The dynamic core of exceptional scope

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Rutgers University, 28 February 2014

1 Overview

- This is a talk about the interpretation of indefinites and disjunctions and how they interact with grammatical resources for scope-taking.

- Both indefinites (e.g. Fodor & Sag 1982, Farkas 1981) and disjunctions (e.g. Rooth & Partee 1982, Schlenker 2006) can "exceptionally" project their existential force out of scope islands:

(1) a. Every grad student heard the rumor that [a famous linguist was at the conference]. ($\exists > \forall$)
b. A grad student heard the rumor that [every famous linguist was at the conference]. ($*\forall > \exists$)
c. A grad student heard the rumor that [most famous linguists were at the conference]. ($*\text{most} > \exists$)

(2) a. John claimed he hires everyone who [speaks French or Spanish]. (I've forgotten which.) ($\vee > \forall$)
b. John claimed he hires everyone who [speaks French and Spanish] ($*\wedge > \forall$)

- Likewise, both indefinites (e.g. Geach 1962) and disjunctions (e.g. Rooth & Partee 1982, Groenendijk & Stokhof 1991, Stone 1992) can antecede pronouns they don't scope over ('donkey anaphora'):[1]

(3) a. Socrates met {a, *every} dog_i. He gave it_i a bone.
b. Everybody who bought {a, *every} sage plant_i here bought eight others along with it_i.
(Heim 1982: 89)

(4) a. Whenever I see $[\text{John or Bill}]_i$ I wave to him_i.
b. Everybody who bought $[\text{a sage plant or a rose bush}]_i$ bought eight others along with it_i.

- My proposal: **these peculiarities follow from a single property shared by indefinites and disjunctions**: namely, that they leave a detectable semantic residue after they're evaluated—or, in another manner of speaking, are **externally dynamic**. Once a scope island is evaluated, the externally dynamic bits of meaning are available for subsequent scope-taking (as well as for fixing the reference of anaphoric material downstream). Indefiniteness survives scope islands.

- My proposal pairs Shan & Barker's (2006) account of in situ quantification with a dynamic analysis of indefinites and disjunction (Dekker 1993, Stone 1992). The resulting treatment of indefiniteness subsumes both dynamic analyses and analyses couched in terms of alternatives (e.g. Kratzer & Shimoyama 2002, Alonso-Ovalle 2006, Mascarenhas 2009, Groenendijk & Roelofsen 2009).

- In addition to giving a unified account of indefinites and disjunction that improves on existing proposals, the theory offers novel analyses in a variety of empirical domains—including a radical take on the structural conditions underlying binding—and converges with independent research on the syntax and semantics of wh quantification.

- Roadmap: I'll offer an introduction to dynamic semantics and the notion of externally dynamic (cf. static) meanings. Adding continuations allows us to compose up dynamic meanings in a novel way and to formulate a proposal about what happens on the shores of a scope island. We'll see how this derives exceptional scope and then have a look at some other predictions (I won't spend much time on criticizing extant theories, but please feel free to press me on that in the Q&A.)

1 Discourse reference to non-indefinite DPs is possible, but generally forces a maximal interpretation, as in (i) (e.g. Kamp & Reyle 1993, van den Berg 1996, Nouwen 2003, Brasoveanu 2007). We'll discuss maximal discourse reference in Section 9.2.

i. Yesterday I bought more than three tomatillos_i. I put them_i in a salsa verde.

2 Refining the picture

- **Intermediate exceptional scope is possible**, suggesting island-violating scope not a matter of interpreting the indefinite referentially (e.g. Farkas 1981, Abusch 1994, Chierchia 2001):

(5) Every member of the club_i was convinced that if [a friend of his_i from Texas had died in the fire] he_i would have inherited a fortune. ($\forall > \exists > \text{if}$)
(von Fintel 2000, ex. 3)

(6) Every logician presented every proof that the Completeness Theorem or the Incompleteness Theorem has.
(Schlenker 2006, ex. 41c) ($\forall > \vee > \forall$)

- **Distributive interpretations of exceptionally scoping plural indefinites are clause-bounded** (Ruys 1992). The same seems to hold for disjoined plurals ('δ' stands for a distributive interpretation).

(7) If [two of my relatives die], I'll inherit a fortune. (I can't remember which.) ($*\delta > \text{if}$)

(8) If [my aunts or my uncles die], I'll inherit a fortune. (Though I've forgotten which.) ($*\delta > \text{if}$)

- **Exceptional scope-taking feeds anaphora**. The indicated readings of (9) and (10) are infelicitous when the indefinite/disjunction scope within its minimal tensed clause but ok if the indefinite/disjunction takes (either maximal or intermediate) exceptional scope (not emphasized in the literature, though see Abusch 1994):

(9) If you manage to read every article [written about a famous problem in binding theory_i], you'll certainly end up an expert on it_i.

(10) Anyone who manages to read every paper [written by $[\text{Chomsky or May}]_i$] cites him_i profusely.

- And even though indefinites scope freely, **they can't be evaluated at a point higher than their restrictor**. Following Brasoveanu & Farkas (2011), I'll call this the Binder Roof Constraint, or "roofing" for short:

(11) a. Mary wants_i to buy an inexpensive_i coat. ($*\exists > \text{wants}$)
(after Fodor 1970)
b. Exactly one student_i submitted a paper he_i wrote. ($*\exists > \exists!$)
(after Schwarz 2001)
c. I didn't manage to read $[\text{a book by a}_2 \text{ famous linguist}]_1$. ($*\exists_1 > \neg > \exists_2$)

- In contrast, **disjunction freely scopes higher than its restrictor** (i.e. the individual disjuncts). In fact, this can already be observed in (2a) (Rooth & Partee 1982 note that (2a) has a wide-scope disjunction, *de dicto* reading but don't connect this fact to indefinites).

(12) Everyone ordered a steak or a burger. (Do you know which?) ($\vee > \forall > \exists$)

(13) Bill wants_i to hire a maid_i or a cook_i. ($\vee > \text{wants} > \exists$)
(after Rooth & Partee 1982, ex. 21c)

3 Dynamic semantics for discourse anaphora: a primer

3.1 The bird's eye view

- Basic tenet of dynamic semantics: sentences help us keep track of **discourse referents**. Processing sentences makes individuals available for downstream anaphora. The grammar is set up in a way that discourse referents find their way to thirsty pronouns, even in the absence of scope.

- Managed here via a *reference stack*—for our purposes just a list of the individuals available for anaphoric reference.

- Stacks get written in brackets: e.g. $[x,y,z,\ldots]$. We can update stacks by adding individuals: $[\alpha,\ldots,\omega]^x = [\alpha,\ldots,\omega,x]$.

