More on *less*

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Slides: `http://bit.ly/moreonless`

Ambiguity in *less* comparatives

(1) Lucy drove less fast than she was allowed to.

✓ Less-than-minimum reading

(2) Lucy drove less fast than the minimal required speed.

✓ Less-than-maximum reading

(3) Lucy drove less fast than the maximal allowed speed.

(Seuren 1978, Rullmann 1995, Heim 2006, Büring 2007, Beck 2012, i.a.)

Disappearance of ambiguity in *less* comparatives

(4) Lucy drove less fast than anyone was allowed to.

✓ Less-than-minimum reading

(5) Lucy drove less fast than everyone's minimal required speed.

✗ Less-than-maximum reading

(6) Lucy drove less fast than everyone's maximal allowed speed.

Rullmann's puzzle: *Less* comparatives may exhibit an ambiguity with certain modals in the comparative clause iff the clause does not also contain a negative polarity item.

(Rullmann 1995, Heim 2006)

Disappearance of ambiguity in *less* comparatives

(7) Lucy drove less fast than every boy did.

✓ Less-than-minimum reading
✗ Less-than-maximum reading

(8) Lucy drove less fast than a/some boy did.

✗ Less-than-minimum reading
✓ Less-than-maximum reading

Heim's (and Kennedy's) puzzle: In contrast to modal quantifiers, no ambiguity can be observed in *less* comparatives with nominal quantifiers in the subject position of the comparative clause.

(cf. Schwarzschild 2008, Beck 2010, Fleisher 2015, Dotlačil & Nouwen 2015, i.a.)

Composition of comparatives

Proposal

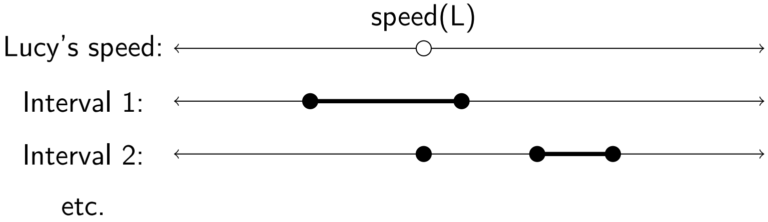
- Adjectival semantics
  - Intervals/degree pluralities
    (esp. Beck 2010, 2012, Dotlačil & Nouwen 2015)
- Compositional glue
  - Existential Closure or Maximality
    (Partee 1987, Chierchia 1998, Dayal 2004, i.a.)

Adjective semantics

(9) $[\![\text{fast}]\!] = \lambda i_{(dt)}.\ \lambda x_e.\ \text{speed}(x) \in i$

(10) a. Lucy drove 70mph fast.
b. speed(Lucy) $\in$ [70mph,∞)

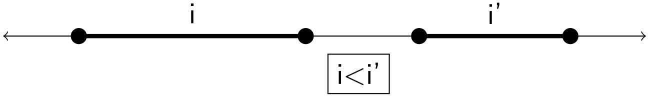
(11) a. [λi [Lucy drove i fast]]
b. {[70mph], [60mph,120mph], [70mph]$\cup$[400mph], ...}



Comparison

(12) $[\![\text{er}]\!] = \lambda i_{(dt)}.\ \lambda i'_{(dt)}.\ i < i'$

(13) $i < i'$ iff $\forall d' \in i': \forall d \in i: d < d'$



How do <u>predicates of intervals</u> (as picked out by the subordinate and matrix clause in the comparative) compose with <u>a relation between intervals</u> (as picked out by the comparison operator *er*)?

