The scope of indefinites

Semantics II

March 26 & 28, 2018

Constraints on covert movement

Constraints on overt movement

Wh-movement can't cross a relative clause, *wh* island, coordination, or adjunct:

1. *Who did John see somebody ⟨who liked _⟩?
2. *Who does John wonder ⟨whether Mary likes _⟩?
3. *Who did John ⟨see _ and yawn⟩?
4. *Who will John get mad ⟨when we invite _⟩?

Scope islands

These constraints also seem to be operative with covert movement (i.e., scope):

5. John saw somebody ⟨who liked every linguist⟩. $^*\forall \gg \exists$
6. Somebody wonders ⟨whether Mary likes every linguist⟩. $^*\forall \gg \exists$
7. Somebody ⟨saw every linguist and yawned⟩. $^*\forall \gg \exists$
8. Somebody will get mad ⟨when we invite every linguist⟩. $^*\forall \gg \exists$

In addition, covert movement is more constrained and freer than overt movement:

9. Somebody thinks that ⟨every linguist left⟩. $^*\forall \gg \exists$
10. Someone from every city likes it. $^\checkmark\forall \gg \exists$

Indefinites (Fodor & Sag 1982)

Data like the last slide is fairly robust across different kinds of quantifiers, though there are exceptions (*if most people tried that, they'd be dead*).

But there's a systematic class of counterexamples involving *indefinites*:

11. John saw everybody ⟨who liked a rich relative of mine⟩. $^{\checkmark}\exists \gg \forall$
12. Everybody wonders ⟨whether Mary likes a rich relative of mine⟩. $^{\checkmark}\exists \gg \forall$
13. Everybody ⟨saw a rich relative of mine and yawned⟩. $^{\checkmark}\exists \gg \forall$
14. Everybody will get mad ⟨when we invite a rich relative of mine⟩. $^{\checkmark}\exists \gg \forall$

Easy to hear any of these as "about" a rich relative of mine. For poorly understood reasons, descriptively "heavier" indefinites tend to bring these readings out.

On sluicing

Sluicing (more or less) requires an indefinite in an antecedent clause to have maximal scope (Chung, Ladusaw & McCloskey 1995, Reinhart 1997, Barker 2013).

15. . . . But I can't remember which rich relative, exactly.

Useful for forcing wide-scope indefinites. But also a bit mysterious since the movement apparently required in the sluice is itself island-violating:

16. *I can't remember which rich relative John saw everybody who liked _.

Generalized "exceptional" scope

Exceptional scope behavior extends to in situ *wh* in English:

17. Which linguists will be mad ⟨if we invite which philosophers⟩?
18. Who knows ⟨who read what⟩?

Also characteristic of *indeterminate phrases* quantification:[1]

19. Taro-wa [⟨dare-ga katta⟩ mochi]-o tabemasita ka?
    'Who is the *x* such that Taro ate rice cakes that *x* bought?'
20. [⟨Dono gakusei-ga syootaisita⟩ sensei]-mo odotta?
    'For every student *x*, the teacher(s) that x had invited danced.'

[1] Huang (1982), Nishigauchi (1990), Kratzer & Shimoyama (2002), Shimoyama (2006), etc.

Plurals and modified numerals

Cardinal phrases are indefinite-like, and also exhibit exceptional scope:

21. If ⟨two rich relatives of mine die⟩ I'll inherit a house.

We can hear this sentence as "about" two paricular rich relatives. But there is an important subtlety.

Plurals and modified numerals

Cardinal phrases are indefinite-like, and also exhibit exceptional scope:

21. If ⟨two rich relatives of mine die⟩ I'll inherit a house.

We can hear this sentence as "about" two paricular rich relatives. But there is an important subtlety. The sentence doesn't say that those two relatives are *each* such that if they died, I'd get a house. It says that *if they each died*, I'd get a house.