- In case Polly laughed, processing *Polly laughed* will look like so:

(14) $$s \longrightarrow [\![\text{Polly laughed}]\!] \longrightarrow s^{\mathsf{p}}$$

- Indefinites also set up discourse referents. In case there's four laughing linguists, a, b, c, and d, we'll have:

(15) $$s \longrightarrow [\![\text{a linguist laughed}]\!] \rightarrow s^{\mathsf{a}},\ s^{\mathsf{b}},\ s^{\mathsf{c}},\ s^{\mathsf{d}}$$

- This means sentences are devices that output *sets* of stacks. How to think about this: (15) is about a "random" or "indeterminate" linguist laughing in the same way that (14) is about Polly laughing. Thus, indefinites are **non-quantificational**.

3.2 An implementation: DyS

- Here's a simple implementation I'll call DyS. (Based on Dekker 1993, but essential features present one way or another in e.g. Groenendijk & Stokhof 1991, Muskens 1996, Brasoveanu 2007.)

(16)

	DyS meaning	Type
laughed	$\lambda x s.\{s\}$ if x laughed, $\{\}$ otherwise	est
Polly	$\lambda \kappa s.\, \kappa\, \mathsf{p}\, s^{\mathsf{p}}$	$(est)st$
a linguist	$\lambda \kappa s.\, \bigcup\{\kappa\, x\, s^x \mid \mathsf{linguist}\, x\}$	$(est)st$

- Combination is functional application. Applying [[Polly]] to [[laughed]] gives us (14):

(17)
$$\lambda s.\{s^{\mathsf{p}}\} \text{ if } \mathsf{p} \text{ laughed, else } \{\}$$
- Polly: $\lambda \kappa s.\, \kappa\, \mathsf{p}\, s^{\mathsf{p}}$
- laughed: $\lambda x s.\{s\}$ if x laughed, else $\{\}$

- Similarly for the indefinite case. Applying [[a linguist]] to [[laughed]] gives us (15):

(18)
$$\lambda s.\{s^x \mid \mathsf{linguist}\, x \wedge \mathsf{laughed}\, x\}$$
- a linguist: $\lambda \kappa s.\, \bigcup\{\kappa\, x\, s^x \mid \mathsf{linguist}\, x\}$
- laughed: $\lambda x s.\{s\}$ if x laughed, else $\{\}$

3.3 The static/dynamic divide

- Not everything is so congenial. Universals like *every linguist* can't bind outside their scope, and discourse referents created in their scope seem to get destroyed:

(19) *Every linguist$_i$ is here. She$_i$'s a phonologist.

(20) Every semanticist met a phonologist$_i$. He$_i$ works on vowel harmony. (*$\forall > \exists$)

- A meaning for *every linguist* that captures this. At most returns the unchanged input stack.

(21) $$[\![\text{every linguist}]\!] =_{\mathsf{DyS}} \lambda \kappa s.\{s\} \text{ if } \forall x.\, \mathsf{linguist}\, x \Rightarrow \exists s'.\, s' \in \kappa\, x\, s^x,\ \{\} \text{ otherwise}$$
('$\{s\}$ if every linguist κ's, $\{\}$ otherwise')

- Assuming every linguist did indeed laugh:

(22) $$s \longrightarrow [\![\text{every linguist laughed}]\!] \longrightarrow s$$

- One way to think about this: there's a natural, motivated bifurcation in DyS between things that create new discourse possibilities (or issues, if that's your persuasion) and things which don't. The former are **externally dynamic**, the later are **externally static**.
- **We can leverage this difference to give a semantic explanation of exceptional scope-taking**. The germ of the idea: once processed, (15) has a "residue" of linguist-ness reflected in the multiplicity of outputs, one (22) lacks. Post-processing, I will show, this residue can take scope.
- Notice that DyS doesn't *itself* give us the answers we need. Meaning composition is static functional application (cf. Bittner 2001), and so scope relations are determined entirely by LF. If scope-taking is delimited by scope islands, exceptional scope would seem to be ruled out (to say nothing of accounting for the intricacies in the data).

4 Continuations

- Everyone needs some apparatus for scope-taking and scope ambiguity. Usually QR+LF. Other alternatives: Montague (1974), Cooper (1983), Hendriks (1993). Continuations (Barker 2002) offer another possibility.
- In a continuized grammar everything denotes a *program*, and meaning composition is *program composition*. Or, in less exotic terms, **everything takes scope**, and **meaning composition is scoping** (generally with a linear bias).
- But continuations aren't exotic. They're simply a directly compositional way of thinking about what you're doing when you do QR. Nevertheless, **they offer a new perspective on dynamic semantics, one which we can draw on to do empirical work**.

4.1 Basic meanings

- Many things are static and boring (ditching much of DyS):

(23)

	Meaning	Type
Polly	p	e
met	met	eet
and	$\lambda q p.\, p \wedge q$	ttt

- But I'll borrow the DyS meaning for *a linguist*:[2]

(24) $$\lambda\kappa s.\bigcup\{\kappa\, x\, s^x \mid \mathsf{linguist}\,x\}$$

- Static things don't inherently denote scope-takers. They become scopal via an application of **type-lifting**, (Partee & Rooth 1983, Partee 1986):

(25) $$\begin{aligned} \mathsf{p} &\rightsquigarrow \lambda\kappa.\kappa\,\mathsf{p} \\ \mathsf{met} &\rightsquigarrow \lambda\kappa.\kappa\,\mathsf{met} \\ \mathsf{and} &\rightsquigarrow \lambda\kappa.\kappa\,(\lambda qp.p\wedge q) \end{aligned}$$

4.2 Combination and the tower notation

- Meaning composition scopes two scopal arguments (in their surface order) to yield a composite scopal expression:

(26) $$[\![\alpha\,\beta]\!] := \lambda\kappa.[\![\alpha]\!]\,(\lambda f.[\![\beta]\!]\,(\lambda x.\kappa\,(f\,x)))$$

- This represents a completely general approach to scope-taking.
- Step-by-step derivation for *Polly met a linguist*.

(27)

- $\lambda\kappa s.\bigcup\{\kappa\,(\mathsf{met}\,x\,\underline{\mathsf{p}})\,s^x \mid \mathsf{linguist}\,x\}$ — Polly met a linguist
  - $\lambda\kappa.\kappa\,\mathsf{p}$ — Polly
  - $\lambda\kappa s.\bigcup\{\kappa\,(\underline{\mathsf{met}}\,x)\,s^x \mid \mathsf{linguist}\,x\}$ — met a linguist
    - $\lambda\kappa.\kappa\,\mathsf{met}$ — met
    - $\lambda\kappa s.\bigcup\{\kappa\,x\,s^x \mid \mathsf{linguist}\,x\}$ — a linguist

- Notice that only the argument to κ changes. In fact, doing derivations in continuized grammars is easier and more familiar than you might have supposed. In particular, there's a handy short-cut called the *tower notation* which allows us to quickly and accurately construct and reason about continuized derivations.
- One way you might think about this: the top level of a tower is a QR'd expression and the bottom level is its trace.