Compositional glue

Following the proposals of Partee (1987), Chierchia (1998), Dayal (2004), i.a., in other domains, we submit that such mismatches can be resolved by applying one of two mechanisms:

- Existential Closure

(14) $[\![\exists]\!] = \lambda \text{I}_{((dt)t)}.\ \lambda \text{I'}_{((dt)t)}.\ \exists \text{i}\ (\text{I(i)} \wedge \text{I'(i)})$

- Maximality (Iota)

(15) $[\![\text{the}]\!] = \lambda \text{I}_{((dt)t)}.\ \iota \text{i}\ (\text{I(i)} \wedge \forall \text{i'}(\text{I(i')} \rightarrow {}^\wedge\text{I(i)} \subseteq {}^\wedge\text{I(i')}))$

Composition of comparatives: Existential Closure

John drove faster than Lucy did.

[John drove [er [wh [λi [Lucy drove i fast]]] fast]]

subordinate clause, wh-movement

[$\exists$ [er [wh [λi [Lucy drove i fast]]] [λi' [John drove i' fast]]]

↓

Ex. Closure

[$\exists$ [wh [λi [Lucy drove i fast]] [λi [$\exists$ [er i] [λi' [John drove i' fast]]]]]

↓

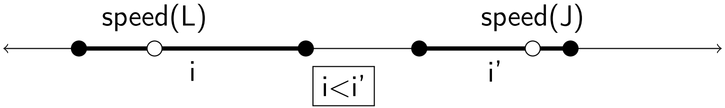
Ex. Closure

(cf. Fox 2014)

Composition of comparatives: Existential Closure

$$[\exists \underbrace{[\text{wh } [\lambda\text{i [Lucy drove i fast]]]}}_{\lambda\text{i. speed(L)} \in \text{i}} \underbrace{[\lambda\text{i } [\exists \text{ [er i] } [\lambda\text{i' [John drove i' fast]]]]]}}_{\lambda\text{i. } \exists\text{i'(i}<\text{i'} \wedge \text{speed(J)} \in \text{i')}}$$

(16) $\exists$i(speed(L) $\in$ i $\wedge$ $\exists$i'(i$<$i' $\wedge$ speed(J) $\in$ i'))



This meaning is equivalent to: speed(L) $<$ speed(J)!

Compostition of comparatives: Maximality

John drove faster than Lucy did.

[John drove [er [the [wh [λi [Lucy drove i fast]]]] fast]]

↓

Maximality

[∃ [er [the [wh [λi [Lucy drove i fast]]]] [λi' [John drove i' fast]]]

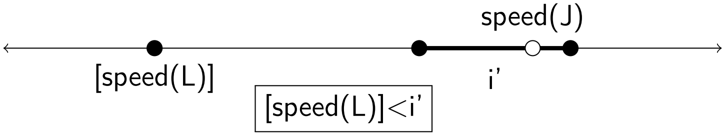
↓

Ex. Closure

Composition of comparatives: Maximality

$[\exists\ [\text{er}\ \underbrace{[\text{the [wh } [\lambda \text{i [Lucy drove i-fast]]]]]}}_{\text{the maxinf interval wrt } (\lambda\text{i.speed(L)}\in\text{i}),\ =\ [\text{speed(L)}]}]\ [\lambda\text{i' [John drove i' fast]]]}$

(17) $\exists$i'([speed(L)]$<$i' $\wedge$ speed(J)$\in$i')



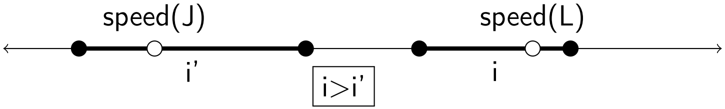
This meaning is equivalent to: speed(L) $<$ speed(J)!

Composition of *less* comparatives: Existential Closure

(18) $[\![\text{less}]\!] = \lambda i_{(dt)}.\ \lambda i'_{(dt)}.\ i > i'$

(19) a. John drove less fast than Lucy did.
b. $[\exists$ [wh $[\lambda$i [Lucy drove i fast]]]
$[\lambda$i $[\exists$ [less i] $[\lambda$i' [John drove i' fast]]]]]

(20) $\exists i(\text{speed}(L) \in i \wedge \exists i'(i > i' \wedge \text{speed}(J) \in i'))$



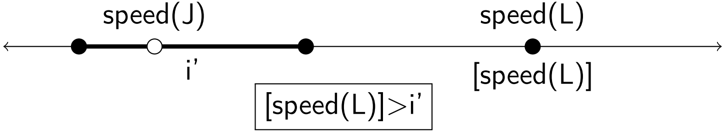
This meaning is equivalent to: $\text{speed}(L) > \text{speed}(J)$!

