Superlative scope, comparison classes, and negative polarity

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Two superlative puzzles

First Definite descriptions generally cannot contain Negative Polarity Items ('any', 'ever', etc.), but superlative descriptions love them!

(1) a. *John climbed the 10,000 ft mountain that anyone ever climbed

b. ✓John climbed the highest mountain that anyone ever climbed

Second Superlative adjectives are systematically ambiguous

(2) Who has seen the most recent episode of Great British Baking Show?

a. Who has seen Pastry Week? [Absolute]

b. Who has seen an episode most recently? [Relative]

The moral of today's story:

- It is surprisingly hard to account for both of these things at once!

Polarity and monotonicity refresher

NPIs are supposed to be licit only in Downward Entailing environments, where entailments are reversed

$$\begin{array}{ccc} X & \supseteq & Y \\ & \Downarrow & \\ [\cdots X \cdots] & \subseteq & [\cdots Y \cdots] \end{array}$$

(3) John [didn't sell a car today]
[$\lambda x.\, \neg\exists y.\, \text{car}\ y \wedge \text{sell}\ y\ x$]

$\subseteq$

(4) John [didn't sell a sedan today]
[$\lambda x.\, \neg\exists y.\, \text{sedan}\ y \wedge \text{sell}\ y\ x$]

$\supseteq$

- If you're a sedan, you're a car
- If you don't sell a car, you don't sell a sedan

Superlatives and monotonicity

So are superlative descriptions Downward Entailing? No, it turns out!

Assume a simple denotation for 'est': there's a degree that distinguishes x from the other members of C with respect to a measure R

$$[\![\text{est}]\!] := \lambda R \lambda C \lambda x.\ \exists d.\ \{x\} = C \cap R\, d$$

$\supseteq$

(5) Monty [is the longest snake]
[$\lambda x.\ \exists d.\ \{x\} = \text{snake} \cap \text{long}\ d$]

(6) Monty [is the longest cobra]
[$\lambda x.\ \exists d.\ \{x\} = \text{cobra} \cap \text{long}\ d$]

$\not\subseteq$

- If you're a cobra, you're a snake
- But if you're the longest snake, no guarantee you're the longest cobra ...

▶ ... because might be a python

Superlatives and monotonictity and presupposition

Claim 'M is the longest cobra' presupposes that M is a cobra; the sentence is infelicitous, not merely false, if not

Hypothesis NPIs are licit in environments that are Downward Entailing when presuppositions are satisfied (von Fintel 1999)

$$[\![\text{est}]\!] := \lambda R \lambda C \lambda x\colon \boxed{C\,x}\,.\, \exists d.\, \{x\} = C \cap R\,d$$

(7) Monty [is the longest snake]
[$\lambda x\colon \text{snk}\,x.\, \exists d.\, \{x\} = \text{snk} \cap \text{long}\,d$]

(8) Monty [is the longest cobra]
[$\lambda x\colon \text{cbr}\,x.\, \exists d.\, \{x\} = \text{cbr} \cap \text{long}\,d$]

If we only consider entities x that are in the domain of both functions (i.e., are both snakes *and* cobras), then the entailment goes through

- This montonicity *modulo presupposition satisfaction* is known as Strawson Monotonicity

Definite descriptions and monotonicity and presupposition

Unfortunately, plain old definite descriptions are also Strawson Downward Entailing, but dont license NPIs (Guerzoni & Sharvit 2007)

(9) Monty [is the snake]
[$\lambda x\colon \exists!z.\ \text{snake}\ z.\ x = \iota\ \text{snake}$]

(10) Monty [is the cobra]
[$\lambda x\colon \exists!z.\ \text{cobra}\ z.\ x = \iota\ \text{cobra}$]

- If you're a cobra, you're a snake
- If you're THE snake (and there's one cobra), then you're THE cobra

In other words, if there's exactly one snake and exactly one cobra, then they're the same

- So these sentences are in fact Strawson Equivalent (when their presuppositions are met, they entail each other)

The narrow monotonic hope

The only analytical daylight left:

Hypothesis NPIs are licit in environments that are Downward Entailing, but not Upward Entailing, when all presuppositions are met

(11) a. *Monty [is the snake that anyone saw]

b. ✓Monty [is the longest snake that anyone saw]

- It's not pretty, but there it is!

Superlative ambiguities

Next, recall that superlative adjectives often associated with two readings (Szabolcsi 1986)

(12) Who has seen the most recent episode of Great British Baking Show?

a. Who has seen Pastry Week? [Absolute]

b. Who has seen an episode most recently? [Relative]

Old Question Is this a matter of domain underspecification or compositional ambiguity?

Domain restriction

On the one hand, quantificational domains known to be rampantly underspecified (von Fintel 1994)

(13) When I walked into my class today, everyone$_C$ was really quiet

a. everyone in the school

b. everyone in my class

(14) Which student visited the largest$_C$ state capital?

John ···✈··· Lincoln

Sue ···✈··· Topeka

Mary···✈··· Austin

Bill ···✈··· Dover

a. **Abs:** No one (... Phoenix)
   - ▶ $C = \{x \mid \text{capital } x\}$

b. **Rel:** Mary (... the largest visited capital)
   - ▶ $C = \{x \mid \text{capital } x,\ \text{visited } x\}$

Scope

On the other hand, degree quantifiers known to take variable scope

(15) John read a longer play ...

a. ... than Macbeth — John read a [long **er** play]

b. ... than Mary — John [read a long **er** play]

(16) Which student visited the largest state capital?

John ···✈··· Lincoln

Sue ···✈··· Topeka

Mary ···✈··· Austin

Bill ···✈··· Dover

a. **Abs:** student visit [large **est** capital]
   - ▶ No one (visited Phoenix)

b. **Rel:** student [visit large **est** capital]
   - ▶ Mary (out-visited the others)

The arguments for scope

Ties Relative readings seem to disallow ties between correlates, not ties between description candidates

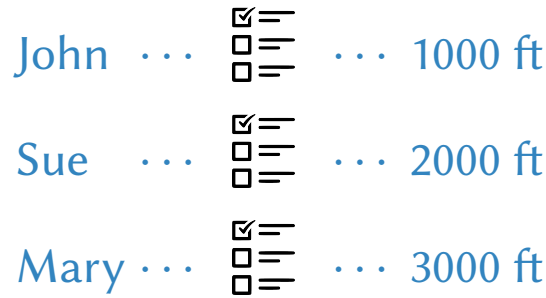
(17) JOHN climbed the highest mountain

		Predictions	
		Restr	**Scope**
a.	John and Mary climbed the same highest climbed mountain	✓	✗
b.	John out-climbs everyone else, by climbing two equally high mountains	✗	✓

The arguments for scope

Split scope Sometimes the comparative force of the superlative seems to outscope the descriptive content (Heim 1999)