(28) $$\frac{f\,[\,]}{x} := \lambda\kappa.f\,[\kappa\,x]$$

(29) $$\underset{left}{\frac{g\,[\,]}{f}}\;\underset{right}{\frac{h\,[\,]}{x}} \rightsquigarrow \underset{left\ right}{\frac{g\,[h\,[\,]]}{f\,x}}$$

[2] There's a small fudge here: binding is modularized in the grammar (note e.g. how the meaning given for *Polly* here has no anaphoric charge), so I actually don't assume the denotation of *a linguist* obligatorily pushes an individual onto the stack.

- A tower just pulls an expression's scopally active and scopally inert parts apart into two levels. Scope-based application composes effects in linear order, function application on bottom:

(30) $$\underset{\text{Polly}}{\frac{[\,]}{\mathsf{p}}}\left(\underset{\text{met}}{\frac{[\,]}{\mathsf{met}}}\;\underset{\text{a linguist}}{\frac{\lambda s.\bigcup\{[\,]\,s^x \mid \mathsf{linguist}\,x\}}{x}}\right) \rightsquigarrow \underset{\text{Polly met a linguist}}{\frac{\lambda s.\bigcup\{[\,]\,s^x \mid \mathsf{linguist}\,x\}}{\mathsf{met}\,x\,\mathsf{p}}}$$

- The resulting expression is equivalent to $\lambda\kappa.\bigcup\{\kappa\,(\mathsf{met}\,x\,\mathsf{p})\,s^x \mid \mathsf{linguist}\,x\}$.
- I'll switch between linear and tower presentation depending on which is easier to understand in context.

4.3 Inverse scope

- Since composition has a linear bias, there's no inverse scope yet. How handled?
- Here's a *really* brief sketch. Uses *higher-order continuations*, which are genuinely a little mind-warping. But all you really need to know is that the eventual result is *the same* as what QR gives you (and that this account already follows from the grammar, see Shan & Barker 2006).
- There's actually two ways to lift an expression that's already scopal/a tower. You can think of these in terms of (respectively) lifting the entire expression, or *lifting its trace*:

(31) $$\underset{exp}{\frac{f\,[\,]}{x}} \rightsquigarrow \underset{exp}{\begin{array}{c}[\,]\\ \hline f\,[\,]\\ \hline x\end{array}} \quad\Big|\quad \underset{exp}{\frac{f\,[\,]}{x}} \rightsquigarrow \underset{exp}{\begin{array}{c}f\,[\,]\\ \hline [\,]\\ \hline x\end{array}}$$

- When you lift something's trace, that pushes its scopal effects onto a higher level. Things on higher levels will out-scope things on lower levels. And that's how you take inverse scope:

(32) $$\underset{\text{someone}}{\begin{array}{c}[\,]\\ \hline \textbf{someone}\,(\lambda x.[\,])\\ \hline x\end{array}}\left(\underset{\text{met}}{\begin{array}{c}[\,]\\ \hline [\,]\\ \hline \mathsf{met}\end{array}}\;\underset{\text{everyone}}{\begin{array}{c}\textbf{everyone}\,(\lambda y.[\,])\\ \hline [\,]\\ \hline y\end{array}}\right)$$

5 Scope islands: lowering and lifting

5.1 Lowering

- Continuized derivations result in scopal expressions. Repeating the meaning derived for *Polly met a linguist*:

(33) $$\lambda\kappa s.\bigcup\{\kappa\,(\mathsf{met}\,x\,\mathsf{p})\,s^x \mid \mathsf{linguist}\,x\}$$

- *Lifting* was how we got into the continuized grammar, but how do we get out? How do we *lower*?
- Answer: **evaluate the program** denoted by the sentence. That is, close off its scope by feeding it some trivial scopal argument as κ.
- This κ should take two arguments—a proposition and a stack—and give back some sort of set (because: $\bigcup$).
- Here's what we'll assume: κ takes a proposition and a stack and holds onto them both by sticking them into an ordered pair (see Kamp 1981 and perhaps Heim 1982 for something like this view; other sorts of trivial κ's can be assumed; see Section 10.2):

(34) $$m^{\downarrow} := m\,(\lambda as.\{\langle a,s\rangle\})$$

- Using this κ to evaluate (33) means we output pairs of propositions and stacks that vary according to which linguist figures in them:

(35)
$$\lambda s.\,\{\langle \mathsf{met}\,x\,\mathsf{p},\ s^x\rangle \mid \mathsf{linguist}\,x\}$$

$$s \longrightarrow [\![\text{Polly met a linguist}]\!] \begin{cases} \to \langle \mathsf{met\,a\,p},\ s^{\mathsf{a}}\rangle \\ \to \langle \mathsf{met\,b\,p},\ s^{\mathsf{b}}\rangle \\ \to \langle \mathsf{met\,c\,p},\ s^{\mathsf{c}}\rangle \\ \to \langle \mathsf{met\,d\,p},\ s^{\mathsf{d}}\rangle \\ \to \langle \mathsf{met\,e\,p},\ s^{\mathsf{e}}\rangle \end{cases}$$

- Obviously, this is quite similar to the DyS view. The only difference is that we've retained the proposition instead of treating it as a mere condition on the stacks output.

5.2 Re-lifting

- For LF theories, a scope island corresponds to constraints on LF representations. For Cooper (1983), a scope island means you empty the store.
- For us: **a scope island is any domain in which evaluation is obligatory**. Evaluation *has* to happen at scope islands (indeed, evaluation is in a sense built into QR). Else every quantifier would be given text-level scope.[3]
- Yet scope islands nevertheless interact with their surroundings in rich and variegated ways. For instance you can bind into islands, and (sometimes) bind out of them. Semantic interaction in a continuized grammar is essentially scope-y. So what went down—what was evaluated into a non-scopal expression—must become scopal again.
- Since evaluation/lowering turns things of the form $\kappa\,p\,s$ into pairs of the form $\langle p,s\rangle$, re-lifting should do the reverse:

(36)
$$\langle \mathsf{met\,a\,p},\ s^{\mathsf{a}}\rangle \rightsquigarrow \kappa\,(\mathsf{met\,a\,p})\,s^{\mathsf{a}}$$

- The actual re-lifting operation just does this a bunch of times (once for each pair in the evaluated meaning) and collects the results. We'll see a concrete example of how this works this very shortly.

(37)
$$p^{\uparrow} \coloneqq \lambda\kappa s.\bigcup\{\kappa\,a\,s' \mid \langle a,s'\rangle \in p\,s\}$$

- Composing evaluation and re-lifting into a single operation gives us what's known in the computer science literature on delimited continuations as a **reset** (e.g. Danvy & Filinski 1990, Wadler 1994):

(38)
$$m^{\downarrow\uparrow} \coloneqq \lambda\kappa s.\bigcup\{\kappa\,a\,s' \mid \langle a,s'\rangle \in m^{\downarrow} s\}$$

- Since evaluation is obligatory at a scope island, and evaluation has to be paired with re-lifting, **a scope island is (also) any domain in which reset is obligatory**.
- Though reset involves lowering and then undoing the lower, it's not generally the case that it has no effect (as we'll see shortly). Same true of related operations in Groenendijk & Stokhof's (1990) Dynamic Montague Grammar ($\uparrow\downarrow\alpha$) or Montague's (1974) intensional logic (${}^{\wedge\vee}\alpha$).