Note: We obtain equivalent results if we use *er* instead of *less*, and each adjective is an argument of an 'antonymizing' reversal function (e.g., Rullmann 1995, Sassoon 2010).

Composition of *less* comparatives: Maximality

(21) a. John drove less fast than Lucy did.
b. [$\exists$ [less [the [wh [λi [Lucy drove i fast]]]]]
[λi' [John drove i' fast]]]

(22) $\exists$i'([speed(L)]$>$i' $\wedge$ speed(J)$\in$i')



This meaning is equivalent to: speed(L) $>$ speed(J)!

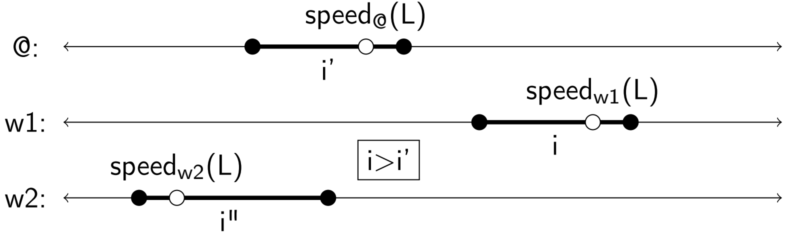
Rullmann's puzzle

Ambiguity with *less* comparatives: Existential Closure

(23) a. Lucy drove less fast than she was allowed to.

b. [$\exists$ [wh [λi [$\Diamond$ [Lucy drove i fast]]]]
[λi [$\exists$ [less i] [λi' [Lucy drove i' fast]]]]]

(24) $\exists$i ($\Diamond$^(speed(L)$\in$i) $\wedge$ $\exists$i'(i$>$i' $\wedge$ speed(L)$\in$i'))



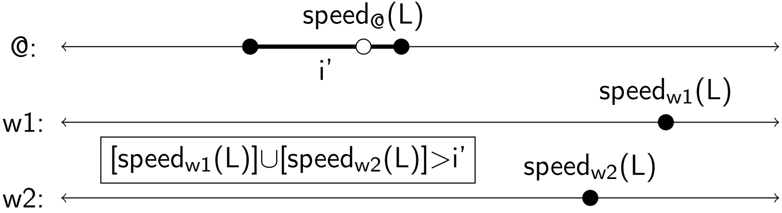
This corresponds to below-the-maximum reading!

Ambiguity with *less* comparatives: Maximality

(25) a. Lucy drove less fast than she was allowed to.

b. [$\exists$ [less [the [wh [λi [$\Diamond$ [Lucy drove i fast]]]]] [λi' [Lucy drove i' fast]]]]]

(26) $\exists$i'([speed$_{\Diamond min}$(L),speed$_{\Diamond max}$(L)]$>$i' $\wedge$ speed(L)$\in$i')



This corresponds to below-the-minimum reading!

Negative Polarity Items: Existential Closure

(27) Lucy drove less fast than any boy did.

Disambiguation with Existential Closure

(28) *[$\exists$ [wh [λi [any boy drove i fast]]]
[λi [$\exists$ [less i] [λi' [Lucy drove i' fast]]]]]

(29) $\exists$i($\exists$x(boy(x) $\wedge$ speed(x)$\in$i) $\wedge$ $\exists$i'(i$>$i' $\wedge$ speed(L)$\in$i'))

$$\not\Rightarrow$$

(30) $\exists$i($\exists$x(slo-boy(x) $\wedge$ speed(x)$\in$i) $\wedge$ $\exists$i'(i$>$i' $\wedge$ speed(L)$\in$i'))

There is no downward-entailing environment in this structure. Thus, NPIs cannot be licensed on this construal of *less* comparatives!