(18) MARY needs to climb the highest mountain



Predictions

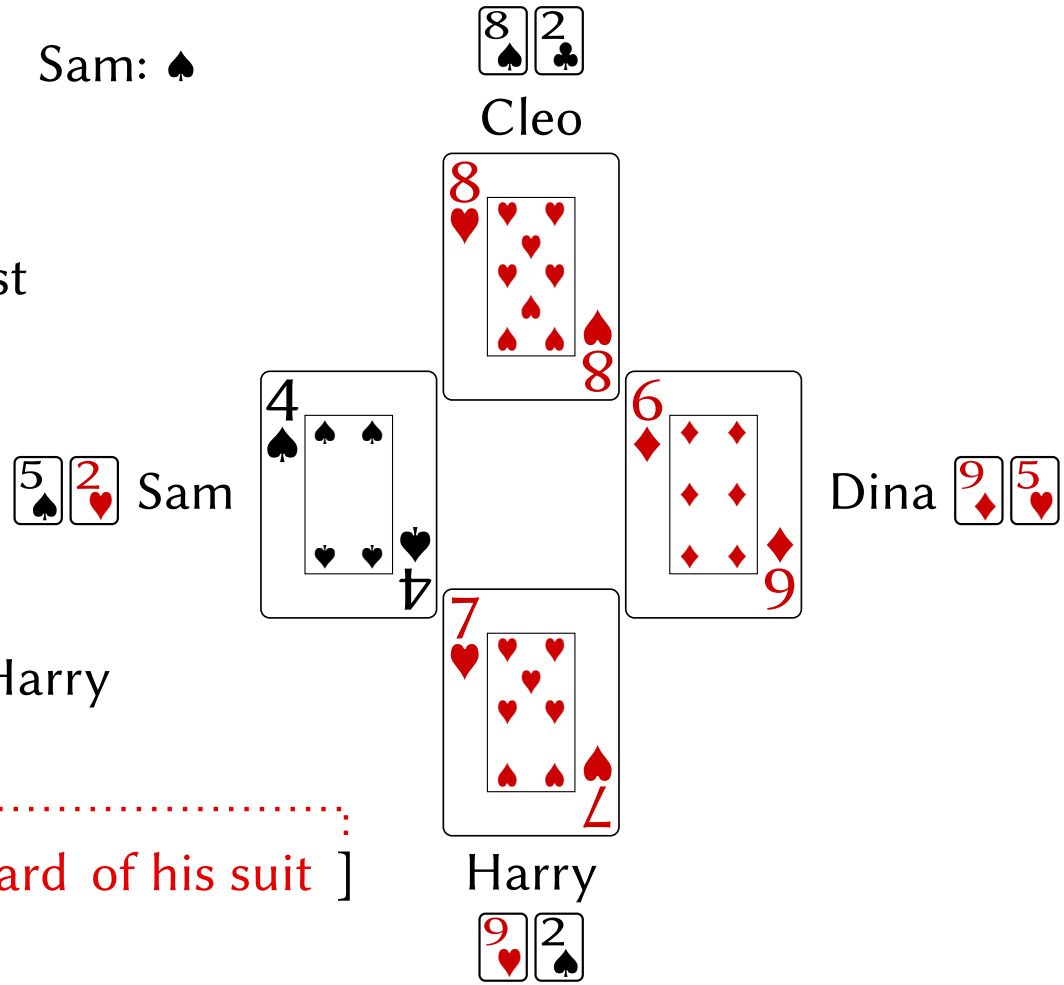
	Restr	**Scope**
a. Mary's climbing requirements exceed everybody else's	✖	✓

The arguments for scope

Sloppiness Relatedly, the description may be bound into by an element that the superlative compares (Bumford 2018)

Cleo: ♣ Dina: ♦ Harry: ♥ Sam: ♠

(19) Who played the highest card of their suit?



a. **Sloppy Reading:** Harry

Harry [played high **est** card of his suit]

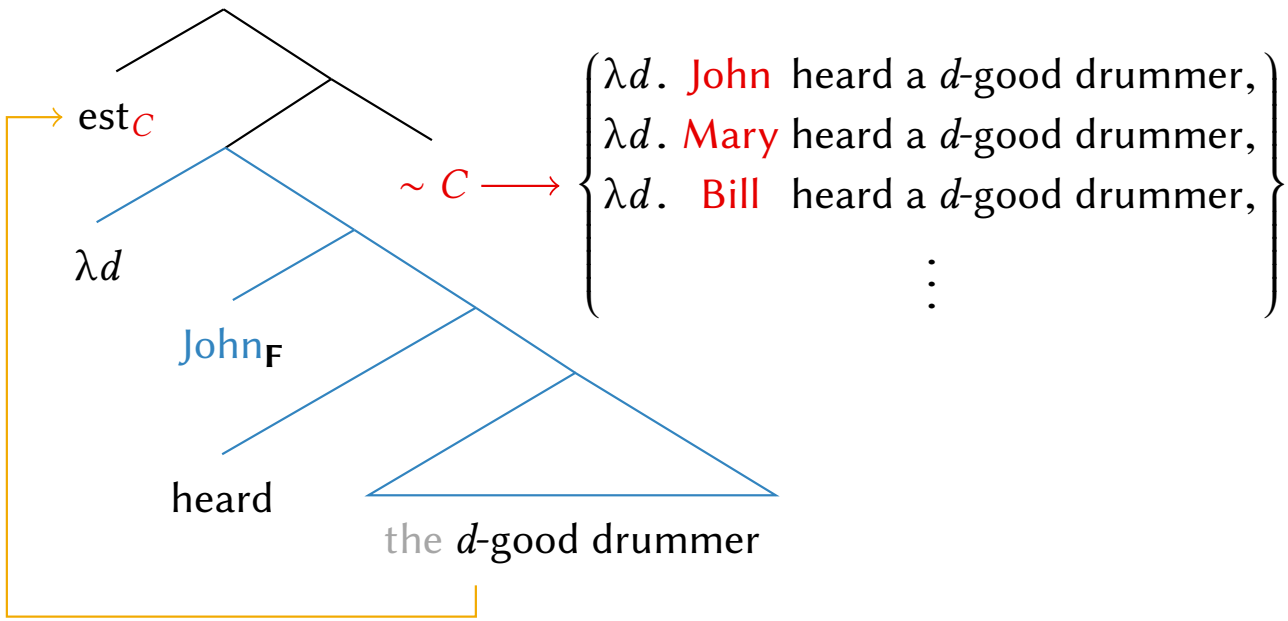
Deriving the relative reading

Heim 1999 proposes the following analysis of these relative readings

- 'est' scopes over sentence; compares the degrees the correlate achieves to the degrees its competitors achieve

$$[\![\text{est}]\!] = \lambda C \lambda P.\, \forall Q \in C.\, Q \neq P \Rightarrow Q \subset P$$

(20) JOHN heard the best drummer

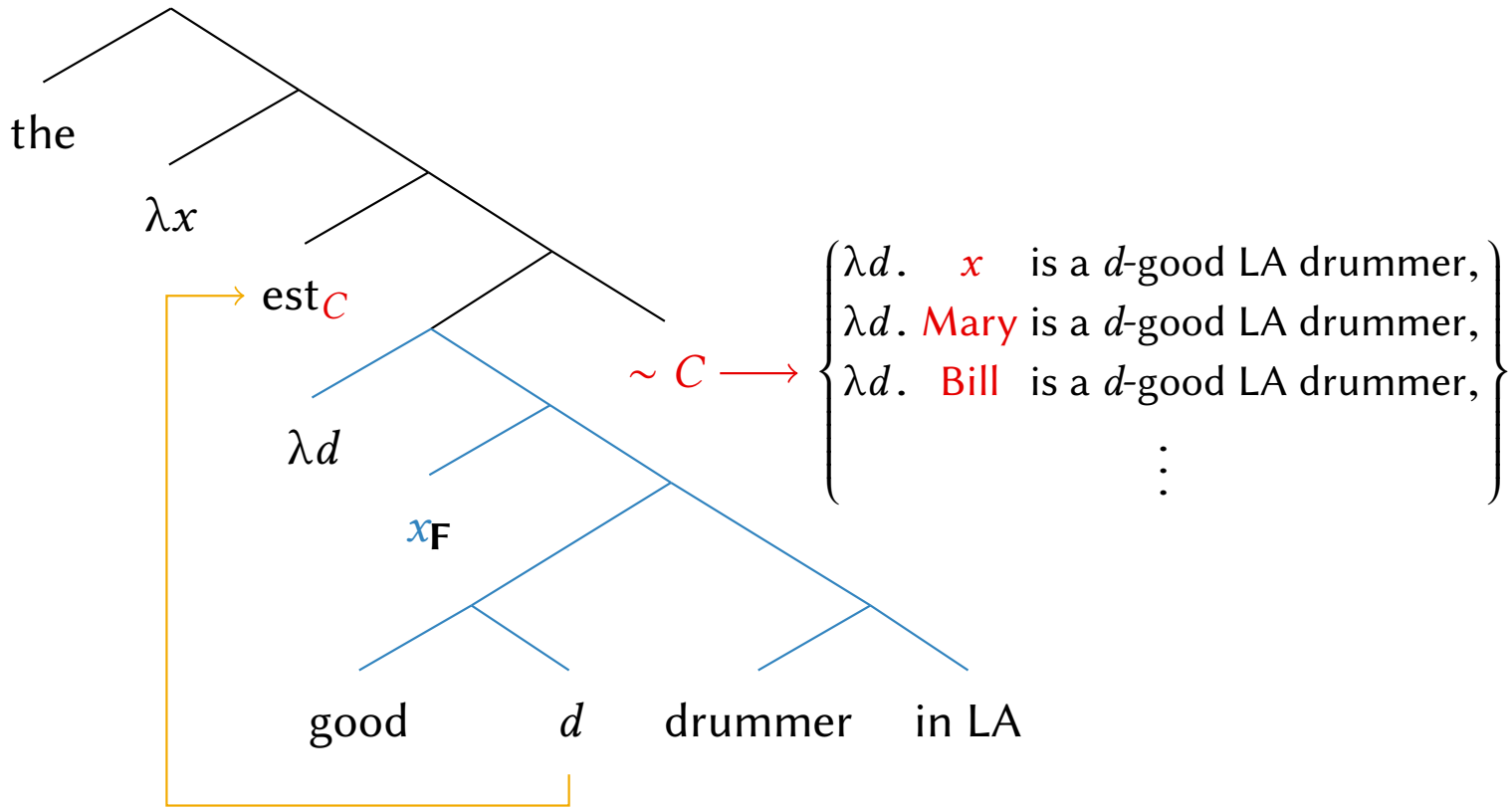


NPIs lost

But is this analysis compatible with NPIs? Doesn't seem like it...