So "existential" scope is unbounded, but "distributive" scope is local (Szabolcsi 2010). Lesson: don't just slap a +ExceptionalQR feature on your indefinites.

Scope without *scope*

Indefinites as referential

Fodor & Sag (1982) analyze wide-scope indefinites as referring expressions:

$$[\![\mathrm{a}_i]\!]^g = \lambda P.\,\iota x.\,P x \wedge x = g_i$$

Posits an ambiguity in the indefinite determiner. But why should exceptionally scoping indefs not behave like proper names/definites in sluicing?

Also unexplained: *intermediate* exceptional scope, when an exceptional indefinite is not construed referentially (e.g., Farkas 1981, Ruys 1992, Abusch 1994).

22. Most linguists have looked at every analysis ⟨that addresses some problem⟩.

$^{\checkmark}$**most** $\gg \exists \gg \forall$

Indefinites as variables

Heim (1982) treats indefinites as “restricted variables”. In modern terms:

$$[\![\mathrm{a}_i]\!]^g = \underbrace{\lambda P.\lambda f.\, P\, g_i \wedge f\, g_i}_{(\mathrm{e}\to\mathrm{t})\to(\mathrm{e}\to\mathrm{t})\to\mathrm{t}}$$

These variables can be bound by an existential closure operator:

$$[\![\mathbb{E}_i\ \alpha]\!]^g = \exists x : [\![\alpha]\!]^{g[i\to x]}$$

Putting these pieces together, for a simple calculation:

$$\begin{aligned}[\![\mathbb{E}_i\ [\mathrm{a}_i \text{ linguist sneezed}]]\!]^g &= \exists x : [\![[\mathrm{a}_i \text{ linguist sneezed}]]\!]^{g[i\to x]} \\ &= \exists x : \mathbf{ling}\, x \wedge \mathbf{sneezed}\, x \qquad \checkmark\end{aligned}$$

Coindexed indefinites

If we treat indefinites as restricted variables, we'll need to be careful with our LFs:

23. $\mathbb{E}_i$ [a$_i$ linguist cited a$_i$ philosopher]

This would require that somebody cited themself, and that person is both a linguist and a philosopher. Definitely not a possible reading!

Interestingly enough, some languages do allow "co-referential indefinites":

24. Zhangsan qing shei, Lisi jiu qing shei.
    'If Zhangsan invites X, Lisi invites X.'

Exceptional scope as *binding*?

Indefinites as restricted variables need to take a bit of scope, since their type is $(\mathtt{e} \to \mathtt{t}) \to \mathtt{t}$, but their existential force is generated by $\mathbb{E}_i$, which can be arbitrarily far away from the indefinite! Can this explain exceptional scope?

25. ... $\mathbb{E}_i$ ... $\langle$ ... a$_i$ rich relative ... $\rangle$ ...

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Unfortunately, it is fairly easy to show that this cannot be how indefinites acquire "existential" scope. It over-generates readings even in simple cases:

26. $[\![\mathbb{E}_i$ [John didn't met a$_i$ linguist]$]\!]^g =$

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What is wrong with this? It's made true by *the mere existence of any non-linguist*. For that reason, it's come to be known as "the Donald Duck problem".

Presuppositional indefinites?

A possible alternative is to treat restricted variables via *presupposition*:

$$[\![\mathrm{a}_i]\!]^g = \underbrace{\lambda P.\begin{cases} g_i \text{ if } P\,g_i \\ \text{undefined otherwise} \end{cases}}_{(\mathrm{e}\to\mathrm{t})\to\mathrm{e}}$$

This presupposition "projects" upwards until it meets an existential closure:

$$[\![\mathbb{E}_i\ \alpha]\!]^g = \exists x : [\![\alpha]\!]^{g[i\to x]} \text{ is defined, and true}$$

