

Less**1. Summary from last week**

- (1) adjective meanings: relational (Rullmann's 'at least' interpretation), i.e.
 $[[\mathbf{tall}]] = \lambda d. \lambda x. TALL(x) \geq d$

Functional ('exactly') meanings were equivalent for almost all purposes, but didn't seem to work with necessity modals.

- (2) meaning of the comparative morpheme **-er** (= **more**):
 $\lambda_{\text{matrix-clause}} [-\mathbf{er} \lambda_{\text{than-clause}}]$ is true iff
 some degree that satisfies λ > every degree that satisfies λ
 the maximal the maximal

In infinite, continuous domains, 'some - every' seemed superior, but otherwise the maximality versions were equivalent.

Another variant which is practically always equivalent:

- (3) $\lambda_{\text{matrix-clause}} [-\mathbf{er} \lambda_{\text{than-clause}}]$ is true iff
 the set of degrees that satisfy λ \supseteq the set of degrees that satisfy λ
 (i.e., is a proper superset of)

Equatives:

- (4) $\lambda_{\text{matrix-clause}} [(\mathbf{at\ least}) \mathbf{as} \lambda_{\text{as-clause}}]$ is true iff
 some degree that satisfies λ \geq every degree that satisfies λ
 the maximal the maximal
 the set of degrees that satisfy λ \supseteq the set of degrees that satisfy λ
- (5) $\lambda_{\text{matrix-clause}} [\mathbf{exactly\ as} \lambda_{\text{as-clause}}]$ is true iff
 some degree that satisfies λ = every degree that satisfies λ
 the maximal the maximal
 the set of degrees that satisfy λ = the set of degrees that satisfy λ

Possibly an advantage for the set-based formulation emerges here: it seems to combine the virtues of the maximality formulation with the ability to handle continuous domains. However, this is not a compositional analysis of 'exactly as'.

- (6) The package is exactly as heavy as it is allowed to be.
(cannot be literally true if the post office specifies 'less than 5 lbs')
- (7) The package is allowed to be exactly as heavy as the letter is (allowed to be).
(arguably true if PO specifies 'less than 5 lbs' for packages as well as letters)

Differential comparatives:

- (8) $\Box_{\text{matrix-clause}} [(\text{at least } d \text{-er } \Box_{\text{than-clause}})]$ is true iff
- (a) some degree that satisfies \Box exceeds every degree that satisfies \Box by at least d
 - (b) the maximal degree that satisfies $\Box \geq d$ + the maximal degree that satisfies \Box
 - (c) the set of degrees that satisfy $\Box \supseteq d$ + the set of degrees that satisfy \Box
- (9) Let A be a set of degrees and d a degree. Then
 $A \uparrow d := A \cup \{d' + d : d' \in A\}$
- (10) $\Box_{\text{matrix-clause}} [\text{exactly } d \text{-er } \Box_{\text{than-clause}}]$ is true iff
- (b) the maximal degree that satisfies $\Box = d$ + the maximal degree that satisfies \Box
 - (c) the set of degrees that satisfy $\Box = d$ + the set of degrees that satisfy \Box
- (11) The package is exactly 1 oz heavier than it is allowed to be.
- (12) The package is allowed to be exactly 1 oz heavier than the letter is (allowed to be).

But recall conflicting evidence from 'exactly' equatives and 'exactly' diff. comparatives containing disjunctions.

2. *less* comparatives

2.1. Simple cases

- (13) Mary is less tall than John is.