All of the descriptive content ends up in the superlative's measure (its comparison class is implicit)

(21) the best drummer in LA



‘est’ is not (S)DE in its scope

But the measure of this ‘est’ is not (S)DE (Howard 2014)

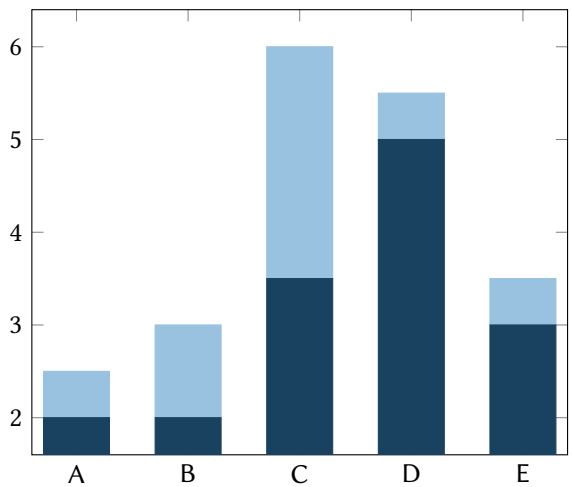
$$[\![\text{est}]\!] = \lambda C \lambda P.\, \forall Q \in C.\, Q \neq P \Rightarrow Q \subset P$$

(22) a. JOHN read the longest novel

est$_C$ λd [John$_{\mathbf{F}}$ read the d-long novel]

b. JOHN read the longest Russian novel

est$_C$ λd [John$_{\mathbf{F}}$ read the d-long Russian novel]



Let the Russian-novel lengths read be 

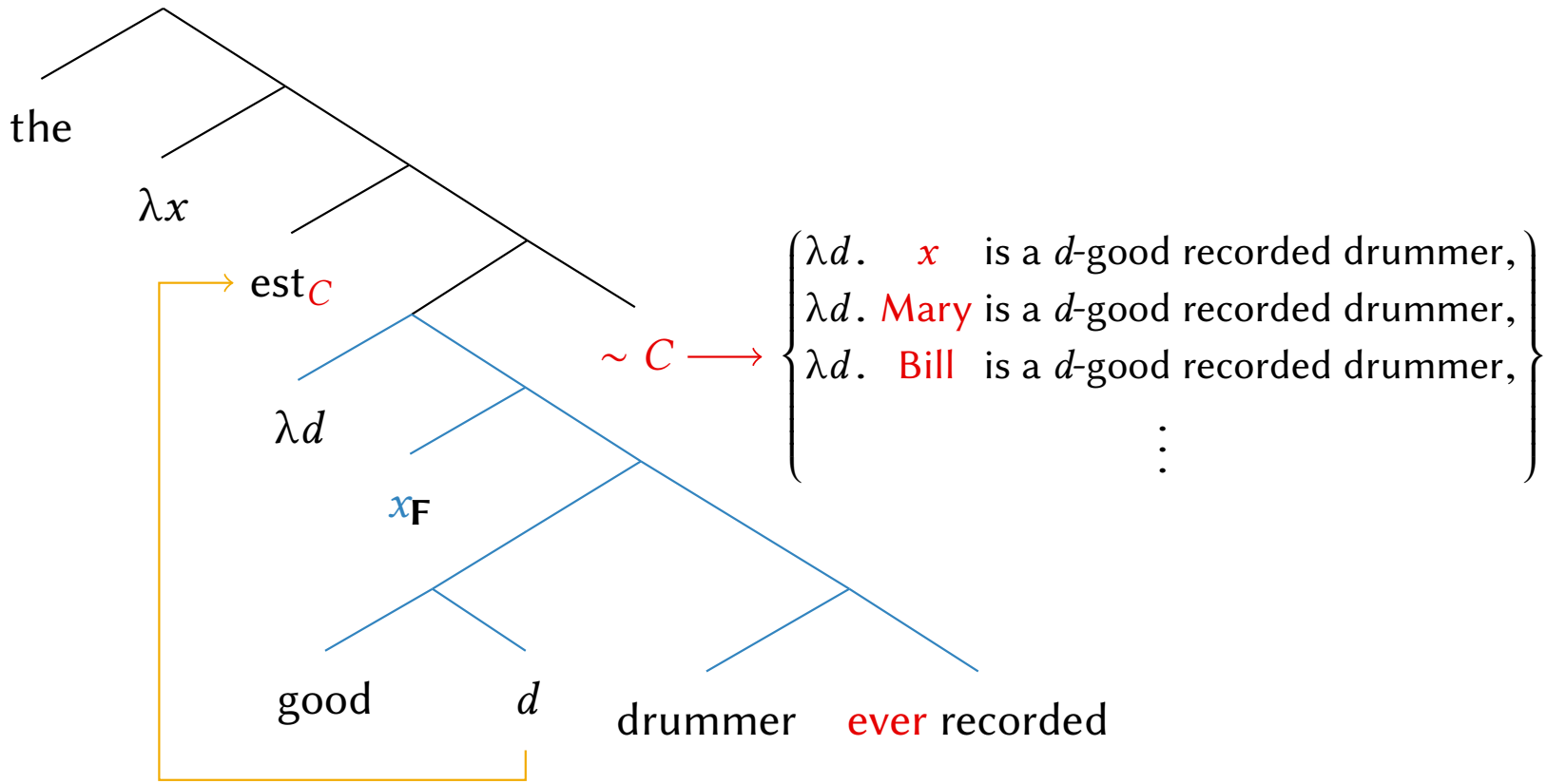
Let the any-novel lengths be  + 

- John may win the overall novel-contest, but still lose the Russian contest

NPIs lost

So in gaining an account of relativity, we've lost an account of why NPIs are licensed in superlative descriptions

(23) the best drummer ever recorded



Fork in the road

- Heim's superlative semantics predicts the range of relative readings, but does not predict NPI licensing in basic (absolute) cases
- Could give up: absolute descriptions derived from one superlative denotation, relative descriptions from another
- But first, is this even a good prediction for relative readings? *Can* we get NPIs in the scope of a relative superlative?
- Almost no work on this question, though there is at least one known systematic class of examples, to which we turn

Relative superlatives with explicit restrictors

Nearly simultaneously, two kinds of superlative descriptions were realized to provide evidence for Heim's analysis

Modal Superlatives (Romero 2013)

(24) John knocked over the fewest possible cones

a. "John knocked over as few cones as it is possible to knock over"

Matching Relative Clauses (Howard 2014)

(25) John knocked over the fewest cones that anyone knocked over

a. "John knocked over fewer cones than anyone else did"