Choice functions

Reinhart (1997) proposes instead to treat indefinites as a kind of variable, but she uses *choice functions* to solve the problems of binding:

$$\mathbf{CF} := \{f \in \mathcal{D}_{(\mathrm{e}\to\mathrm{t})\to\mathrm{e}} \mid \forall P \neq \emptyset : \underbrace{P(f\,P)}_{\text{or: } f\,P \in P}\}$$

Choice functions pick a member out of a non-empty set. Then we can give the following semantics for indefinite determiners and existential closure (Heim 2011):

$$[\![\mathrm{a}_i]\!]^g = g_i \qquad\qquad [\![\mathbb{E}_i\ \alpha]\!]^g = \exists f \in \mathbf{CF} : [\![\alpha]\!]^{g[i\to f]}$$

Some basic meanings derived by this theory:

27. $\exists f \in \mathbf{CF} : \neg\,\mathbf{met}(f\,\mathbf{ling})\,\mathbf{j}$
28. $\exists f \in \mathbf{CF} : \mathbf{if}(\mathbf{dies}(f\,\mathbf{rich.relative}))\,\mathbf{house}$

Empty restrictors

For any non-empty set P, choice functions have to pick some element of P. But what if P is empty? It seems that, e.g., *John saw a pink unicorn* should be false, right?

Not such an easy problem to fix, but see Reinhart 1997, Winter 1998.

Roofing

Consider the following sentence:

29. No candidate$_i$ submitted [a paper she$_i$ had written].

And now consider the following questions about it:

- It has two quantifiers. Is it ambiguous? Why or why not?
- What does a standard theory of indefinites (based on QR) predict about it?
- What does a theory based on choice functions predict?

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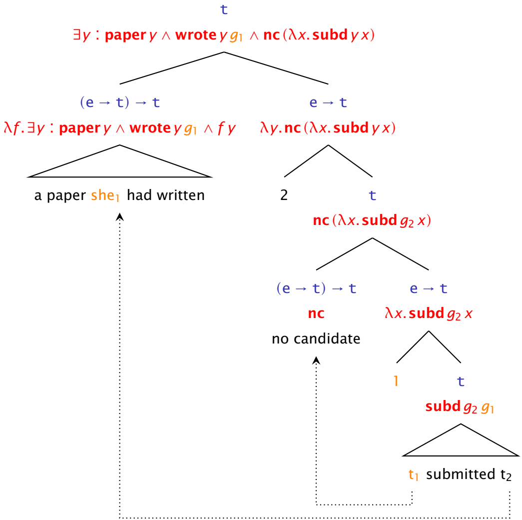
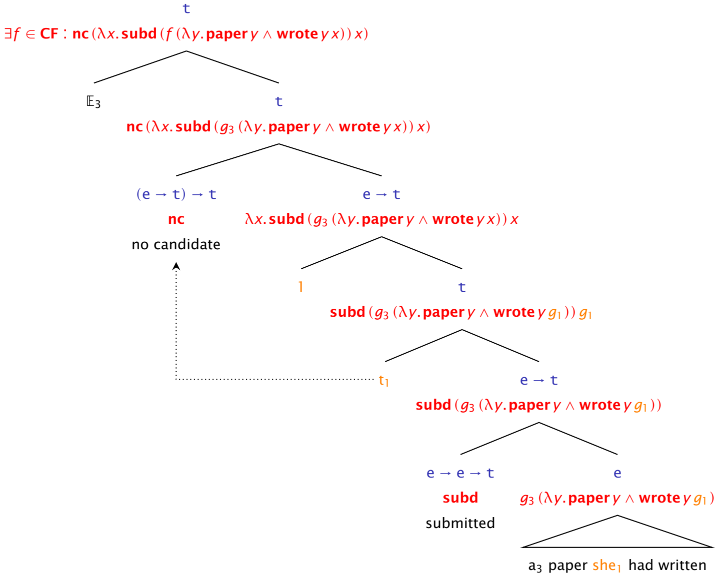
The sentence is *unambiguous* on the indicated indexing: it lacks an inverse-scope reading. Clearly, this is due to the bound pronoun inside the indefinte.