Given our decision in favor of relational adj meanings, we seem to need one of the following:

- (14) $\Box_{\text{matrix-clause}} [\text{less } \Box_{\text{than-clause}}]$ is true iff
- (a) every degree that satisfies $\Box <$ some degree that satisfies \Box
 - (b) the maximal degree that satisfies $\Box <$ the maximal degree that satisfies \Box
 - (c) the set of degrees that satisfy $\Box \subseteq$ the set of degrees that satisfy \Box

Rullmann: *less* comparatives argue for

- maximality analysis of than-clauses, and
- functional adj meanings

(15) Rullmann's meanings for **more** and **less**:

$\Box_{\text{matrix-clause}} [\text{-er } \Box_{\text{than-clause}}]$ is true iff
some degree that satisfies $\Box >$ the maximal degree that satisfies \Box

$\Box_{\text{matrix-clause}} [\text{less } \Box_{\text{than-clause}}]$ is true iff
some degree that satisfies $\Box <$ the maximal degree that satisfies \Box

He assumes that the quantificational force of the than-clause comes from the semantics of the wh-clause itself (a kind of free-relative analysis). Hence this should be uniform across different degree operators.

As for the quantificational force in the matrix, he takes it to be contributed by the degree operator. Thus no real reason for uniformity (e.g., 'some' throughout). So he could have chosen (14b) and relational adj meanings instead – at least for what we have seen so far.

2.2. Two readings with *less*

Sentences for which the analysis so far is adequate (from Rullmann):

(20) John is less strong than he could be.

(21) Students spend less than a professor can spend.

However, we make incorrect predictions for the following examples:

(22) John is less tall than any of the girls.
predicted: *'he is shorter than the tallest girl'
observed: 'he is shorter than the shortest girl'

(23) John is less tall than he ever was.
predicted: *'he is below his greatest previous height'
observed: 'he is below his lowest previous height'

(24) amended meaning suggested by these examples (see Rullmann):

$\Box_{\text{matrix-clause}} [\text{less } \Box_{\text{than-clause}}]$ is true iff
some (the maximal) degree that satisfies $\Box <$ the minimal degree that satisfies \Box

This, however, crucially relies on using functional adj meanings after all! Reference to minima otherwise does not make any sense.

Rullmann's findings:

- **less** is ambiguous between 'below minimum' and 'below maximum' readings:

(25) [**less**_{<max} [*than*-clause] \square _{matrix-clause}] is true iff
some degree that satisfies \square < the maximal degree that satisfies \square

(26) [**less**_{<min} [*than*-clause] \square _{matrix-clause}] is true iff
some degree that satisfies \square < the minimal degree that satisfies \square

- ambiguity emerges only with quantifiers:

(27) When there is no quantifier (incl. time or world quantifiers) in the *than*-clause, then minimum = maximum = unique degree that satisfies *than*-clause. Hence the ambiguity is undetectable.

- NPIs disambiguate:

(28) Only the **less**_{<min} reading is available when the *than*-clause contains negative polarity items. This follows from the logical properties of the two readings together with Ladusaw's theory of NPI-licensing.

(29) I got more than I could ever pay back.

(30) I got less than I could ever live on.

- existence presuppositions for each reading:

(32) Only the **less**_{<min} reading is available when no maximum exists, and only the **less**_{<max} reading is available when no (non-trivial) minimum exists.

(33) The monastery scenario: Praying is good, sleeping is bad.
You are required to pray at least 6 hours a day, and the more you pray, the better.
You are allowed to sleep at most 6 hours a day, and the less you sleep, the better.

(34) I slept less than was allowed.
(true if, e.g., I slept 5 hours; **less**_{<max} reading)

(35) I prayed less than was allowed.
(true if, e.g., I prayed for 5 hours; **less**_{<min} reading)

Sentences that are ambiguous, because minima as well as maxima exist:

(36) The helicopter was flying less high than a plane can fly.
(a) the h. was flying at an altitude below the maximal altitude at which a plane can fly
(b) the h. was flying at an altitude below the minimal altitude at which a plane can fly

(37) Lucinda is driving less fast than is allowed on this highway. (from Rullmann 1995a)

- (a) she's driving below the speed limit
- (b) she's driving below the minimum speed

• There is no analogous ambiguity in *more*-comparatives:

(38) Lucinda is driving faster than is allowed on this highway.

- (a) she's driving above the speed limit
- (b) *she's driving above the minimum speed

(39) in monastery scenario:

- (a) I slept more than was allowed.
(true if, e.g., I slept 7 hours)
- (b) #I prayed more than was allowed.
(cannot be true in this scenario)

3. Shortcomings of Rullmann's initial analysis

conceptual issue:

(40) Why is *less* ambiguous?