3 The idea that certain domains are obligatorily evaluated bears some resemblance to the Minimalist notion of phase (Chomsky 2008, see also Cecchetto 2004).

6 Exceptional scope-taking is scope-taking post-reset

- The crucial point: this lifting operation *sees* the dynamic residue in the evaluated meaning that serves as its input: the new κ is **a function on the outputs of the evaluated meaning**. If the stacks have some binding information on them, it sees that. If there is more than one pair, it sees that too.
- In a slogan: $p^{\uparrow}$ *inherits* the dynamics visible in p.
- Ok, so time to re-lift the lowered meaning from (35): κ is fed each of the output pairs.

(39)
$$\lambda\kappa s.\bigcup\{\kappa\,a\,s' \mid \langle a,s'\rangle \in \{\langle \mathsf{met}\,x\,\mathsf{p},\ s^x\rangle \mid \mathsf{linguist}\,x\}\}$$
$$\equiv\ \lambda\kappa s.\bigcup\left\{\begin{array}{l} \kappa\,(\mathsf{met\,a\,p})\,s^{\mathsf{a}} \\ \kappa\,(\mathsf{met\,b\,p})\,s^{\mathsf{b}} \\ \kappa\,(\mathsf{met\,c\,p})\,s^{\mathsf{c}} \\ \kappa\,(\mathsf{met\,d\,p})\,s^{\mathsf{d}} \\ \kappa\,(\mathsf{met\,e\,p})\,s^{\mathsf{e}} \end{array}\right\}$$

- **This expression is equivalent to the pre-reset meaning**:

(40)
$$\equiv\ \lambda\kappa s.\bigcup\{\kappa\,(\mathsf{met}\,x\,\mathsf{p})\,s^x \mid \mathsf{linguist}\,x\}$$

- This means **indefiniteness survives evaluation and reset**.
- Since indefiniteness survives reset, **we can jack it up to a higher level**, like so:

(41)
$$\begin{array}{c} \lambda s.\bigcup\{[\,]\,s^x \mid \mathsf{linguist}\,x\} \\ \hline \mathsf{met}\,x\,\mathsf{p} \\ \text{Polly met a linguist} \end{array} \rightsquigarrow \begin{array}{c} \lambda s.\bigcup\{[\,]\,s^x \mid \mathsf{linguist}\,x\} \\ \hline [\,] \\ \hline \mathsf{met}\,x\,\mathsf{p} \\ \text{Polly met a linguist} \end{array}$$

- This means we can give a simple derivation of exceptional scope for our original example (with a toy treatment of *heard*). The tensed clause was reset and jacked up à la (41), and the indefiniteness outscopes the universal.

(42)
$$\begin{array}{c} [\,] \\ \hline \textbf{every\_grad}\,(\lambda x.[\,]) \\ \hline x \\ \text{every grad} \end{array} \left(\begin{array}{c} [\,] \\ \hline [\,] \\ \hline \mathsf{heard} \\ \text{heard} \end{array} \begin{array}{c} \lambda s.\bigcup\{[\,]\,s^y \mid \mathsf{famous\_linguist}\,y\} \\ \hline [\,] \\ \hline \mathsf{at\_conf}\,y \\ \text{a famous linguist was at the conf} \end{array} \right)$$

- Evaluating all of this, assuming the famous linguists are a and d:

(43)
$$s \longrightarrow [\![\text{every grad heard...}]\!] \begin{cases} \to \langle \forall x.\,\mathsf{grad}\,x \Rightarrow \mathsf{heard}\,(\mathsf{at\_conf\,a})\,x,\ s^{\mathsf{a}}\rangle \\ \to \langle \forall x.\,\mathsf{grad}\,x \Rightarrow \mathsf{heard}\,(\mathsf{at\_conf\,d})\,x,\ s^{\mathsf{d}}\rangle \end{cases}$$

- Externally static operators work almost as in DyS, modulo the acknowledgement that we're dealing with pairs.

(44)
$$[\![\text{every linguist}]\!] = \lambda\kappa s.\,\{\langle \forall x.\,\mathsf{linguist}\,x \Rightarrow \exists s'.\,\langle \top, s'\rangle \in \kappa\,x\,s^x,\ s\rangle\}$$
'{⟨every linguist κ's, s⟩}'

- So for example processing *Polly met every linguist* (given a derivation like the indefinite case) outputs a single pair with a boring universal truth condition and an unchanged input stack:

(45) $$s \longrightarrow [\![\text{Polly met every linguist}]\!] \longrightarrow \langle \forall x.\, \textsf{linguist}\, x \Rightarrow \textsf{met}\, x\, \textsf{p},\ s\rangle$$

- Re-lifting this with $\uparrow$ will turn it back into a scope-taker, but the quantificational force (and ability to bind pronouns) has been utterly discharged.
- Empirical virtues: **intermediate scope is possible** (since the wide-scope indefinite isn't interpreted referentially). **Distributivity is predicted to be clause-bounded** (since distributive operators are universal quantifiers, their quantificational force is discharged on reset). Since exceptional scope is bona fide scope, we explain why it **feeds donkey anaphora**, and why it's incoherent for an indefinite to out-scope something that binds into its restrictor, i.e. **roofing**.

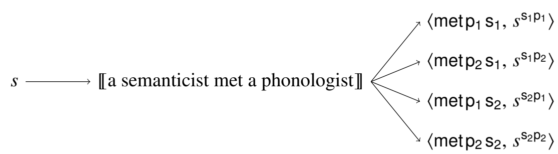
7 Multiple indefinites and higher-order issues

- Indefinites in same constituent should be able to take scope in diff ways (sort of tacitly assumed in much of the literature, though the cross-linguistic picture is more complicated, cf. e.g. Shimoyama 2006).
- See a minimally tweaked version of our first example, where *a famous semanticist* can be interpreted outside its minimal tensed clause whilst *a phonologist* is interpreted inside.

(46) Every grad student heard that [a famous semanticist was talking to a phonologist].