Roofing in a standard theory: scope is scope



Roofing with choice functions: scope is *pseudo*-scope



Thinking about the choice-functional meaning

Repeating the meaning derived on the last slide:

$$\exists f \in \mathbf{CF} : \mathbf{nc}\,(\lambda x.\,\mathbf{subd}\,(f\,(\lambda y.\,\mathbf{paper}\,y \wedge \mathbf{wrote}\,y\,x))\,x)$$

In prose: there is a way of choosing papers, such that no candidate submitted *that* paper that she had written. What does this require?

One complication has to do with the empty-set problem. Let's abstract away from this by assuming that every candidate wrote at least one paper — so the choice function always has something to choose.

Thinking some more

Let's imagine that we've got three candidates, $\{\mathbf{a}, \mathbf{b}, \mathbf{c}\}$, and that each of them wrote and submitted two good papers, and wrote one terrible paper they didn't submit.

$$\mathbf{a} \longrightarrow \{\mathbf{a}_1, \mathbf{a}_2, \mathbf{a}_3\} \qquad \mathbf{b} \longrightarrow \{\mathbf{b}_1, \mathbf{b}_2, \mathbf{b}_3\} \qquad \mathbf{c} \longrightarrow \{\mathbf{c}_1, \mathbf{c}_2, \mathbf{c}_3\}$$

In this context, is the meaning we derived true or false?

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$$\exists f \in \mathbf{CF} : \mathbf{nc}\,(\lambda x.\,\mathbf{subd}\,(f\,(\lambda y.\,\mathbf{paper}\,y \wedge \mathbf{wrote}\,y\,x))\,x)$$

It is **true**! Here is the value for f that witnesses its truth:

$$f\,\{\mathbf{a}_1, \mathbf{a}_2, \mathbf{a}_3\} = \mathbf{a}_3 \qquad f\,\{\mathbf{b}_1, \mathbf{b}_2, \mathbf{b}_3\} = \mathbf{b}_1 \qquad f\,\{\mathbf{c}_1, \mathbf{c}_2, \mathbf{c}_3\} = \mathbf{c}_2$$

In other words, because no candidate submitted her terrible paper, f can choose, for each candidate, *that paper*.

Generally

So long as each candidate failed to submit at least one of their papers, it will *always* be possible to find an f that makes the meaning we derived true:

$$\exists f \in \mathbf{CF} : \mathbf{nc}\,(\lambda x.\,\mathbf{subd}\,(f\,(\lambda y.\,\mathbf{paper}\,y \wedge \mathbf{wrote}\,y\,x))\,x)$$

So, summing up, what this meaning requires is that no candidate submitted *every* paper she wrote.[2] This isn't a possible meaning for *no candidate submitted a paper she had written*, and so we've over-generated (Schwarz 2001).

[2] Again, making the assumption that every candidate wrote a paper, to avoid the empty-set problem.

Coindexing

Recall that treating indefinites as simple variables ($[\![\text{a}_i]\!]^g = \lambda P.\lambda f.\, P\, g_i \wedge f\, g_i$) had unwelcome consequences: we could spuriously co-index two indefinites.

30. $\mathbb{E}_i$ [a$_i$ linguist cited a$_i$ philosopher]

Does a version of that problem recur with choice functions?

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30. $\mathbb{E}_i$ [a$_i$ linguist cited a$_i$ philosopher]

Does a version of that problem recur with choice functions? Not in precisely the same form. For a case like (30) the choice function f selects from two different sets:

$$\exists f \in \mathbf{CF} : \mathbf{cited}\,(f\,\mathbf{ling})\,(f\,\mathbf{phil})$$

The choice function is free to pick l from **ling** and p from **phil** (where $l \neq p$), so we don't generate a problematic reading for this construction.