Negative Polarity Items: Maximality

(31) Lucy drove less fast than any boy did.

Disambiguation with Maximality

(32) [$\exists$ [less [the [wh [λi [any boy drove i fast]]]]]
[λi' [Lucy drove i' fast]]]

(33) $\exists$i'([speed(boy$_1$)]$\cup$...$\cup$[speed(boy$_n$)]$>$i' $\wedge$ speed(L)$\in$i'))

$$\Rightarrow$$

(34) $\exists$i'([speed(boy$_1$)]$\cup$...$\cup$[speed(boy$_{n-1}$)]$>$i' $\wedge$ speed(L)$\in$i'))

There is a downward-entailing environment in this structure. Thus, NPIs can be licensed on this construal of *less* comparatives!

Disappearance of ambiguity in *less* comparatives

(35) Lucy drove less fast than anyone is allowed to.

Disambiguation with Maximality is forced by the NPI

(36) [$\exists$ [less [the [wh [λi [anyone [λx [$\Diamond$ [x drove i fast]]]]]]]]
[λi' [Lucy drove i' fast]]]

(37) $\exists$i'([lowest$\Diamond$speed,highest$\Diamond$speed]$>$i' $\wedge$ speed(L)$\in$i'))

This corresponds to below-the-minimum reading!

Intermediate summary: Rullmann's puzzle

Modal quantifiers in *less* comparative clause

- The meanings of the matrix and subordinate clause in comparatives are glued together by an application of Existential Closure or that of Maximality (see, e.g., Partee 1987, Chierchia 1998).
- In modal *less* comparatives discussed, Existential Closure yields below-the-maximum, Maximality yields below-the-minimum.
- The scope of Maximality (but not that of Existential Closure!) in a *less*-comparative clause constitutes a DE environment.
- Accordingly, the presence of an NPI, which must occur in a DE environment, necessitates the Maximality disambiguation of the comparative, and thus below-the-minimum reading!

Heim's puzzle

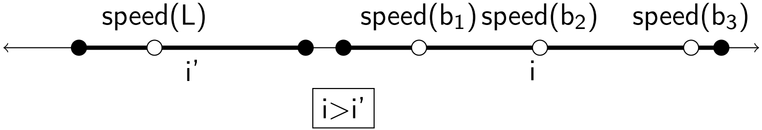
Lack of ambiguity with nominal quantifiers: Universals

(38) Lucy drove less fast than every boy did.

Disambiguation with Existential Closure

(39) $[\exists$ [wh $[\lambda$i [every boy drove i fast]]]
$[\lambda$i $[\exists$ [less i] $[\lambda$i' [Lucy drove i' fast]]]]]

(40) $\exists$i($\forall$x(boy(x) $\rightarrow$ speed(x)$\in$i) $\wedge$ $\exists$i'(i$>$i' $\wedge$ speed(L)$\in$i')))



This is equivalent to: speed(L) $<$ speed(the slowest boy)!

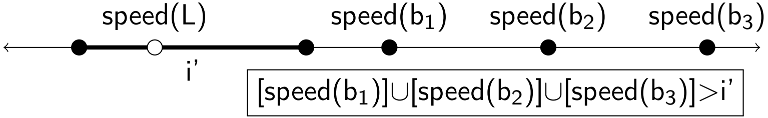
Lack of ambiguity with nominal quantifiers: Universals

(41) Lucy drove less fast than every boy did.

Disambiguation with Maximality

(42) [$\exists$ [less [the [wh [λi [every boy drove i fast]]]]]
[λi' [Lucy drove i fast]]]

(43) $\exists$i'([speed(b_1)]$\cup$...$\cup$speed(b_n)]$>$i' $\wedge$ speed(L)$\in$i')))



This is equivalent to: speed(L) $<$ speed(the slowest boy)!