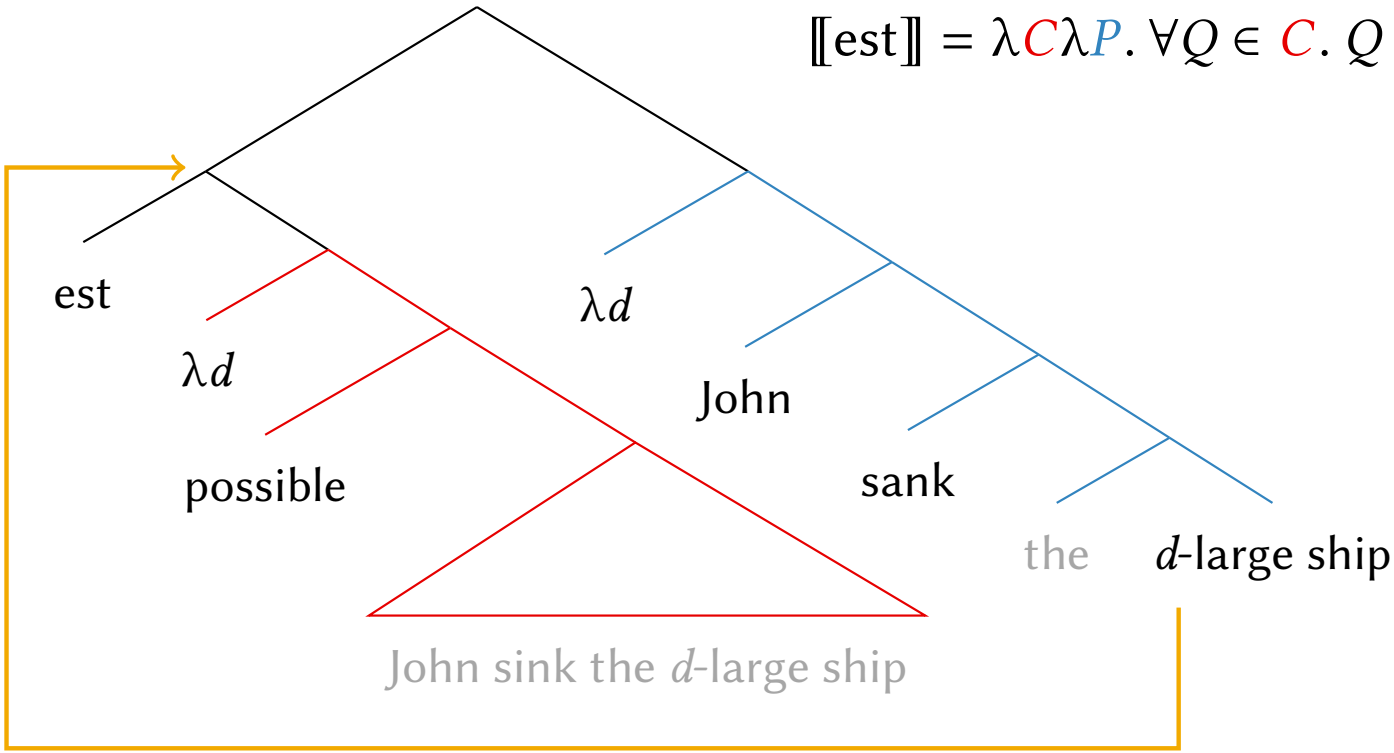
Howard and Romero converge on very similar analyses for these two constructions, both exploiting Heim's derivation

Modal Superlatives

(26) John sank the largest possible ship

a. "The max size that John could sink a ship of is one he did sink a ship of"

$[\![\text{est}]\!] = \lambda C \lambda P.\, \forall Q \in C.\, Q \neq P \Rightarrow Q \subset P$



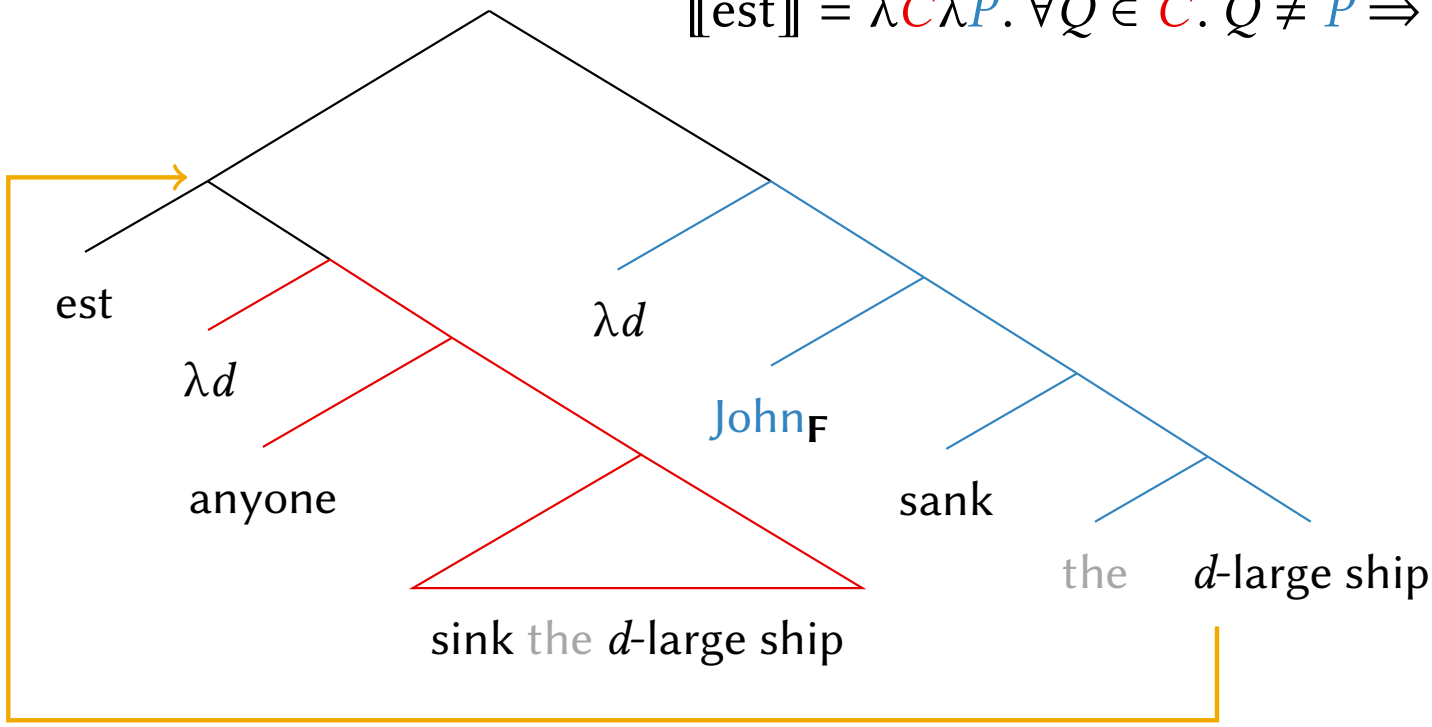
- The (elliptical) 'possible' clause specifies the comparison class C

Polarity clauses

(27) John sank the largest ship that anyone sank

a. "The max size that anyone sank a ship of is one that John sank a ship of"

$$[\![\text{est}]\!] = \lambda C \lambda P.\, \forall Q \in C.\, Q \neq P \Rightarrow Q \subset P$$



- The (overt) relative clause specifies the superlative's comparison class C

Matching effects in polarity clauses

Howard leans heavily on the presuppositions of the superlatives to explain what he calls "matching effects" and tie-breakers

(28) a. ✓ John laughed the loudest that anyone here laughed

b. * John laughed the loudest that anyone else laughed

c. # John sang the loudest that any soprano sang

The superlative presupposes that the degree property that wins (John's performance) is among those that the relative clause evokes

$$[\![\text{est}]\!] = \lambda C \lambda P\text{: } \boxed{P \in C}\text{. } \forall Q \in C.\ Q \neq P \Rightarrow Q \subset P$$

Ties in polarity clauses

(29) ✓ John laughed the loudest that anyone here laughed

Moreover, (29) is **false** if Mary laughed just as loud; this means it's not sufficient to look for the maximum degree set among

$$\left\{\begin{array}{l}\lambda d.\ \text{John laughed } d\text{-loud}\\ \lambda d.\ \text{Mary laughed } d\text{-loud}\\ \lambda d.\ \text{Fred laughed } d\text{-loud}\end{array}\right\}$$

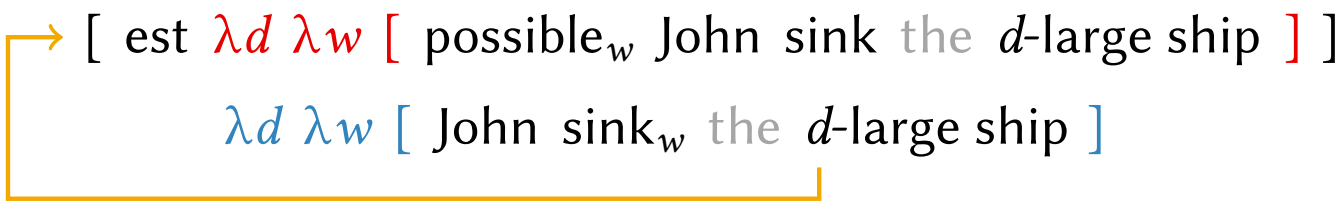
We need to look for the maximum degree property among

$$\left\{\begin{array}{l}\lambda d\lambda w.\ \text{John laughed}_w\ d\text{-loud}\\ \lambda d\lambda w.\ \text{Mary laughed}_w\ d\text{-loud}\\ \lambda d\lambda w.\ \text{Fred laughed}_w\ d\text{-loud}\end{array}\right\}$$

$$[\![\text{est}]\!]^{\boxed{w}} := \lambda C \lambda P{:}\ \boxed{P \in C}\ .\ \forall Q \in C.\ Q \neq P \Rightarrow \boxed{Q\,w} \subset \boxed{P\,w}$$

Incompatibility of modal and polarity adjunct analyses

But, as Howard (2014) notes, the modal adjuncts cannot meet this presupposition!