Coindexing strikes back

But we do generate bad readings when the same CF applies to equivalent NPs:

31. $[\![\mathbb{E}_i \text{ [a}_i \text{ linguist cited a}_i \text{ linguist]}]\!]^g = \exists f \in \mathbf{CF} : \mathbf{cited}\,(f\,\mathbf{ling})\,(f\,\mathbf{ling})$

Choice functions are *functions*. So any f that makes this true picks the same linguist for subject and object. Predicted reading is equivalent to *a linguist cited herself*.

It's worth pondering what it would take to rule (31) out. Do you have any ideas?

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It's worth pondering what it would take to rule (31) out. Do you have any ideas? It seems to me that it will be difficult to state a constraint that works in general. E.g., if you thought something *Binding-Theoretic* was wrong with (31), what about:

32. $\mathbb{E}_i$ [[the man who cited a_i linguist] knows [the woman who cited a_i linguist]]

A related issue

Consider the following LF and the meaning we derive for it (Geurts 2000):

33. $[\![\mathbb{E}_i \text{ every girl}_j \text{ called a}_i \text{ boy she}_j \text{ knew}]\!]^g$

$$= \exists f \in \textbf{CF} : \forall x \in \textbf{girl} : \textbf{called}\,(f\,(\lambda y.\,\textbf{boy}\,y \wedge \textbf{knew}\,y\,x))\,x$$

The problem occurs when the girls all know the same boys — i.e., when for any girl x, the set $\lambda y.\,\textbf{boy}\,y \wedge \textbf{knew}\,y\,x$ is the same group of boys.

Again, choice functions are *functions*. So if the set of boys doesn't change as we consider different girls, the boy selected by f also cannot change. Prediction: (33) entails that if the girls know the same boys, every girl called the same boy.

Alternative semantics

Alternative semantics in two steps[3]

All meanings are sets, $\mathrm{S}\,a ::= a \to \{0, 1\}$.

$$[\![\text{John}]\!] := \underbrace{\{\mathrm{j}\}}_{\mathrm{S\,e}} \qquad [\![\text{met}]\!] := \underbrace{\{\mathrm{met}\}}_{\mathrm{S\,(e \to e \to t)}} \qquad [\![\text{a linguist}]\!] := \underbrace{\{x \mid x \in \mathrm{ling}\}}_{\mathrm{S\,e}}$$

Meaning combination is *pointwise* functional application.

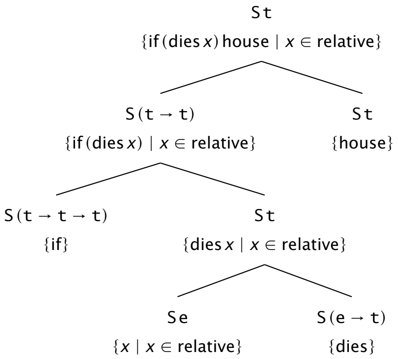
$$[\![A\ B]\!] = \{f\,x \mid f \in [\![A]\!], x \in [\![B]\!]\}$$

Indefinites introduce non-determinism. The grammar "expands" it upward:

$$[\![\text{John met a linguist}]\!] = \{\mathrm{met}\,x\,\mathrm{j} \mid x \in \mathrm{ling}\}$$

[3] Hamblin (1973), Rooth (1985), Kratzer & Shimoyama (2002), Alonso-Ovalle & Menéndez-Benito (2013).

Alternatives on islands: exceptional scope as pseudo-scope



(Without leaving home, the indefinite acquires a kind of ‘scope’ over the conditional.)

Existential closure

Alternatives can be flattened out by an existential closure operator:

$$[\![\mathbb{E}\ \alpha]\!] = \{\exists p \in [\![\alpha]\!] : p = \text{True}\}$$

For example, applying this closure operator to the meaning derived in the last slide:

$$\{\exists p \in \{\textbf{if}\,(\textbf{dies}\,x)\,\textbf{house} \mid x \in \textbf{rel}\} : p = \text{True}\} = \{\exists x \in \textbf{rel} : \textbf{if}\,(\textbf{dies}\,x)\,\textbf{house}\}$$

$\mathbb{E}$ can be inserted at non-maximal levels, in order to derive non-specific readings.