Is it an accident that *less* is ambiguous but *more* isn't?

empirical issue: apparently similar ambiguities arise elsewhere.

(41) It's amazing how little one is allowed to eat here.

- (a) I thought one would have been allowed to eat more.
- (b) I thought one would have been required to eat more.

(42) We are shocked that they are allowed to teach so little.

- (a) 'we are shocked that they aren't allowed to teach more'
- (b) 'we are shocked that they get away with so little teaching'

(43) It's a disgrace how little they are allowed to sleep in this monastery!

(= they should have been allowed to sleep more)

(44) It's a disgrace how little they are allowed to pray in this monastery!

(= they should have been required to pray more)

Suspicion: The ambiguity is related to the presence of **little**. It shows up systematically with expressions of the form [degree morpheme + **little**], where the degree morpheme can be **how**, **so**, **-er**, etcetera. **less** is just one special case, the suppletive spell-out of **-er little**.

4. Rullmann's second account of the ambiguity

- (45) **faster** = **-er fast**
less fast = **-er little fast**

The ambiguity arises because **little** can be either part of the comparative operator or part of the adjective.

- (46) She drove faster than she was allowed to. -- only one derivation:
she drove [_{Deg} **-er**] [_{Adj} **fast**] **than wh she was allowed to** [VP]
 Deg + *than*-clause takes scope:
 [-er **than wh she was allowed to**]₁ **she drove t₁ fast**
 ellipsis filled in contains matching adjective:
 [-er **than wh₂ she was allowed to drive t₂ fast**]₁ **she drove t₁ fast**
 meaning: 'faster than maximal permitted speed'
- (47) She drove less fast than she was allowed to. -- first derivation:
she drove [_{Deg} **-er little**] [_{Adj} **fast**] **than wh she was allowed to** [VP]
 Deg + *than*-clause takes scope:
 [-er **little than wh she was allowed to**]₁ **she drove t₁ fast**
 ellipsis filled in contains matching adjective:
 [-er **little than wh₂ she was allowed to drive t₂ fast**]₁ **she drove t₁ fast**
 meaning: 'slower than maximal permitted speed'
- (48) She drove less fast than she was allowed to. -- second derivation:
she drove [_{Deg} **-er**] [_{Adj} **little fast**] **than wh she was allowed to** [VP]
 Deg + *than*-clause takes scope:
 [-er **than wh she was allowed to**]₁ **she drove t₁ little fast**
 ellipsis filled in contains matching adjective:
 [-er **than wh₂ she was allowed to drive t₂ little fast**]₁ **she drove t₁ little fast**
 meaning: 'slower than minimal required speed'

But how exactly do these structures express these respective meanings?

Sketch of semantics

- (49) [-er \square *than*-clause] \square *matrix*-clause is true iff
 some degree that satisfies \square > the maximal degree that satisfies \square

- (50) [-er little \square than-clause] \square matrix-clause is true iff
some degree that satisfies $\square <$ the maximal degree that satisfies \square

Note: this is the same semantics previously given to the **less**_{<max} homonym.

- (51) [[fast]] = \square d: d is a degree of fastness. \square x. x is d-fast
 (52) Degrees of fastness are ordered in such a way that higher speeds correspond to greater degrees of fastness.
 (53) [[little fast]] = [[slow]] = \square d: d is a degree of slowness. \square x. x is d-slow
 (54) Degrees of slowness are ordered in such a way that lower speeds correspond to greater degrees of slowness.

Predicted readings:

- (55) for (46):
She had a degree of fastness above the maximal allowable fastness.
 (56) for (47):
She had a degree of fastness below the maximal allowable fastness.
 (57) for (48):
She had a degree of slowness above the maximal allowable slowness.
= She had a degree of fastness below the minimal allowable fastness.

Evaluation of this account

Advantage over previous account (see criticism (40)):

- (58) **less** is now more complex than **-er (more)**, so there is a principled reason why it gives rise to more readings.