The nuclear scope of the superlative is **not** an element of its restrictor

- λdλw. John sank$_w$ the d-large ship maps any degree to the proposition that John sank a ship of that size
- λdλw. possible$_w$ [John sank the d-large ship] maps any degree to the proposition that it is possible for John to sink a ship of that size

Undergeneration

But these accounts probably should be compatible... because NPIs are licensed in modal superlative clauses!

(30) John sank the largest ship possible for anyone to sink

Howard and Romero can both account for this, but only on pain of losing an explanation for the matching effects

(31) *John sang the loudest that anyone else sang

More troublingly, these analyses both only account for NPIs in funny relative clauses, since they hypothesize that these clauses are the (SDE) restrictors of the superlative

Undergeneration

... But actually the distribution of NPIs appears to be much more liberal

(32) a. The judge who gave the highest score to any rookie later regretted it

b. Which car went the fastest during any 1 second point of the race?

c. John has donated the most money to any third-party candidate

d. Of all the perturbations examined, PIC treatment at 1 week resulted in the smallest GnRH-1 cells that exhibited any peaks

e. This method makes the least exacting demands on any calculative or analytical powers

f. Which would you say is the company that has the best excuse for any security breach so far?

g. That is done just after midnight, when there are the fewest vehicles parked at any time of day

Undergeneration

Even modal superlatives license NPIs in non-matching descriptions, or outside of the description altogether

(33) a. Our goal with this satellite is to capture the best (possible) image (possible) of any asteroid in the Kuiper Belt (possible)

b. We took pains to ensure that the fewest people possible suffered from any unexpected side effects

It is trickier to hunt down examples of 'ever', but these seem like candidates

(34) a. Economics remains the field in which the fewest women have ever won a Nobel Prize

b. The zoo that the largest animal has ever escaped from is in Kansas City, and it was a rhinoceros

c. The city that the most dentists have ever been in at the same time is probably Cologne

Taking stock

From Howard, we know that C is SDE, but P is not:

$$[\![\text{est}]\!]^w := \lambda C \lambda P\colon P \in C.\ \forall Q \in C.\ Q \neq P \Rightarrow Q\,w \subseteq P\,w$$

But this makes a complete mystery out of NPI-licensing in absolute readings, where **the entire description** is in the measure argument

$$\text{the}\ \ \lambda x\ \ \text{est}_C\ \ \lambda d\ \ [\ \ x_{\mathbf{F}}\ \ d\text{-old book ever written}\ \ ]$$

Likewise for most relative readings, where basically **the entire clause** is in the superlative's measure

$$\text{est}_C\ \ \lambda d\ \ [\ \ \text{John}_{\mathbf{F}}\ \ [\ \ [\ \ \text{laughed at any of my jokes}\ \ ]\ \ d\text{-loud}\ \ ]\ \ ]$$

Howard and Romero quarantine a few special cases of relative clauses

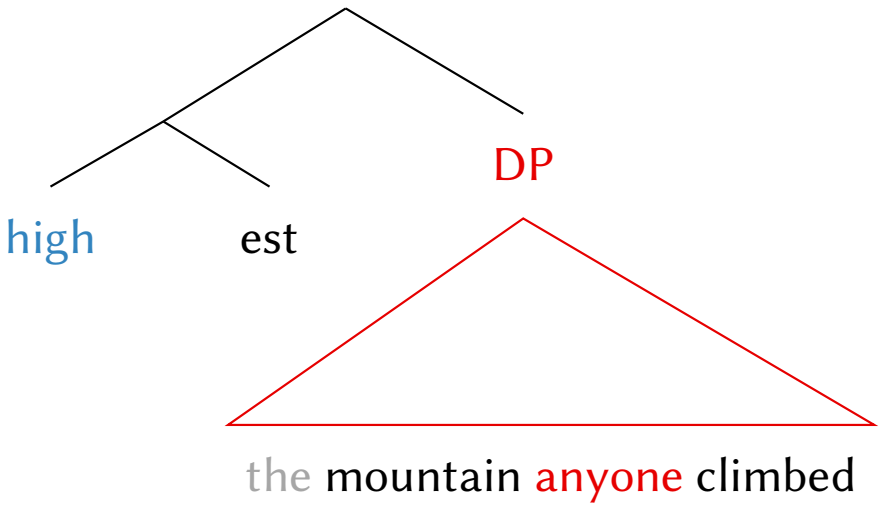
(35) John read the longest book { that anyone read, possible }

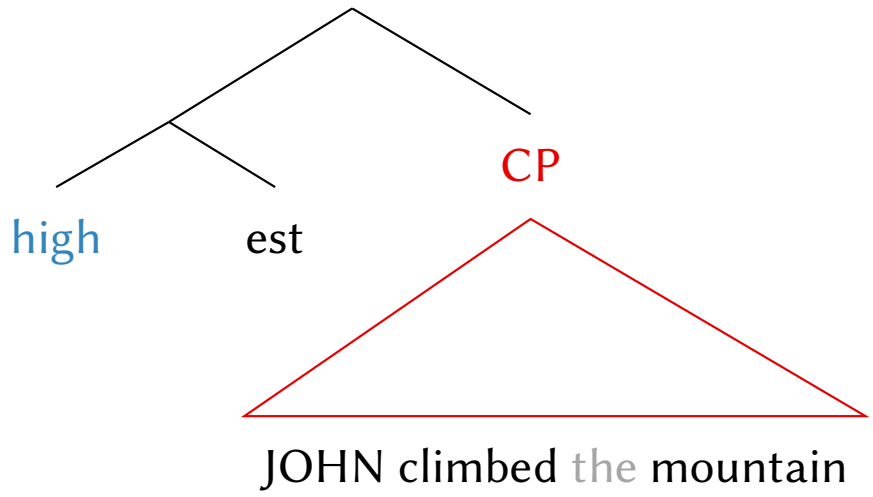
- But it looks like the entire nuclear scope is contaminated!

Toward a solution

The polarity data suggests we want something like the following

- In absolute readings, the entire description ought to be in the (S)DE comparison class of the superlative, leaving only the adjective as a measure





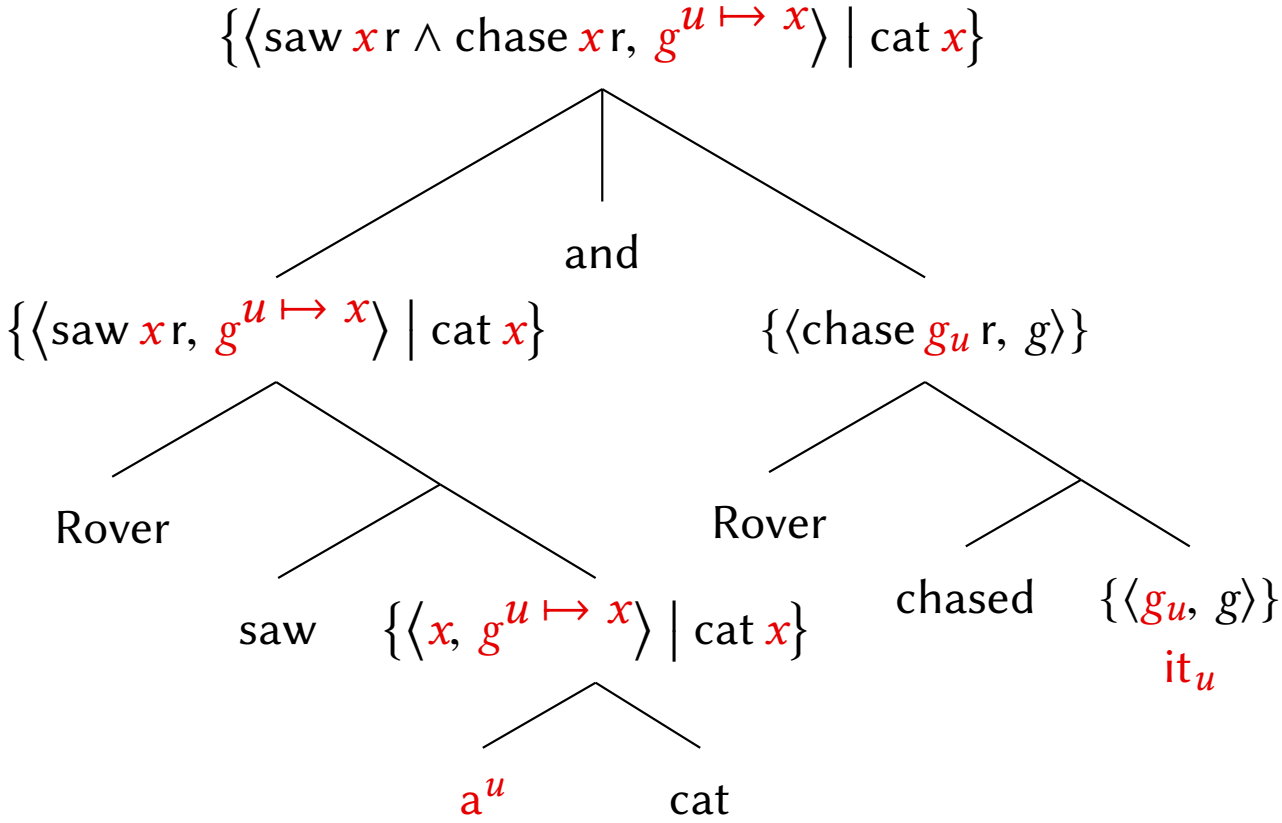
- In relative readings, the entire clause ought to be in the (S)DE comparison class of the superlative, leaving only the adjective as measure