- How's this work? The most obvious output of evaluation in our semantics will look like so (i.e. with one big agglomerated chunk of semanticist-phonologist indefiniteness):

(47) $$\lambda s.\, \{\langle \textsf{met}\, y\, x,\ s^{xy}\rangle \mid \textsf{semanticist}\, x \wedge \textsf{phonologist}\, y\}$$



- This would seem to predict, contrary to fact, that either *both* indefinites take exceptional scope, or *neither* do. The reset only sees one chunk of indefiniteness. No possibility of one floating up and one staying low.
- However, consider the licit derivation in (48), where we've started by jacking one indefinite up to a higher scope-taking level than the other. We **lower once** (applying $\downarrow$ to the bottom two levels) to give a two-story tower with a (function into) a set of pairs on the bottom (call it '**p**'), then **we lower again** (applying $\downarrow$):

(48) $$\dfrac{\lambda s.\, \bigcup\{[\,]\, s^x \mid \textsf{semanticist}\, x\}}{\dfrac{\lambda s.\, \bigcup\{[\,]\, s^y \mid \textsf{phonologist}\, y\}}{\textsf{met}\, y\, x}} \rightsquigarrow \dfrac{\lambda s.\, \bigcup\{[\,]\, s^x \mid \textsf{semanticist}\, x\}}{\lambda s.\, \{\langle \textsf{met}\, x\, y,\ s^y\rangle \mid \textsf{phonologist}\, y\} =: \textbf{p}}$$

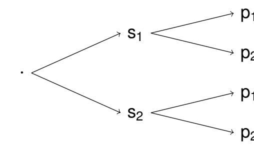
$$\rightsquigarrow \lambda s.\, \{\langle \textbf{p},\ s^x\rangle \mid \textsf{semanticist}\, x\}$$

a semanticist met a phonologist

- The evaluated result is a little hard to grok (and requires some center-embedding to even talk about: a set of pairs of [sets of pairs and stacks] and stacks). Let's try this: think about a basic dynamic proposition such as **p** as a proposition wrapped up in a little dynamic box, i.e. $\boxed{t}$.

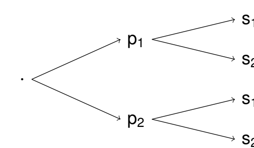
- That means the output in (48) is doubly-wrapped, i.e. $\boxed{\boxed{t}}$. In a sense, we've embedded the which-phonologist issue inside the which-semanticist issue:

(49) $$\lambda s.\, \{\langle \textbf{p},\ s^x\rangle \mid \textsf{semanticist}\, x\}$$



- Relevantly for example (46) layered issues can be recursively pulled apart exactly the same as before—i.e. with two applications of $\uparrow$. In other words, each of the derivability arrows in (48) goes *both ways*.
- Thus on this derivation both indefinites survive reset, and moreover survive on different levels. This means they're free to take exceptional scope in possibly different ways.
- The internal structure of the indefiniteness here is rather like a pop-up book: you can close it down and open it up without losing any structure.
- If we reversed the relative scopes of *a semanticist* and *a phonologist*, we'd get a different layering of issues in the $\boxed{\boxed{t}}$ (call the semanticist-$\boxed{t}$ '**s**'):

(50) $$\lambda s.\, \{\langle \textbf{s},\ s^y\rangle \mid \textsf{phonologist}\, y\}$$



- And keeping them on the same level gives one big set of alternatives, as we observed in (47).
- In other words, we predict three (substantively different) ways to layer the alternatives/issues here. So all possible exceptional scopings are predicted (this is the same prediction as most accounts of indefinites make).
- So if there is potentially higher-order structure in alternative sets, as I'm suggesting, can we see the effects of this anywhere else? I think yes.
- For one, an analogous claim about the existence/empirical utility of higher-order issues has been motivated in the closely related domain of questions under the rubric of *higher-order questions* Dayal (1996, 2002), Fox (2012).[4]
- For another: AnderBois (2010), Barros (2013) argue (pace Chung et al. 1995, Merchant 2001) that sluicing (e.g. *John met a linguist, but I don't know who*) is **anaphora to issues** (in the sense that the issue raised by the antecedent clause has to be isomorphic to the issue raised by the sluiced clause), which inquisitive semantics (a close relative of the semantics here, see e.g. Groenendijk & Roelofsen 2009) models as *sets of alternatives*.
- If sluicing is anaphora to an issue and a sentence with two indefinites is *ambiguous* in its issue-raising potential, then we predict that sluices in cases where the antecedent clause has multiple indefinites will be ambiguous.

4 Note in this respect that if we treat wh-words as alternative generators (e.g. Hamblin 1973, Kratzer & Shimoyama 2002), we likewise predict their insensitivity to islands and derive the existence of higher-order questions.

- This is born out. The sluice in (51) 3-ways ambiguous. The *who* could target semanticists, phonologists, or both.[5,6]

(51) A semanticist recently wrote a paper with a morphologist, but I forget who. (3-ways ambiguous)

- Languages with richer case systems and multiple sluicing display the full paradigm. Here's a Hungarian example:

(52)
Valaki megvert valakit de nem tudom hogy {ki, kit, ki kit}.
someone up-beat someone-Acc but not know-1sg that=subord {who, whom, who whom}
'Someone beat someone up, but I don't know {who beat someone, who someone beat, who beat who}.'

- In essence, indefinites presuppose very little about the type of object they scope over (i.e. they're *polymorphic* on their scope). They just ask us to do whatever it is we were going to do anyway a number of times (one for each individual in the restrictor).
- If you were planning on returning a proposition and a stack, the indefinite asks you to do that a bunch of times. If you were planning on returning something fancier, i.e. with a higher-order alternative structure, the indefinite just asks you to do *that* a bunch of times.
- Importantly, universals (and static operators more generally) *don't* work that way since they actually care about the boolean values output by their scope. This means a universal can only ever return a $\boxed{t}$ and never a $\boxed{\boxed{t}}$.

8 Disjunction

- An indefinite-y treatment of disjunction has been motivated on independent and quite diverse grounds by Rooth & Partee (1982), Groenendijk & Stokhof (1991), Stone (1992), Alonso-Ovalle (2006), Charlow (2012).
- Here is our official semantics for disjunction, parallel to indefinites.

(53) $[\![\text{or}]\!] \coloneqq \lambda m n \kappa s.\, m\,\kappa\,s \cup n\,\kappa\,s$

(54) $\equiv \lambda m n \kappa s.\, \bigcup\{\mu\,\kappa\,s \mid \mu \in \{m,n\}\}$

- Gloss: both of these disjuncts wanna take scope. Ok, let them take scope in parallel and then collect the results.
- Thus a disjunction is just like an indefinite, but is restricted by the individual disjuncts. Disjoining (lifted) *Polly* and *Chris* will yield something equivalent to *someone who is John or Bill*.

(55)
$$\frac{\lambda s.\,\{\langle \mathsf{laughed\,p},\, s^{\mathsf{p}}\rangle,\, \langle \mathsf{laughed\,c},\, s^{\mathsf{c}}\rangle\}}{\text{Polly or Chris laughed}}$$

(56)
$$s \longrightarrow [\![\text{Polly or Chris laughed}]\!] \begin{cases} \langle \mathsf{laughed\,p},\, s^{\mathsf{p}}\rangle \\ \langle \mathsf{laughed\,c},\, s^{\mathsf{c}}\rangle \end{cases}$$

- Disjoining *likes John* and *hates Bill* will yield an indefinite-y VP-type meaning.