But there are still problems:

- compositionality:

- (59) There is no meaning for **little** by itself. Entries are given for **-er little** in (50), and for **little fast** in (53). These collocations are, in effect, treated as idioms.
 (60) Challenge: define a uniform meaning for **little** that converts the meaning of **-er** into the meaning of **less**_{<max}, and also converts the meaning of **fast** into that of **slow**.

- generality:

- (61) To capture the ambiguity in exclamatives like (41) - (44) in an analogous way, we have to posit not just two structures for each sentence, but also separate entries for **how** and **how little**.
- (62) $[\text{Deg}_{\text{how}}]_1$ **they are allowed to pray** t_1 **little**
- (63) $[\text{Deg}_{\text{how little}}]_1$ **they are allowed to sleep** t_1 **much**
- (64) **how** \square ! conveys that the maximal degree satisfying \square was expected to be lower.
- (65) **how little** \square ! conveys that the maximal degree satisfying \square was expected to be higher.

5. A compositional variant of Rullmann's second account

5.1. Syntax: DegP-recursion

structure of simple comparative:

- (66) $[\text{DegP } \text{-er than } [\text{CP } \text{wh } \dots]]_i$ **John is** t_i **tall**

a well-known case of potential recursion in DegP: differential comparatives

- (67) (a) John is 6 inches taller than Mary.
 $[\text{DegP } \underline{\text{6 inches}} \text{-er than wh } \dots]_i$ **John is** t_i **tall**
- (b) John is as much taller than Mary as you are.
 $[\text{DegP } \text{as as wh } \dots]_j$ $[\text{DegP } t_j \text{-er than wh } \dots]_i$ **John is** t_i **tall**]

a new case of nested DegPs: **little**

- (68) LF-structure for **John is less tall than Mary**
 $[\text{DegP } \text{-er than wh } \dots]_j$ $[\text{DegP } t_j \text{ little}]_i$ **John is** t_i **tall**]
- (69) content of elided 'than'-clause must match, hence "...." is as follows:
 wh_k $[\text{DegP } t_k \text{ little}]_1$ **Mary is** t_1 **tall**

comparison with Rullmann:

Like Rullmann, I decompose **less** into **-er** and **little**. Unlike Rullmann, I never treat **little** as part of the top-most comparative operator. **little** always stays within the clause that is the comparative operator's nuclear scope. Therefore, it must always be present in the 'than'-clause as well, to ensure the proper parallelism for ellipsis.

5.2. Semantics

5.2.1 Background: amended semantics of adjectives and comparative **-er**

- (70) Adjectives: relational ("at least") interpretation
 $\llbracket \mathbf{tall} \rrbracket = \lambda d. \lambda x. TALL(x) \geq d$
- (73) Example: suppose John is exactly 6 ft tall.
 Then $\{d: TALL(\text{John}) \geq d\} = \{d: d \leq 6 \text{ ft}\} = (0, 6\text{ft}]$
- (74) For any individual x , the set of degrees to which x is tall is an initial segment of the height scale, i.e., an interval stretching from the bottom of the scale to a certain point. It is open at the bottom and closed at the top.
- (76) Refinement: treat restriction to a certain sort of degrees as a presupposition.
 amended entry for **tall**:
 $\llbracket \mathbf{tall} \rrbracket = \lambda d: d \in SD. \lambda x. TALL(x) \geq d$
 where SD is the set of spatial distances (a proper subset of D_d)
 i.e., $\llbracket \mathbf{tall} \rrbracket$ is undefined (rather than false) for degrees that are not heights.
- (77) Semantics for the comparative operator:
-er denotes the proper subset relation between sets of degrees:
 $\llbracket \mathbf{-er} \rrbracket = \lambda A. \lambda B. A \sqsubset B$
- (78) Relation to previous semantics in terms of maximality:
 If A and B are initial segments of the height-scale and each have a maximal element, then $A \sqsubset B$ iff $\max(A) < \max(B)$.