But how could the superlative, in such relative configurations, manage to measure propositions by height?

Dynamic semantics to the rescue

Of course we really just need to measure the **respective mountains** "in" each alternative, not the whole proposition

In a strange twist to this story, it turns out dynamic semantics provides just enough resolution for this

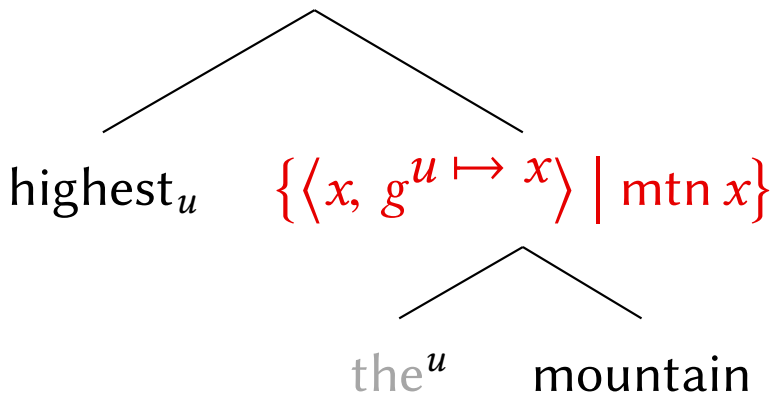


Superlatives as candidate filters

$$[\![\text{highest}_u]\!] := \lambda G \lambda \langle \alpha,\ g \rangle : \langle \alpha,\ g \rangle \in G.\ \neg \exists \langle \beta,\ g' \rangle \in G.\ g'_u > g_u$$

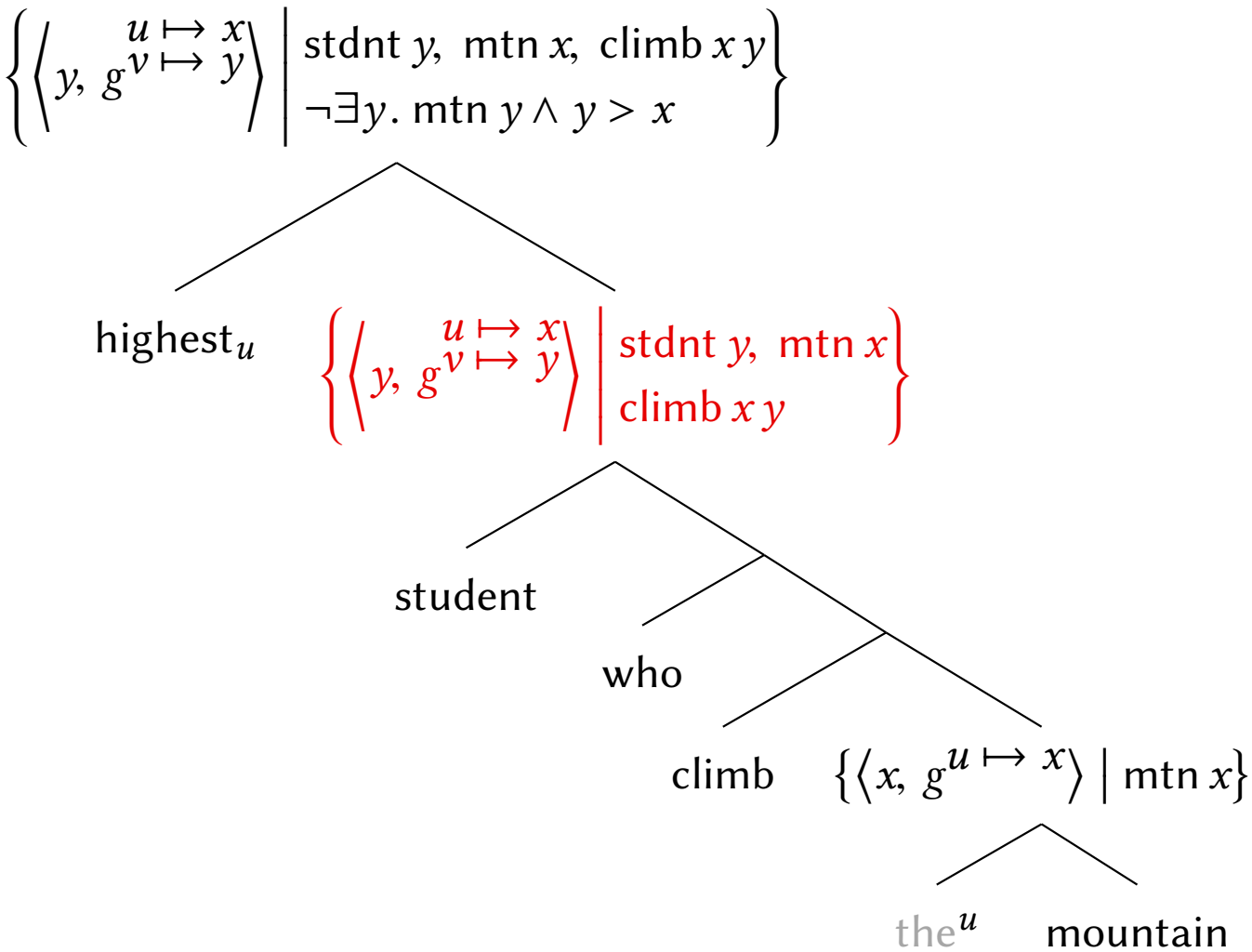
- Given a set of potential (constraint-satisfying) assignments, eliminate all those that are dominated in their choice of u (Bumford 2017a)

$$\left\{ \left\langle x,\ g^{u \mapsto x} \right\rangle \mid \text{mtn}\ x,\ \neg \exists y.\ \text{mtn}\ y \wedge y > x \right\}$$



Dynamic relative readings

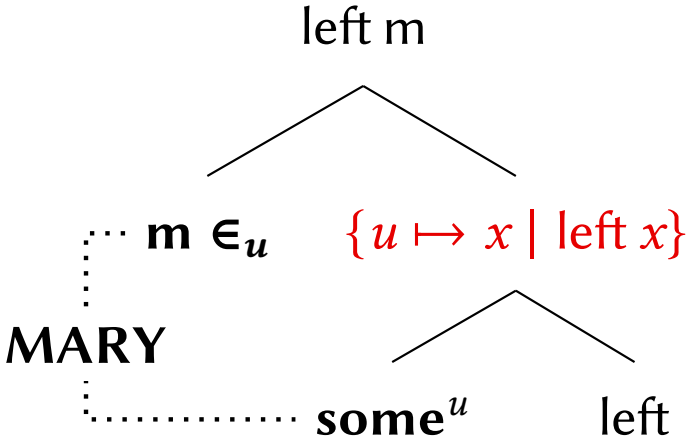
If ‘est’ scopes over a chunk of sentence where more participants have been introduced, the candidates it considers may be more constrained



Focus effects

For clausal relative readings, I assume focus has the same effect as a host description does above (Bumford 2017b)

