max-allowed-speed > $\text{speed}_@$(Lucy)

The second parse is one with SHIFT in the standard clause and is given in (38). The meaning of the sentence is provided in (39): as we discussed in (25) above, the standard clause in this case picks out the interval containing all (and only) the allowed speeds; since everyone of these speeds is greater than Lucy's speed, this means that Lucy was driving slower than the minimal required speed. This is the minimum-related reading.

(38) [less [MAX [λd [$\Diamond$ [L drove SHIFT d fast]]]]] [MAX [λd' [Lucy drove d' fast]]]

(39) $\max(\lambda \text{d}.\ \Diamond_w(\text{speed}_w(\text{Lucy}) \sqsubseteq \text{d})) > \text{speed}_@(\text{Lucy})$
⇔ $\oplus_{\Diamond w}\ \text{speed}_w(\text{Lucy}) > \text{speed}_@(\text{Lucy})$
⇔ min-required-speed > $\text{speed}_@$(Lucy)

To summarize: The first observation – that *less* comparatives with an existential modal in the standard clause are ambiguous between a minimum-related and maximum-related interpretation – follows from the assumption that there is an optional shift from degrees to pluralities of degrees, brought about by SHIFT, that can occur at the level of the adjective in the standard clause.

7. Negative Polarity Items

NPIs are acceptable in the standard clauses of both *more* and *less* comparatives. This is exemplified in (40) with *any* and *ever*. If we assume that NPIs are licensed only if they occur in a downward-entailing environment, then *any* and *ever* must be contained in such environments in (40).

(40) a. Lucy drove faster than any boy (ever) did.
b. Lucy drove less fast than any boy (ever) did.

Again, two construals of the sentences in (40) are in principle admitted by our proposal: one with SHIFT in the standard clause, and one without SHIFT. While the choice between the two is irrelevant for the *more* comparative in (40a) – in both cases, the standard clause constitutes a downward-entailing environment[7] –, it does matter in the case of *less* comparatives. The parse of (40b) without SHIFT, given in (41), yields the meaning in (42): Lucy's speed is lower than the maximal speed such that some boy drove at that speed.

(41) [less [MAX [λd [any boy drove d-fast]]]] [MAX [λd' [Lucy drove d' fast]]]

(42) max(λd. $\exists$x(boy(x) $\wedge$ speed(x)$\geq$d)) $>$ speed(Lucy)

Any is in an upward-entailing environment on this parse: Lucy's speed being lower than the maximal speed of all the boys does not entail Lucy's speed being lower than the maximal speed of, say, all the slow boys, given in (43). So this parse is ruled out.

(43) max(λd. $\exists$x(boy(x) $\wedge$ speed(x)$\geq$d)) $>$ speed(Lucy) $\not\Rightarrow$
max(λd. $\exists$x(slow.boy(x) $\wedge$ speed(x)$\geq$d)) $>$ speed(Lucy)

Fortunately, there is another parse of the sentence. If the standard clause of (40b) contains SHIFT, as in (44), we obtain the meaning in (45): Lucy speed is lower than the speeds of all the boys.

[7]The reason for this is that we obtain the meaning that Lucy's speed is greater than either the maximal speed of all the boys (= without SHIFT) or the minimal plurality containing the speeds of all the boys (= with SHIFT). Switching to a subset of boys will yield the same or a lower maximal speed, or the same minimal plurality of the speeds of all the boys or a sub-plurality thereof. Accordingly, Lucy's speed will remain greater than what is obtained after the switch. Thus, *any* and *ever* are in a downward-entailing environment in (40a).

(44) [less [MAX [λd [any boy drove SHIFT d fast]]]] [MAX [λd' [Lucy drove d' fast]]]

(45) max(λd. $\exists$x(boy(x) $\wedge$ speed(x) $\sqsubseteq$ d)) > speed(Lucy)
$\Leftrightarrow \oplus_{boy(x)}$ speed(x) > speed(Lucy)

Any is in a downward-entailing environment on this construal and is correctly predicted to be acceptable: Lucy speed being lower than the speeds of all the boys entails her speed being lower than the speeds of any subset of the boys, as illustrated in (46).

(46) $\oplus_{boy(x)}$ speed(x) > speed(Lucy) $\Rightarrow \oplus_{slow.boy(x)}$ speed(x) > speed(Lucy)

The generalization that we end up with is that an occurrence of an NPI in the standard clause of a *less* comparative requires a shift to plural degrees. This plays a crucial role in deriving the second observation in (4).