Application to an example:

- (79) John is taller than Mary.
- (80) LF representation:
 $[-\mathbf{er} \text{ than } [\mathbf{wh}_1 \text{ Mary is } \mathbf{t}_1 \text{ tall}]]_2 [\mathbf{John is } \mathbf{t}_2 \text{ tall}]$
- (81) interpretation of the two λ -abstracts:
 $\llbracket \mathbf{wh}_1 \text{ Mary is } \mathbf{t}_1 \text{ tall} \rrbracket = \{d: TALL(\text{Mary}) \geq d\}$
 $\llbracket \mathbf{2 John is } \mathbf{t}_2 \text{ tall} \rrbracket = \{d: TALL(\text{John}) \geq d\}$

(82) Applying the meaning of **-er**:

Truth-condition for (80): $\{d: \text{TALL}(\text{Mary}) \geq d\} \sqcap \{d: \text{TALL}(\text{John}) \geq d\}$

equivalently:

the maximal degree to which John is tall > the maximal degree to which Mary is tall

5.2.2. Semantics of **little**: DegP-negation

(83) **little** takes a degree-argument and forms a generalized quantifier over degrees.

(type <d, <dt,t>>)

(84) $\llbracket \text{little} \rrbracket = \lambda d. \lambda P_{\langle d, t \rangle}. P(d) = 0$.

intuitively: 'd-little' means 'not d' or 'not to degree d'

(cf. 'not John': $\lambda P_{\langle e, t \rangle}. P(j) = 0$)

(85) LF for 'Mary is less tall than John':

$[-\text{er than } \text{wh}_1 \llbracket [\text{t}_1 \text{ little}]_3 \text{ J is t}_3 \text{ tall} \rrbracket]_2 \llbracket [\text{t}_2 \text{ little}]_4 \text{ M is t}_4 \text{ tall} \rrbracket]$

The comparative quantifier is [-er than CP]. **little** is left behind inside the clause over which the comparative quantifier takes scope.

Because **little** is left behind in the matrix clause, we expect a matching **little** in the elliptical 'than'-clause.

t little itself is also a degree-quantifier, so this too needs to take scope at an interpretable position. (The required movement may be very short – just enough for interpretability. In the example, I have moved to the edge of the minimal clause, but there may be lower possible landing sites.)

(86) Interpretation:

$\llbracket \text{3 John is t}_3 \text{ tall} \rrbracket = \{d: \text{TALL}(j) \geq d\}$

$\llbracket \text{t}_1 \text{ little} \rrbracket^g = \lambda P_{\langle d, t \rangle}. P(g(1)) = 0$

$\llbracket \text{t}_1 \text{ little 3 John is t}_3 \text{ tall} \rrbracket^g = 1$ iff $\neg \text{TALL}(j) \geq g(1)$

$\llbracket \text{wh}_1 [\text{t}_1 \text{ little}]_3 \text{ John is t}_3 \text{ tall} \rrbracket = \{d: \neg \text{TALL}(j) \geq d\}$

by analogous calculation:

$\llbracket \text{2 } [\text{t}_2 \text{ little}]_4 \text{ Mary is t}_4 \text{ tall} \rrbracket = \{d: \neg \text{TALL}(m) \geq d\}$

using entry for **-er**, the complete structure is true iff

$\{d: \neg \text{TALL}(j) \geq d\} \sqcap \{d: \neg \text{TALL}(m) \geq d\}$

equivalently, $\{d: \text{TALL}(m) \geq d\} \sqcap \{d: \text{TALL}(j) \geq d\}$,

i.e., John is taller than Mary.

(87) set-theoretic law which is responsible for this last equivalence:

For any sets A, B such that $A \subseteq U$ and $B \subseteq U$:

$A \subseteq B$ iff $U - B \subseteq U - A$.