(36) MARY left



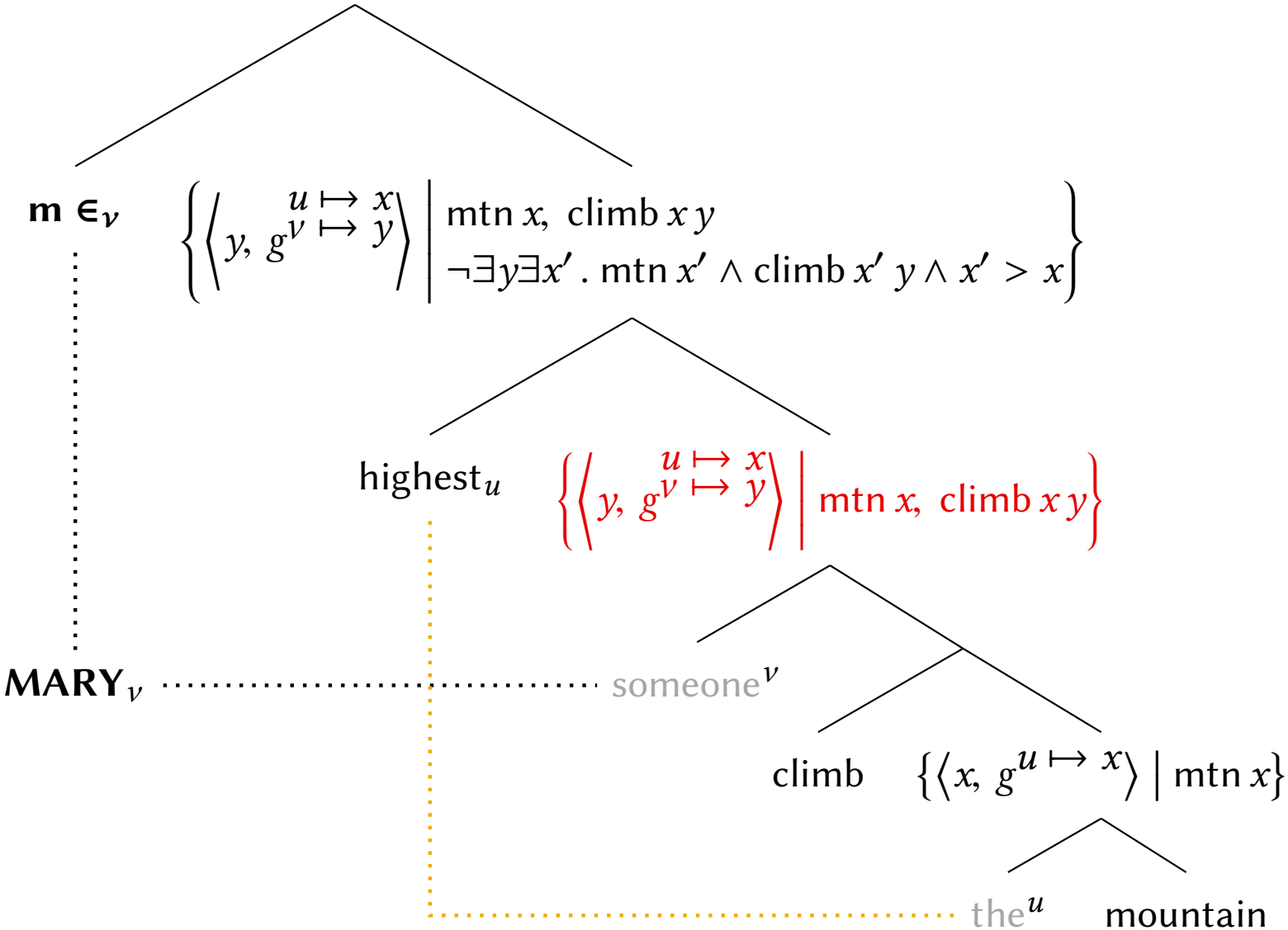
Second Check if Mary is among them

$\mathbf{m} \in_u := \lambda G.\, \mathrm{m} \in \{g\, u \mid g \in G\}$

First Build up set of entities who left

Canonical reading derived

(37) MARY climbed the highest mountain



Polarity reclaimed

Where does any of this leave us with respect to polarity?

- This postsuppositional superlative is (Strawson) Downward Entailing on its complement!

$$\mathbf{S}_u := \lambda G \lambda \langle \alpha,\ g \rangle : \langle \alpha,\ g \rangle \in G.\ \neg \exists \langle \beta,\ g' \rangle \in G.\ g'_u > g_u$$

- Let $G \subseteq H$ $\qquad \{\langle x,\ g^{u \mapsto x} \rangle \mid \mathrm{lab}\, x\} \subseteq \{\langle x,\ g^{u \mapsto x} \rangle \mid \mathrm{dog}\, x\}$
- Let $\mathbf{S}_u\, G f$ and $\mathbf{S}_u\, H f$ be defined $\qquad \mathrm{lab}\, f_u \wedge \mathrm{dog}\, f_u$
- If $f \in \mathbf{S}_u\, H$ ...
- ... Then $\neg \exists \langle \beta,\ h \rangle \in H.\ h_u > f_u$ $\qquad \neg \exists x \in \mathrm{dog}.\ x > f_u$
- ... So $\neg \exists \langle \beta,\ g \rangle \in G.\ g_u > f_u$ $\qquad \neg \exists x \in \mathrm{lab}.\ x > f_u$
- Therefore $f \in \mathbf{S}_u\, G$
- So $\mathbf{S}_u\, H \subseteq \mathbf{S}_u\, G$

Conclusion

- The best guess about polarity licensing in and around presuppositions is that NPIs go in Strawson Downward Entailing positions
- The best existing analyses of relative readings leave almost all the positions where NPIs show up non-Downward Entailing
- Dynamic techniques allow us to isolate the source of non-DE-ness (the adjective) and still give the superlative high enough scope to get the right truth conditions
- Modal and restrictive elements may then be dealt with in familiar ways from numeral and quantificational domains

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What about modal readings?

In the first place, it's not obvious how to recover the original knock-down argument for scope

(38) MARY needs to climb the highest mountain

$$\mathbf{m} \in_{\nu} [\ \mathbf{the\ highest}_{u} [\ \mathbf{some}^{\nu} [\ \text{needs climb } \mathbf{some}^{u} \text{ mountain }]\ ]\ ]$$

There may be no actual mountains that Mary needs to climb, so what is 'highest' supposed to compare?

Actually, the situation is actually quite similar to what we find with modified numerals

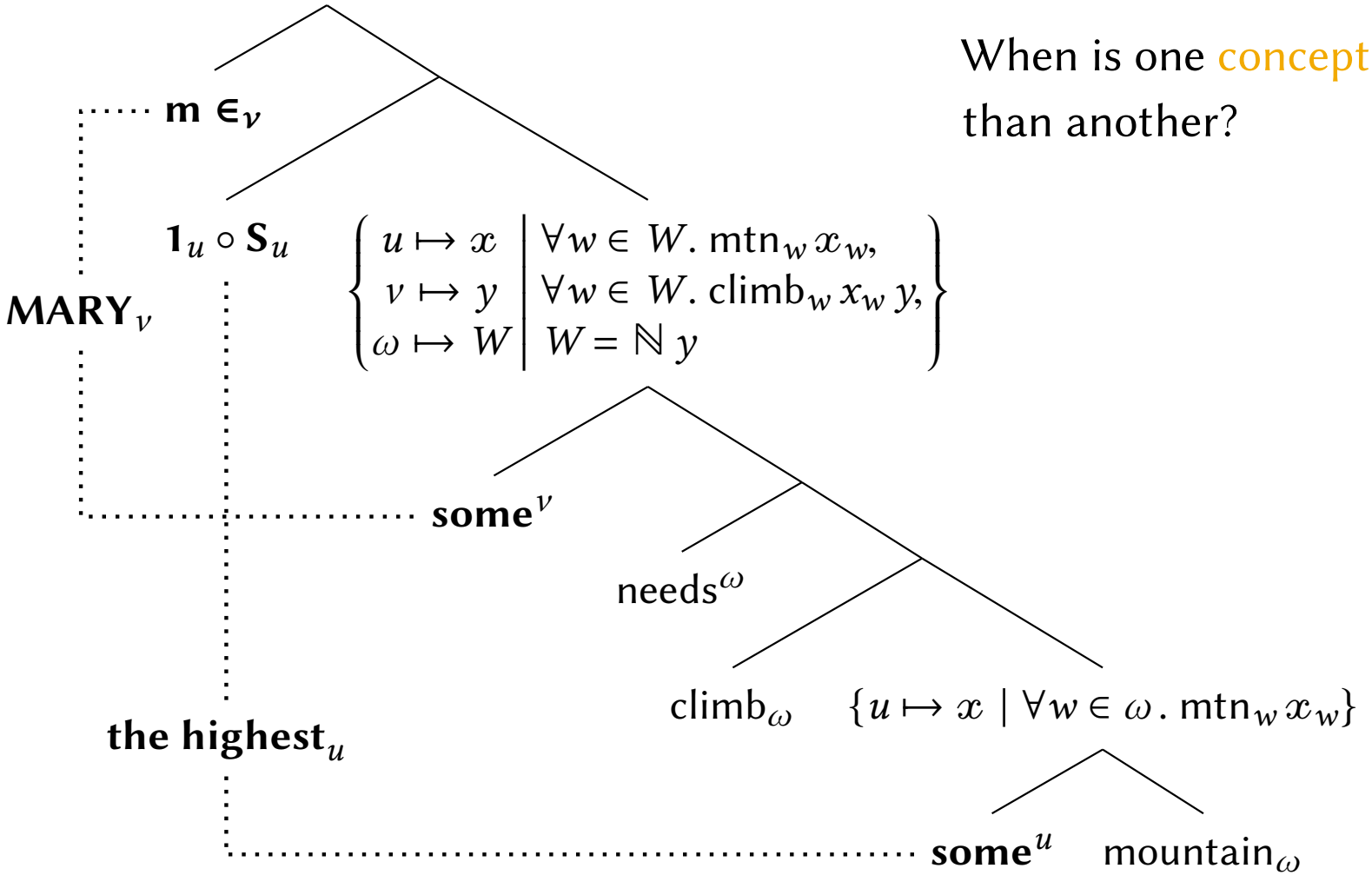
(39) Mary is allowed to take at most three classes