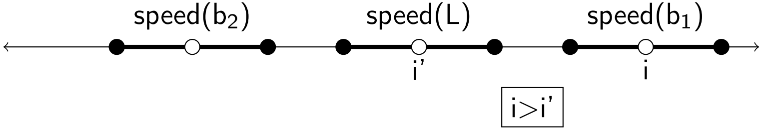
Lack of ambiguity with nominal quanitifiers: Existentials

(44) Lucy drove less fast than a/some boy did.

Disambiguation with Existential Closure

(45) $[\exists$ [wh [λi [some boy drove i fast]]]
[λi [$\exists$ [less i] [λi' [Lucy drove i' fast]]]]]

(46) $\exists i(\exists x(boy(x) \wedge speed(x) \in i) \wedge \exists i'(i > i' \wedge speed(L) \in i'))$



This is equivalent to: speed(L) $<$ speed(the fastest boy)!

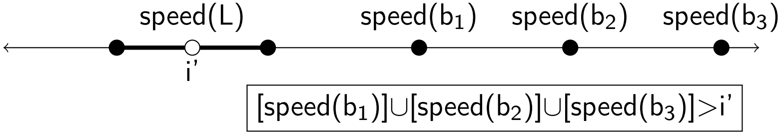
Lack of ambiguity with nominal quantifiers: Existentials

(47) Lucy drove less fast than a/some boy did.

Disambiguation with Maximality

(48) [$\exists$ [er [the [wh [λi [some boy drove i fast]]]]]
[λi' [Lucy drove i fast]]]

(49) $\exists$i'([speed(b_1)]$\cup$...$\cup$[speed(b_n)]$>$i' $\wedge$ speed(L)$\in$i')



This is equivalent to: speed(L) $<$ speed(the slowest boy)! ✗?

Only disambiguation with Existential Closure appears to be available.

Tentative suggestion about existentials

Some

- PPIhood, competition with *any*.

Weak indefinites

- If it were presupposed that the comparative clause contains at least one interval, it would also be presupposed that the restrictor of the existential quantifier in the clause is non-empty.
- Since *every* presupposes existence, in contrast to certain indefinites, its use may be mandated by a principle requiring the use of presuppositionally stronger alternatives if possible.

Intermediate summary: Heim's puzzle

Nominal quantifiers in subject position of *less* comparative clause

- Interval degree semantics coupled with Existential Closure and Maximality inherits most predictions of the approaches it is based on (esp. Beck 2010, 2012, Dotlačil & Nouwen 2015).
- In the case of universal quantifiers in subject position, the matrix clause effectively predicates over all the degrees associated with the quantifier, no matter what disambiguation is chosen.
- In the case of existential quantifiers in subject position, the disambiguation with Existential Closure yields the observed readings. The disambiguation with Maximality must be ruled out. We hinted at some ways of doing this.

Conclusion and outlook

- We adopted an interval/plural approach to degree semantics (following esp. Beck 2010, 2012, Dotlačil & Nouwen 2015).
- We proposed systematic ambiguity in how comparative clauses are put together (cf. Partee 1987, Chierchia 1998):
  - Existential Closure
  - Maximality
- This allowed us to capture the Rullmann ambiguities in *less* comparatives, and their disappearance in the presence of NPIs.
- We were able to capture the lack of ambiguity in *less* comparatives with universal nominal quantifiers in comparative clauses. Further stipulations are required for existential quantifiers.

Conclusion and outlook

Universal modals

- Correct predictions for *less* comparatives with *should/ought to*. Further inquiry into the behavior of *have to* modals is needed (only below-the-minimum reading is predicted for them).

Antonymy

- We could not attend here to some asymmetries between *less* comparatives and their proper antonym counterparts (*less fast* vs. *more slowly*) (see e.g. Büring 2007, Heim 2008).

Differentials

- Correct predictions for (non-UE) differentials with nominal quantifiers in the comparative clause. Predictions appear to be too strong for differentials with modals (Dotlačil & Nouwen 2016).