5.2.3. Antonymy

(88) **tall** and **short**:¹

(a) $[[\mathbf{tall}]] = \lambda d: d \subseteq SD. \lambda x. TALL(x) \geq d$ (see above)

(b) $[[\mathbf{short}]] = \lambda d: d \subseteq SD. \lambda x. \neg TALL(x) \geq d$

This means that **short** is indeed equivalent to **little tall**, as Rullmann suggested:

(89) (a) **John is t_1 short**

$\neg TALL(\text{John}) \geq g(1)$

(b) **John is [t_1 little] tall**

LF: $[t_1 \text{ little}]_2 \text{ John is } t_2 \text{ tall}$

$[\lambda P.P(g(1))](\lambda d.TALL(\text{John}) \geq d)$

equivalent to: $\neg TALL(\text{John}) \geq g(1)$

Confirmation for this equivalence:

(90) (a) John is taller than Mary.

(b) Mary is shorter than John.

(c) Mary is less tall than John.

All three of these are equivalent.

But **little tall** differs from **short** in containing a separate, movable, constituent. Therefore, the two will not always be equivalent in more complex sentences: **little**, as we will see, can sometimes take non-local scope, giving rise to readings not shared by **short**.

6. Ambiguity of *less* as a scope ambiguity

The covert **little** in the *than*-clause can take scope either below or above the modal operator **allowed**. This will give us the two readings:

(91) **little** above **allowed**: below-maximum reading

little below **allowed**: below-minimum reading

¹ This is (almost) the treatment of antonymy (polar opposition) in Stechow (1984b) and Kennedy (1997, 2000). See also Bierwisch (1987) and Meier (2000).

(92) Lucinda drove less fast than she was allowed to.

(93) LF-(i): [-er than wh₁ [t₁ little]₃ was allowed L to drive t₃ fast]₂
 [t₂ little]₄ L drove t₄ fast

interpretation:

{d: ¬∃w ∃ Acc: L drives d-fast in w} ⊆ {d: ¬L drives d-fast}

equivalently:

{d: L drives d-fast} ⊆ {d: ∃w ∃ Acc: L drives d-fast in w}

i.e., her actual speed is below her highest allowable speed

(94) LF-(ii): [-er than wh₁ was allowed [t₁ little]₃ L to drive t₃ fast]₂
 [t₂ little]₄ L drove t₄ fast

interpretation:

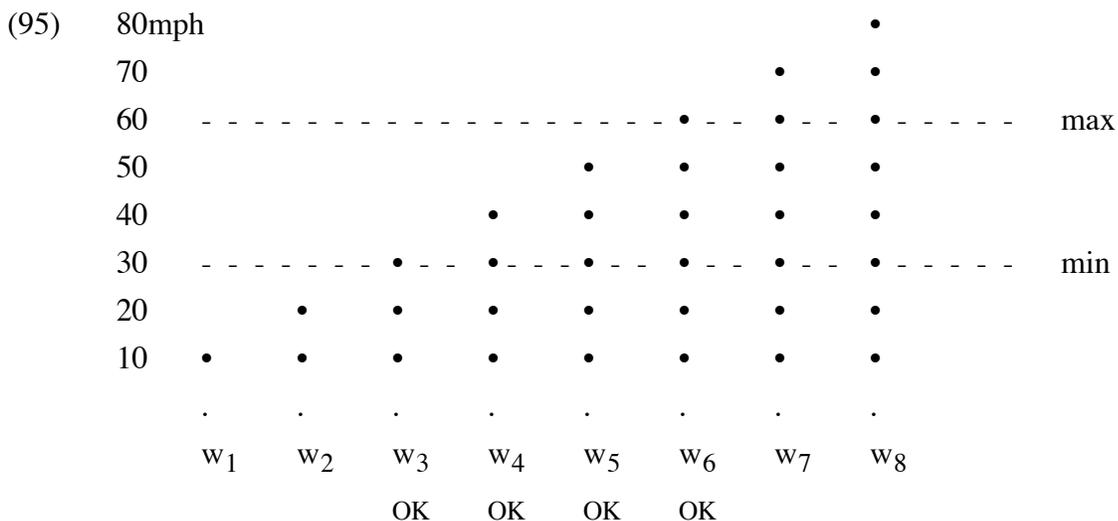
{d: ∃w ∃ Acc: ¬L drives d-fast in w} ⊆ {d: ¬L drives d-fast}

equivalently:

{d: ¬∃w ∃ Acc: L drives d-fast in w} ⊆ {d: ¬L drives d-fast}

{d: L drives d-fast} ⊆ {d: ∃w ∃ Acc: L drives d-fast in w}

i.e., her actual speed is below her lowest allowable speed



(96) I am amazed that we are allowed to teach so little.