(57)
$$\frac{\lambda s.\,\{\langle \mathsf{likes\,j\,s},\, s^{\mathsf{sj}}\rangle,\, \langle \mathsf{hates\,b\,s},\, s^{\mathsf{sb}}\rangle\}}{\text{Steve likes John or hates Bill.}}$$

(58)
$$s \longrightarrow [\![\text{Steve likes John or hates Bill}]\!] \begin{cases} \langle \mathsf{likes\,j\,s},\, s^{\mathsf{sj}}\rangle \\ \langle \mathsf{hates\,b\,s},\, s^{\mathsf{sb}}\rangle \end{cases}$$

5 The last of these readings is potentially problematic for popular accounts of sluicing.
6 NB: something like ∃-closure over outputs can't be what distinguishes the relevant issues. Closure over outputs obliterates alternatives and should accordingly render anaphora to the closed-over issue impossible, contrary to fact:

i. A semanticist$_i$ recently wrote a paper with a morphologist$_j$, but I don't know who$_j$, or why he$_i$ thought it was a good idea.

- Because disjunction is externally dynamic in this way, the exceptional scope properties of disjunction are immediate (as is clause-bounded distributivity and feeding donkey anaphora). The disjunction will survive reset and is free to float away. Discourse anaphora to disjunction follows since disjunction does the same sort of work as an indefinite.
- But why can a disjunction be evaluated at a different place from its disjuncts? Whence the absence of roofing?
- The reason: disjunctions are indefinite-y things, but they differ crucially from indefinites in that they are *polymorphic on their restrictors* (i.e. not so picky about the types), as well as their scope. Polymorphism follows from the fact that disjunction is cross-categorial (cf. Barker 2002 for discussion of a similar point in re: conjunction).
- Thus, the effect of the disjunction can be on a different level from the effects associated with the things it disjoins:

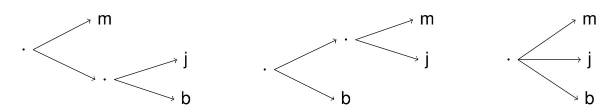
(59)
$$\left(\begin{array}{c} [\,] \\ \hline \textbf{a-maid}\,(\lambda x.[\,]) \\ \hline x \\ \text{a maid} \end{array} \quad \begin{array}{c} \\ \textbf{or} \\ \\ \text{or} \end{array} \quad \begin{array}{c} [\,] \\ \hline \textbf{a-cook}\,(\lambda x.[\,]) \\ \hline x \\ \text{a cook} \end{array}\right)$$

- Yields something like an indefinite whose restriction is *these towers*. Indefiniteness in effect lives on the third level, already out-scopes the quantifiers on the second levels!
- Since the issue contributed by the disjunction can take scope independently of the disjuncts, you correctly predict sluices to wide-scope disjunction with narrow-scoping disjuncts:

(60) Everyone ate a burger or a steak, but I can't remember which!

- Binding into disjuncts when disjunction scopes over the binder works the same. The stack sensitivity lives on the second level. The disjunction takes scope on the third level.
- Meanwhile, *exceptionally* scoping disjunction with narrow scoping disjuncts works analogously to the layered-alternatives account of how indefinites in a single clause can take differential scope with respect to operators outside the clause.
- As with indefinites, there's evidence for these higher-order issues (Anna Szabolcsi, p.c.):

(61) Mary or John or Bill stole my pencil. Steve knows which. (3-ways ambiguous)

(62)


- Again, a flat alternative won't get this ambiguity (on the assumption that the interpretation of the second clause stems from the issues generated by the first). For us this falls out immediately since disjunctions can scope at different levels.

9 Some other predictions

9.1 Surprising sloppy readings

- A standard (and extensively motivated) assumption in the literature on ellipsis is that sloppy pronouns have to be bound (e.g. Evans 1988, Rooth 1992, Takahashi & Fox 2005).
- Given this, a natural way to account for the (indicated) sloppy reading of (63) is to suppose that *Bill*^{j} donkey-binds the underbracketed elided sloppy pronoun *him*$_j$ (Tomioka 1999, Hardt 1999, Charlow 2012):

(63) The cop who arrested John^i insulted him$_i$.
The cop who arrested Bill^j didn't ~~insult him~~$_j$.
(after Wescoat 1989, as reported by Dalrymple et al. 1991)

- Yet donkey-binding of sloppy pronouns is not always straightforward to achieve. We can construct cases analogous to (63) but where the sloppy thing's antecedent is separated by a scope island from a position above a static operator, which should make the requisite binding impossible. See (64a). Cases (64b) and (64c) show that the phenomenon is totally cross-categorial.

(64) a. If everyone who despises Walt^i comes, I'll feel pretty bad for him$_i$.
If everyone who despises Pete$_j$ does ~~come~~, I won't ~~feel pretty bad for him$_j$~~.
b. If the professor thinks you'll do the reading, you don't need to ~~do the reading~~.
If she thinks you'll come to office hours, you do ~~need to come to office hours~~.
c. If everyone who likes coffee shows up, you'll need to brew some ~~coffee~~.
If everyone who likes tea does ~~show up~~, you won't ~~need to brew some tea~~.

- For us, these cases pose no problem. We predict that the discourse referent associated with e.g. a proper name (fudging a little on binding here) can take exceptional scope in exactly the same way as an indefinite since it survives reset. In fact, as with an indefinite, reset has no effect:

(65) $(\lambda \kappa s.\, \kappa\, (\mathsf{left\,j})\, (s \cdot \mathsf{j}))^{\downarrow\uparrow} \equiv \lambda \kappa s.\, \kappa\, (\mathsf{left\,j})\, (s \cdot \mathsf{j})$

- In other words, no matter how deeply embedded relative to some pronoun, an indefinite or a name can *always* bind it by taking exceptional scope over any static operators in its way. Picture that emerges is similar to that advocated by Safir (2004) (cf. also Fiengo & May 1994, Barker 2012): for dynamic meanings, **surface c-command has absolutely no role to play in constraining binding by externally dynamic things**.[7]

9.2 Maximal discourse reference

- Szabolcsi (2010) suggests that the existential scope of *universals* is unbounded; see (66a), whose first sentence naturally entails the existence of a set of all the first-years. But this actually seems to reflect a more general property of nominal restrictors, since the same holds of (66b).

(66) a. Nobody could possibly believe the rumor that every first-year$_i$ got an A in phonology.
b. Nobody could possibly believe the rumor that {more than three, fewer than five, several, exactly ten} first-years$_i$ got an A in phonology.

- Moreover, this exceptional scope-taking feeds maximal donkey anaphora. Any of (66b) can be continued with *they're all semanticists*, where *they* ranges over all the first-years.

- Unsurprising: the restrictor can be analyzed as externally dynamic, i.e. as giving rise to a discourse referent that takes exceptional scope in precisely the same way as a proper name's discourse referent. Reference to the restrictor is just discourse anaphora to the restrictor *qua* plural individual:

(67) $$\lambda \kappa s.\, \kappa\ \textsf{first-years}\ s^{\textsf{first-years}}$$

- Maximal discourse reference to the NP ∩ VP set, see (68), also has exceptional scope properties: it's possible to use a pronoun to refer back to a maximal discourse referent generated in a deeply embedded position, as in (69). There, the second sentence is readily interpreted as "the senators who admire Cruz are all very junior".