Selectivity

When two alternative-inducing expressions live on island, they can take scope in different ways outside the island:

34. If [a phenomenal lawyer visits a rich relative of mine], I'll inherit a fortune.

In alternative semantics, the [island]'s meaning doesn't distinguish lawyers and relatives. So it is tricky to percolate one, but not the other, over the conditional.

$$\{\textbf{visits}\, x\, y \mid \textbf{lawyer}\, y, \textbf{relative}\, x\}$$

Binding

Binding in a standard semantics, *sans* alternatives:

$$[\![\lambda_i\ \alpha]\!]^g = \underbrace{\lambda x.\, [\![\alpha]\!]^{g[i \to x]}}_{a \to b}$$

Binding in alternative semantics is trickier (Poesio 1996, Shan 2004). We want a possibly non-singleon set of functions, type $\mathrm{S}\,(a \to b)$, but that's hard to come by:

$$[\![\lambda_i\ \alpha]\!]^g = \underbrace{\{\lambda x.\, [\![\alpha]\!]^{g[i \to x]}\}}_{\mathrm{S}\,(a \to \mathrm{S}\,b)}$$

Can we use *choice functions* (cf. Hagstrom 1998, Kratzer & Shimoyama 2002)?

$$[\![\lambda_i\ \alpha]\!]^g = \underbrace{\{\lambda x.\, f\, [\![\alpha]\!]^{g[i \to x]} \mid f \in \mathrm{CH}\}}_{\mathrm{S}\,(a \to \mathrm{b})}$$

Binding, continued

But the result here is as if we'd interpreted any alternative-generators in α via *obligatorily Skolemized* choice functions (Charlow 2017, cf. Shan 2004).

$$\begin{aligned}\{\lambda x.\, f\, [\![\mathrm{t}_0 \text{ saw a guy}]\!]^{g[0\to x]} \mid f \in \mathrm{CH}\} &= \{\lambda x.\, f\, \{\mathbf{saw}\, y\, x \mid \mathbf{guy}\, y\} \mid f \in \mathrm{CH}\} \\ &= \{\lambda x.\, \mathbf{saw}\,(f_x\, \mathbf{guy})\, x \mid f \in \mathbf{SkCH}\}\end{aligned}$$

This over-generates functional readings (any alternative generator under a λ_i is interpreted functionally), and under-generates exceptional scope readings (since functional readings ≈ narrow scope, as emphasized by Kratzer (1998)).

35. Nobody λ_0 t_0 saw a linguist. $\rightsquigarrow \{\mathbf{nb}\,(\lambda x.\, \mathbf{saw}\,(f_x\, \mathbf{ling})\, x) \mid f \in \mathbf{SkCH}\}$
36. Everybody λ_0 t_0 would be happy if [a famous expert on binding cited them$_0$].
$\rightsquigarrow \{\mathbf{eb}\,(\lambda x.\, \mathbf{happy.if}\,(\mathbf{cited}\, x\,(f_x\, \mathbf{expert}))\, x) \mid f \in \mathbf{SkCH}\}$

Morals

Indefinites present a challenge for semantic theory: their exceptional scope properties suggest that we may wish for the ability to assign them wide scope *without moving them into their scope position*.

But allowing indefinites to acquire scope without *real* scope poses challenges of its own. Most tellingly, perhaps, we note that *binding* interacts with indefinites in precisely the way you'd expect if their scope was assigned solely via QR.

If you are interested in exploring these issues further, and seeing a solution that uses some of the tools we developed to handle questions, let me humbly recommend Charlow 2017.

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