- (97) *ad hoc* semantics for *I am amazed that so*:
 {d: d } is larger than I expected.
- (98) LF-(i): **little** above **allowed**:
 [so₁ little]₃ are [allowed [we to teach t₃ much]]
 interpretation:
 {d: $\neg \Box w \Box$ Acc: we teach d-much in w } is larger than I expected
 reading: I expected a higher maximum (i.e., a permission to teach more)
- (99) LF-(i): **little** below **allowed**:
 are allowed [[so₁ little]₃[we to teach t₃ much]]
 interpretation:
 {d: $\Box w \Box$ Acc: \neg we teach d-much in w } is larger than I expected
 reading: I expected a higher minimum (i.e., a requirement to teach more)

Summary: desirable features of the new analysis

- new features (advantages over both of Rullmann's analyses):
- (100) There are no ambiguous morphemes and no morphemes that only are interpretable as part of idioms. **-er**, **little** each have meanings of their own, and each are unambiguous. The observed ambiguity is structural (a scope ambiguity). The scoping mechanism that creates it is independently needed (for interpretability).
- (101) The account of ambiguity in **less**-comparatives generalizes to ambiguous constructions with **how little**, **so little**.
- inherited features (preserved from Rullmann's analyses):
- (102) Ambiguity is not shared by *more*-comparatives. Reason: The extra piece, **little**, whose variable scope matters, is not present there. (Maybe an extra **much** is there, but if so, it is semantically vacuous or trivial in such a way that its scope doesn't affect meaning.)
- (103) Ambiguity disappears when the *than*-clause is too simple. Reason: no room for non-trivial scope differences.
- (104) Ambiguity disappears when minimum or maximum doesn't exist (same pragmatic explanation as before).

Some *prima facie* disadvantages and unexplored consequences

- explanation of negative island effect:

Rullmann, following v. Stechow, attributes the deviance of (105) to the fact that the set of degrees to which Mary isn't tall has no maximum:

(105) *John is taller than Mary isn't.

But the present analysis doesn't refer to maxima. (105) is predicted to have a well-defined meaning:

(106) $\{d: \neg \text{TALL}(\text{Mary}) \geq d\} \sqcap \{d: \text{TALL}(\text{John}) \geq d\}$

Tentative suggestion: (105) is deviant because (106) is necessarily false. A final segment of the scale can never be a proper subset of an initial segment. The same problem arises with (107).²

(107) *John is taller than Mary is short.

But there are still problems. (108) should be fine, in fact the same as (109).

(108) *John is shorter than Mary isn't tall.

(109) John is shorter than Mary is.

Maybe we need a syntactic account of the negative island effect, after all? (See Beck 1996, Beck & Rullmann 1999 for more discussion.)

- predictions about NPI licensing:

(110) $[-\text{er} \sqcap_{\text{than-clause}}] \sqcap_{\text{matrix-clause}}$
 the set of degrees satisfying $\sqcap \sqcap$ the set of degrees satisfying \sqcap

Here \sqcap is a downward entailing context.

Reason: if $A' \sqcap A$, then $A \sqcap B$ implies $A' \sqcap B$.

correct prediction: NPIs are okay in the (immediate) scope of **-er** within the 'than'-clause.

(111) structure of *less*-comparatives:

$[-\text{er} \sqcap_{\text{than-clause}=\sqcap \dots \text{little}[\text{scope-of-little}=\sqcap \dots]}] \sqcap_{\text{matrix-clause}}$

²See Kennedy on "cross-polar anomaly".