(47) *Generalization about NPIs in* less *comparatives:*
If an NPI occurs in the standard clause of a *less* comparative, the degree argument abstracted over in the standard clause must be an argument of SHIFT.

8. Forcing disambiguation

The conclusion of the preceding section was that if an NPI occurs in the standard clause, the clause must also contain SHIFT. This holds also if the standard clause in addition contains an existential modal. For example, the sentence in (48) must be parsed as in (49) for the NPI to occur in a downward-entailing environment and be licensed.

(48) Lucy drove less fast [than anyone was allowed to].

(49) [less [MAX [λd [anyone [λx [$\Diamond$ [x drove SHIFT d fast]]]]]]
[MAX [λd' [Lucy drove d' fast]]]]

The meaning of (49), computed in (50), corresponds to the minimum-related reading: Lucy's speed is lower than everyone's minimal required speed. Since no other parse of the sentence in (48) is admitted, due to the Generalization about NPIs, the sentence is correctly predicted to only convey the minimum-related reading. This accounts for the second observation in (4).

(50) $\oplus_{person(x),\Diamond w}$ speed$_w$(x) > speed(Lucy)
$\Leftrightarrow$ [min-required-speed, max-allowed-speed] > speed(Lucy)

To summarize: the presence of an NPI in the standard clause of a *less* comparative forces a parse with SHIFT. If the standard clause contains an existential modal, this leads to a minimum-related reading. We have thus accounted for the two observations in (4):

(51) i. *Less* comparatives with an existential modal in the standard clause are ambiguous between a maximum- and a minimum-related reading unless

[$\rightsquigarrow$ *an insertion of* SHIFT *in the standard clause results in a minimum-related reading, its absence results in a maximum-related reading*]

ii. the standard clause contains an NPI.

[$\rightsquigarrow$ *an insertion of* SHIFT *is needed for the NPIs to be licensed (= to be in a DE environment), which results in a minimum-related reading*]

In the final two sections of the paper, we point to some predictions of the proposal for other types of comparatives with quantified standard clauses.

9. *More* comparatives

When it comes to *more* comparatives, the proposal makes the opposite prediction than for *less* comparatives with respect to standard clauses containing modals: comparatives with existential modals are predicted to be unambigous, while comparatives with universal modals are predicted to be ambiguous. We suggest that this is borne out.

9.1 Existential modals

In Section 4, we already showed that our proposal predicts that standard clauses containing an existential modal will not lead to an ambiguity in *more* comparatives: we should obtain only the maximum-related reading. The prediction seems to be right (e.g., Schwarzschild & Wilkinson 2002, Schwarzschild 2008, Beck 2012). For example, sentence (52) is correctly predicted to convey that Lucy drove faster than the maximal allowed speed, 70 mph in our scenario, and indeed this is the only interpretation of the sentence. (See the discussion surrounding example (27) above.)

(52) Lucy drove faster [than he was allowed to].

a. Predicted: Minimum-related reading # Maximum-related reading ✓
b. Observed: Minimum-related reading # Maximum-related reading ✓

9.2 Universal modals

In contrast to examples with existential modals, the proposal predicts that examples with universal modals in the standard clause will exhibit an ambiguity. This appears *not* to be borne out in examples like (53), which convey only a minimum-related reading (e.g., Schwarzschild & Wilkinson 2002, Schwarzschild 2008, Beck 2012).

(53) Lucy drove faster [than she was required to].

a. Predicted: Minimum-related reading ✓ Maximum-related reading ✓
b. Observed: Minimum-related reading ✓ Maximum-related reading #

In the following, we first elaborate on how these predictions are derived on our proposal. Subsequently, we suggest that the initial appearance of lack of ambiguity may be misleading, though a detailed investigation of the contexts in which it surfaces is left to a future occasion (see footnote 8). We begin by looking at the two parses of sentence (53):

(54) a. [er [MAX [λd [$\Box$ [Lucy drove d fast]]]]] [MAX [λd' [Lucy drove d' fast]]]
b. [er [MAX [λd [$\Box$ [L drove SHIFT d fast]]]]] [MAX [λd' [L drove d' fast]]]

These have the meanings provided in (55) and (56), respectively. The first meaning is the minimum-related one: John's speed in the actual world is greater than the maximal speed that he has in every accessible possible world, that is, the minimal required speed.