(68) Many senators admire Cruz, but they're all very junior.

(69) I very much doubt that many senators admire Cruz. Certainly, they're all very junior.

7 Modulo ruling out interpretations where a dependent item c-commands what it depends on. See Safir (2004).

- Also not so surprising. *Many senators* is externally dynamic in that it plops a plurality (≈ NP ∩ VP) onto the stack:

(70) $$\lambda \kappa s.\, \{\langle \textsf{many sens M},\, s^{\textsf{M}} \rangle\}$$
$$\text{where } \textsf{M} := \{x \mid \textsf{sen}\, x \wedge \exists s'.\, \langle \top, s' \rangle \in \kappa\, x\, s^x\}$$
many senators

(71) $$s \longrightarrow [\![\text{many sens admire Cruz}]\!] \longrightarrow \langle \textsf{many sens (admire c)},\, s^{\textsf{sen} \cap \textsf{admire c}} \rangle$$

- The quantificational force of *many* is still discharged on reset. Yet a discourse referent, notated 'M', does survive. Post-reset, it's free to take exceptional scope in the same way as indefinites and the discourse referents induced by proper names and restrictors.[8]

10 Discussion

10.1 Virtues of the proposal

- Explains exceptional scope in terms of independently motivated properties of lexical entries (namely their anaphoric character). Or if you prefer, you can read that as a vice versa.
- Because we analyze all scope-taking as bona fide scope-taking, we explain why the indefinite's restrictor *can* be evaluated at the indefinite's scope position, thus why you can feed donkey anaphora.
- Explains why restrictor sometimes *must* be evaluated at scope position (roofing effects with indefinite DPs), and sometimes needn't be (lack of roofing effects with disjunctions). Scope is scope, and disjunctions are polymorphic.
- By contrast, the usual way to theorize about exceptional scope is in terms of pseudo-scope (e.g. Kratzer 1998, Schwarzschild 2002) or alternative mechanisms for scope-taking (e.g. Reinhart 1997, Winter 1997, Kratzer & Shimoyama 2002, Brasoveanu & Farkas 2011).
- Those accounts don't explain why restrictors can be evaluated at the indefinite's scope, why they must in certain cases, or how disjunction differs, and for these reasons make a number of problematic empirical predictions (e.g. Geurts 2000, Schwarz 2001, Shan 2004).
- Predicts a range of unexpected but attested scope-taking.

10.2 Modularity

- Our choice of a trivial κ, namely $\lambda a s.\, \{\langle a, s \rangle\}$, enabled us to formulate a reset that discarded neither the proposition nor the stack. But other options are conceivable.
- Here again is the derived meaning for *Polly met a linguist*:

(72) $$\lambda \kappa s.\, \bigcup\{\kappa\, (\textsf{met}\, x\, \textsf{p})\, s^x \mid \textsf{linguist}\, x\}$$

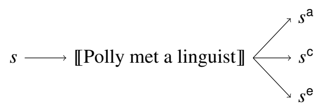
- Option one: κ takes a proposition and a stack and returns the stack (wrapped up in a set) only if the first is true. This gives

8 Note that any conversational context that fails to entail that there are senators who admire Cruz will cause M to be empty at some possibilities and lead to presupposition failure. This seems like a reasonable prediction.

us sets of **stacks** à la DyS. (In our model the Polly-met linguists are a, c, and e.)

(73) $\lambda as.\{s\}$ if a, $\{\}$ otherwise

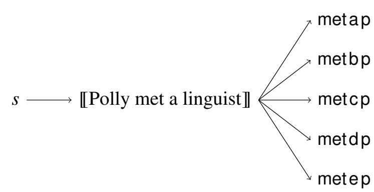
$\rightsquigarrow \lambda s.\{s^x \mid \text{linguist}\, x \wedge \text{met}\, x\, \text{p}\}$



- Option two: κ takes a proposition and a stack and discards the stack. This gives us sets of **propositions** à la alternative/inquisitive semantics (Hamblin 1973, Kratzer & Shimoyama 2002, Mascarenhas 2009, Groenendijk & Roelofsen 2009):

(74) $\lambda as.\{a\}$

$\rightsquigarrow \lambda s.\{\text{met}\, x\, \text{p} \mid \text{linguist}\, x\}$



- Thus our choice of κ (outputting sets of **proposition-stack pairs**) properly *subsumes* both dynamic and alternative semantics. Allows us to bring an expression's anaphoric potential, issue-raising potential, and exceptional scope profile under one umbrella.

10.3 Summing up and future directions

- What have I assumed? Very little: took a minimal dynamic interpretation scheme and added scope-taking via continuations (something everybody needs), and a proposal for scope islands (ditto). But not nothing: there's other forms lowering could take, as we saw in Section 10.2.
- One alternative lowering rule yields DyS and sacrifices exceptional scope. The other yields alternative semantics and sacrifices discourse anaphora.
- I say: why choose? The benefits include empirical robustness, and unifying alternatives-based and dynamic semantics into a single interpretation scheme with the best of both.
- The account enables us to *derive* the exceptional scope properties of indefinites and disjunction from independently motivated pieces, as well as how indefinites and disjunctions differ from each other.
- The continuations-based technique for modularizing a dynamic semantics is, I think, independently interesting: starting with some static lexical entries and a meaning for the indefinite, we can end up either with dynamic semantics, alternative semantics, or the system I propose, all depending on the way we choose to evaluate.
- Though I used a minimal Dekker (1993)-style semantics for indefinite DPs, my proposal is compatible with wide range of assumptions about dynamic interpretation—from Heim (1982) and Groenendijk & Stokhof (1991) to Muskens (1996), van den Berg (1996), Bittner (2001), and Brasoveanu (2007)—so long as they agree that the semantic reflex of indefiniteness is indeterminacy (i.e. sets).

- There is a very real sense in which exceptional scope is due not to the *indefinite* taking scope, but to the indefinite-hosting island *itself* taking scope (remember what I said about the bottom level of a tower being like a trace). Similar proposals have been made for apparent non-locality in wh-quantification (e.g. Dayal 1996, 2002, Moltmann & Szabolcsi 1994, Krifka 2001). In other words, the indefinite/wh-word interacts with higher elements, but the way this happens is *indirect*, mediated by the island. This connection should be explored further.
- Indefinites and disjunctions generate alternatives, and the grammar lets the alternatives *take scope*. This picture of how the grammar manages alternatives should readily extend to other domains, i.e. association with focus and neo-Gricean theories of scalar implicature. It remains to be seen if this extension has any empirical content.

References

Abusch, Dorit. 1994. The scope of indefinites. *Natural Language Semantics* 2(2). 83–135. http://dx.doi.org/10.1007/BF01250400.

Alonso-Ovalle, Luis. 2006. *Disjunction in Alternative Semantics*: University of Massachusetts, Amherst Ph.D. thesis.

AnderBois, Scott. 2010. Sluicing as Anaphora to Issues. In Nan Li & David Lutz (eds.), *Proceedings of Semantics and Linguistic Theory 20*, 451–470. Ithaca, NY: Cornell University.