- (112) Recall from above (see e.g. (93), (94)):
 less-than-maximum reading arises when **little** is "high"
 less-than-minimum reading arises when **little** is "low"
- (113) Recall from Rullmann:
 less-than-maximum reading does not license NPIs
 less-than-minimum reading does license NPIs
- (114) correct prediction: NPIs in between **-er** and **little** should be okay.
 Reason: this is a DE context, as shown in (110).
 Thus, if **little** is low and NPI is above it, that's okay.
- (115) potential problem: what about when **little** is high and NPI is inside the scope of **little** in the 'than'-clause?

If entailment patterns are tested for the whole structure in (111), then we find that \square is not a DE context. This would give the right prediction, viz. that clauses with high **little** have no room for NPIs.

- (116) meaning of (111)³:
 the complement of the set of degrees satisfying \square \square the set of degrees satisfying \square
 If $A' \square A$, then $D_d - A \square B$ does not imply $D_d - A' \square B$
 (rather, the reverse, so \square is a UE context).

But if we just look at the local structure containing \square in (111), NPIs should be licensed there, since they are in the scope of **little**, which is a negation.

Speculation: **-er** and high **little** "cancel each other out", i.e., act as a unit for NPI-licensing. Does this happen elsewhere?

- (117) He didn't say that nobody ate anything.
 (118) ?He didn't feed nobody anything.
 (119) ??No fewer than five people ate anything.

- intermediate readings:

Unlike Rullmann's version, which always predicts (at most) two readings for each occurrence of

³This is assuming that there is nothing between **-er** and **little**. The monotonicity result obtains more generally as long as there is nothing non-UE in that region.

little, the present analysis in principle allows intermediate scopes for **little** when there is more than one other scope-taking element in the 'than'-clause. Is this option ever attested?

6. Further predictions: necessity; modality in matrix

The ambiguous examples treated by Rullmann all involve possibility operators in the *than*-clause. Our analysis predicts analogous ambiguities when (a) the *than*-clause contains a necessity operator, or (b) there is a modal operator in the matrix. These predictions are borne out for both cases.

Necessity in 'than'-clause

(120) It was easy to get an A in this class. You only had to do 60% of the assignments. Still, John only got a B.
He turned in less than was required.
'less-than-minimum' reading

(121) To get an A in this course, you had to solve all these problems in 45 minutes or less. John had no problem.
He took even less time than was required.
'less than maximum' reading

(122) **little** in *than*-clause scopes over **required**:
than wh₁ [t₁ little]₂ required [to turn in t₂ much]
{d: ¬∃w ∃ Acc: John turns in d-much in w} ∩ {d: ¬ John turn in d-much}
= 'less than minimum' reading

(123) **little** in *than*-clause scopes below **required**:
than wh₁ required [t₁ little]₂ [to take t₂ much time]
{d: ∃w ∃ Acc: ¬John takes d-much time in w} ∩ {d: ¬ John took d-much time}
= 'less than maximum' reading

Modal operator (necessity or possibility) in matrix clause

(124) We are allowed less than 7 hours of sleep.
'it is not allowed that we sleep (as much as) 7 hours'

(125) We are allowed to have less than 7 hours of prayer.
'it is allowed that we don't pray (as much as) 7 hours'

(126) We are allowed to have less than 7 hours of sleep. [judgment?]

- (127) We are allowed less than 7 hours of prayer. [judgment?]
- (128) I need less than 5 hours of sleep (to stay healthy).
'it is not necessary that I have (as much as) 5 hours of sleep'
- (129) I need to have less than 5 hours of prayer (to maintain my sanity).
'it is necessary that I not have (as much as) 5 hours of prayer'
- (130) I need to have less than 5 hours of sleep (to stay healthy). [judgment?]
- (131) I need less than 5 hours of prayer (to maintain my sanity). [judgment?]

A minimal contrast between **less fast** and **more slowly**:

- (132) John and Mary want to be in Boston by 8 pm (at the latest). Currently, John is 30 miles away from Boston, and Mary is 40 miles away from Boston. Therefore:
- (a) She needs to drive faster than he needs to drive.
 - (b) He needs to drive less fast than she needs to drive.
 - (c) # He needs to drive more slowly than she needs to drive.