(55) $\text{speed}_{@}(\text{Lucy}) > \max(\lambda \text{d}.\ \Box(\text{speed}(\text{Lucy}) \geq \text{d}))$
$\Leftrightarrow \text{speed}_{@}(\text{Lucy}) > \text{min-required-speed}$

The second meaning is the maximum-related one: John's speed in the acutal world is greater than the plurality of all (and only) the speeds that John may drive at. This is the reading that is judged to be unavailable.

(56) $\text{speed}_{@}(\text{Lucy}) > \max(\lambda \text{d}.\ \Box(\text{speed}(\text{Lucy}) \sqsubseteq \text{d}))$
$\Leftrightarrow \text{speed}_{@}(\text{Lucy}) > \oplus_{\Diamond_w} \text{speed}_{w}(\text{Lucy})$
$\Leftrightarrow \text{speed}_{@}(\text{Lucy}) >$ [min-required-speed, max-allowed-speed]

Although one could try to rule out the maximum-related reading by identifying an independent factor that would ban the structure in (54b), we tentatively suggest that, while definitely dispreferred, the maximum-related interpretation of sentence (53) may surface in certain configurations. One such configuration may be where the comparative is embedded under a downward-entailing operator, as in (57). The sentence in (57) may be compatible with me thinking that Lucy was not breaking the law (say, with me thinking that she was driving 60 mph in our scenario). This is expected only if we allow for the embedded comparative to have a maximum-related interpretation, that is, the parse in (54b).[8] (In contrast, no ambiguity obtains if the universal modal is replaced with an existential one.)

(57) I doubt that Lucy drove faster than she was required to.

[8] Although we cannot fully investigate here why the maximum-related reading may become detectable in downward-entailing environments, we suspect that the principle of Truth Dominance (Meyer & Sauerland 2009), provided in (i), may play a role: if the parse without SHIFT is the most accessible one, sentence (53) would have to be judged to be true in any situation in which its logically weaker minimum-related reading would be true. Obviously, more would need to be said, not least because of the seemingly easy accessibility of the minimum-related readings of *less* comparatives containing existential modals.

(i) *Truth dominance:*
Whenever an ambiguous sentence S is true in a situation on its most accessible reading, we must judge sentence S to be true in that situation.

To summarize: we showed that our proposal correctly predicts that *more* comparatives containing an existential modal in the standard clause will have a maximum-related reading only. It also predicts an ambiguity for *more* comparatives containing a universal modal in the standard clause. We argued that this prediction may be correct on the basis of the interpretation of comparatives in DE environments.

10. Other quantifiers

One argument against treating degree expressions as having a non-plural semantics as basic, and against getting plurality via an optional SHIFT operator can be devised on the basis of how nominal quantifiers behave in comparatives (see esp. Beck 2012). One major feat of the proposals by Schwarzschild & Wilkinson, Beck, and Dotlačil & Nouwen was to without further ado capture much of the behavior of nominal quantifiers in standard clauses. We do not – at least not without further ado.

Consider a comparative sentence whose standard clause contains a universal nominal quantifier. The comparative is, unlike its counterpart with a universal modal, unambigous and exhibits only a maximum-related reading – say, that Lucy drove faster than the fastest boy in (58). Parallel facts hold for *less* comparatives.

(58) Lucy drove faster [than every boy did].

a. Predicted: Minimum-related reading ✓ Maximum-related reading ✓
b. Observed: Minimum-related reading # Maximum-related reading ✓

However, both readings are predicted to exist by the proposal developed above. They are derived from the parses in (59) and (60): the first one yields the minimum-related reading; the second one yields the maximum-related reading. We leave it to the reader to check this (note that the state of affairs is completely parallel to the examples containing universal modals in the standard clause, see (53) above).

(59) [er [MAX [λd [every boy [λx[x drive d fast]]]]]] [MAX [λd' [L drive d'-fast]]]

(60) [er [MAX [λd[every boy [λx[x drv SHIFT d fast]]]]]] [MAX [λd'[L drv d' fast]]]

This is a problem. In the following, we merely present a variant of the usual response to the issue here (see esp. Heim 2000, 2006b): the overgeneration can be reined in by an *ad hoc* stipulation pertaining to the chain induced by the movement of the degree *wh* expressions – degree *wh* may cross a nominal quantifier only if it also crosses SHIFT. As it stands, we do not know why this stipulation should hold. We hope to take on this as well as many other issues raised by our proposal in the future.

(61) *Modified Heim-Kennedy Generalization:* If the scope of a quantificational DP contains the trace of a DegP, that trace must be a sister of SHIFT.

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