a. ✓ Mary is not allowed to take four or more classes

$$\mathbf{3} = \mathbf{max}\{n \mid \text{Mary is allowed to take } n\text{-}\mathbf{many} \text{ classes}\}$$

Scopal superlatives with concepts

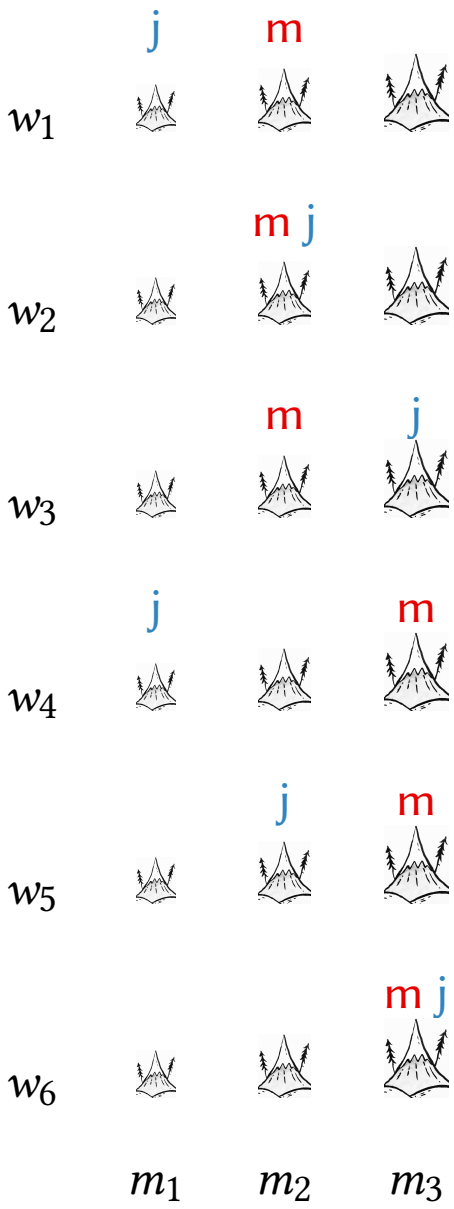
Taking cues from Brasoveanu 2012, assume that in these cases, the descriptions range not over possible entities, but over possible concepts



When is one concept bigger than another?

Comparing concepts

Allowable worlds:



Which concept j or m is bigger?

- Neither is bigger pointwise
- Neither has a bigger maximum
  (can climb as high as you want!)

A disappointingly unprincipled hypothesis:

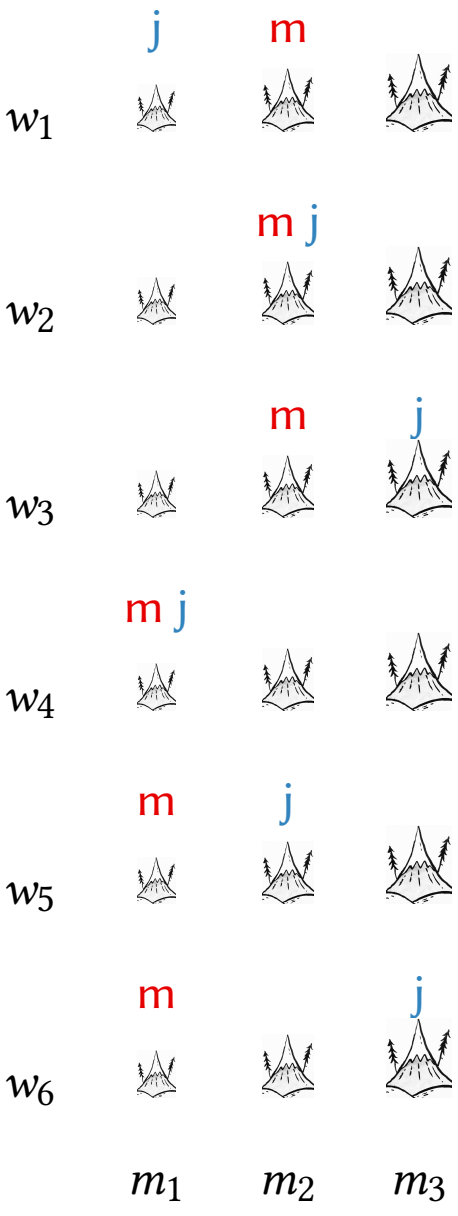
$$x > y \text{ iff } \min_w x_w > \min_w y_w$$

"Predicts" the superlative reading we're after

$$\mathbf{S}_u \left\{ \begin{array}{l|l} u \mapsto x & \forall w \in W.\, \mathrm{mtn}_w\, x_w, \\ v \mapsto y & \forall w \in W.\, \mathrm{climb}_w\, x_w\, y \\ \omega \mapsto W & W = \mathbb{N}\, y \end{array} \right\}$$

Comparing concepts

Allowable worlds:



Somewhat encouragingly though, it also predicts the right truth conditions for existential modals

(40) JOHN is allowed to climb the highest mountain

$$\mathbf{S}_u \left\{ \begin{array}{l|l} u \mapsto x & \forall w \in W.\ \mathrm{mtn}_w\, x_w \\ v \mapsto y & \forall w \in W.\ \mathrm{climb}_w\, x_w\, y \\ \omega \mapsto W & W \subseteq \mathbb{A}\, y \end{array} \right\}$$

This time, each climber paired with many concepts:

some $v \mapsto$ j concepts:

	x_1	x_2	x_4
w_1	m_1	m_1	
w_2	m_2		
w_3	m_3	m_3	m_3
w_4			
w_5		m_2	
w_6		m_3	m_3

some $v \mapsto$ m concepts:

	x_5	x_6	x_7
w_1	m_2	m_2	m_2
w_2	m_2		m_2
w_3	m_2	m_2	
w_4	m_1	m_1	
w_5	m_1		
w_6	m_1	m_1	

Back to the funky relative clauses

So this postsuppositional superlative filter stands a chance of recovering the essential absolute and relative readings, and licensing NPIs!

What remains to be accounted for are the modal and polarity clauses that were taken to show that 'est' must be a relation between degree properties

Modal superlatives

- Given what we've just seen, 'highest mountain possible for John to climb' is going to denote a property of mountain concepts
- Just let 'the highest mountain possible ...' refer to (one of) these, in the same way that 'the mountain John needs to climb' would

Polarity clauses

- Howard could be right that these are domain restricting, but even dynamic quantifiers get domain restrictions!
- For instance, 'the loudest that any soprano sang' could be restricted to just *soprano-singing* events, filtering out all but the loudest