Barker, Chris. 2002. Continuations and the Nature of Quantification. *Natural Language Semantics* 10(3). 211–242. http://dx.doi.org/10.1023/A:1022183511876.

Barker, Chris. 2012. Quantificational Binding Does Not Require C-Command. *Linguistic Inquiry* 43(4). 614–633. http://dx.doi.org/doi:10.1162/ling_a_00108.

Barros, Matthew. 2013. Harmonic sluicing: Which remnant/correlate pairs work and why. In Todd Snider (ed.), *Proceedings of Semantics and Linguistic Theory 23*, 295–315.

van den Berg, Martin H. 1996. *Some aspects of the internal structure of discourse. The dynamics of nominal anaphora*: University of Amsterdam Ph.D. thesis.

Bittner, Maria. 2001. Surface Composition as Bridging. *Journal of Semantics* 18(2). 127–177. http://dx.doi.org/10.1093/jos/18.2.127.

Brasoveanu, Adrian. 2007. *Structured nominal and modal reference*: Rutgers University Ph.D. thesis.

Brasoveanu, Adrian & Donka F. Farkas. 2011. How indefinites choose their scope. *Linguistics and Philosophy* 34(1). 1–55. http://dx.doi.org/10.1007/s10988-011-9092-7.

Cecchetto, Carlo. 2004. Explaining the locality conditions of QR: Consequences for the theory of phases. *Natural Language Semantics* 12(4). 345–397. http://dx.doi.org/10.1007/s11050-004-1189-x.

Charlow, Simon. 2012. Cross-Categorial Donkeys. In Maria Aloni, Vadim Kimmelman, Floris Roelofsen, Galit W. Sassoon, Katrin Schulz & Matthijs Westera (eds.), *Logic, Language and Meaning*, vol. 7218 Lecture Notes in Computer Science, 261–270. Springer Berlin Heidelberg. http://dx.doi.org/10.1007/978-3-642-31482-7_27.

Chierchia, Gennaro. 2001. A Puzzle about Indefinites. In Carlo Cecchetto, Gennaro Chierchia & Maria Teresa Guasti (eds.), *Semantic Interfaces: Reference, Anaphora, and Aspect*, Stanford: CSLI Publications.

Chomsky, Noam. 2008. On phases. In Robert Freidin, Carlos Otero & Maria-Luisa Zubizaretta (eds.), *Foundational Issues in Linguistic Theory*, 133–166. Cambridge, MA: MIT Press.

Chung, Sandra, William A. Ladusaw & James McCloskey. 1995. Sluicing and logical form. *Natural Language Semantics* 3(3). 239–282. http://dx.doi.org/10.1007/BF01248819.

Cooper, Robin. 1983. *Quantification and syntactic theory*. Dordrecht: Springer Science+Business Media.

Dalrymple, Mary, Stuart M. Shieber & Fernando C. N. Pereira. 1991. Ellipsis and higher-order unification. *Linguistics and Philosophy* 14(4). 399–452. http://dx.doi.org/10.1007/BF00630923.

Danvy, Olivier & Andrzej Filinski. 1990. Abstracting control. In *Proceedings of the 1990 ACM conference on Lisp and functional programming*, 151–160. New York: ACM Press.

Dayal, Veneeta. 1996. *Locality in Wh quantification*. Dordrecht: Springer Science+Business Media.

Dayal, Veneeta. 2002. Single-pair versus multiple-pair answers: Wh-in-situ and scope. *Linguistic Inquiry* 33(3). 512–520. http://dx.doi.org/10.1162/ling.2002.33.3.512.

Dekker, Paul. 1993. *Transsentential meditations: ups and downs in dynamic semantics*: University of Amsterdam Ph.D. thesis.

Evans, Frederic. 1988. Binding into Anaphoric Verb Phrases. In Joyce Powers & Kenneth de Jong (eds.), *Proceedings of the 5th Annual Eastern States Conference on Linguistics*, 122–129. ESCOL Publications Committee: Linguistics Department, The Ohio State University.

Farkas, Donka F. 1981. Quantifier scope and syntactic islands. In Roberta Hendrick, Carrie Masek & Mary Frances Miller (eds.), *Papers from the Seventh Regional Meeting, Chicago Linguistic Society*, 59–66. Chicago, IL: CLS.

Fiengo, Robert & Robert May. 1994. *Indices and Identity*. Cambridge, MA: MIT Press.

von Fintel, Kai. 2000. Singleton Indefinites (re. Schwarzschild 2000). MIT Syntax-Semantics Reading Group Talk.
Fodor, Janet Dean. 1970. *The Linguistic Description of Opaque Contexts*: MIT Ph.D. thesis.
Fodor, Janet Dean & Ivan A. Sag. 1982. Referential and quantificational indefinites. *Linguistics and Philosophy* 5(3). 355–398. http://dx.doi.org/10.1007/BF00351459.
Fox, Danny. 2012. Lectures on the semantics of questions. Unpublished lecture notes, MIT.
Geach, Peter. 1962. *Reference and Generality*. Ithaca, NY: Cornell University Press.
Geurts, Bart. 2000. Indefinites and Choice Functions. *Linguistic Inquiry* 31(4). 731–738. http://dx.doi.org/10.1162/002438900554550.
Groenendijk, Jeroen & Floris Roelofsen. 2009. Inquisitive Semantics and Pragmatics. In Jesus M. Larrazabal & Laraitz Zubeldia (eds.), *Meaning, Content, and Argument: Proceedings of the ILCLI International Workshop on Semantics, Pragmatics, and Rhetoric*, Bilbao: University of the Basque Country Press.
Groenendijk, Jeroen & Martin Stokhof. 1990. Dynamic Montague Grammar. In Laszlo Kalman & Laszlo Polos (eds.), *Proceedings of the Second Symposium on Logic and Language*, 3–48. Budapest: Eötvös Loránd University Press.
Groenendijk, Jeroen & Martin Stokhof. 1991. Dynamic predicate logic. *Linguistics and Philosophy* 14(1). 39–100. http://dx.doi.org/10.1007/BF00628304.
Hamblin, C. L. 1973. Questions in Montague English. *Foundations of Language* 10(1). 41–53.
Hardt, Daniel. 1999. Dynamic Interpretation of Verb Phrase Ellipsis. *Linguistics and Philosophy* 22. 187–221.
Heim, Irene. 1982. *The Semantics of Definite and Indefinite Noun Phrases*: University of Massachusetts, Amherst Ph.D. thesis.
Hendriks, Herman. 1993. *Studied Flexibility: Categories and Types in Syntax and Semantics*: University of Amsterdam Ph.D. thesis.
Kamp, Hans. 1981. A theory of truth and semantic interpretation. In Jeroen Groenendijk, Theo Janssen & Martin Stokhof (eds.), *Formal Methods in the Study of Language*, 277–322. Mathematical Centre Amsterdam.
Kamp, Hans & Uwe Reyle. 1993. *From Discourse to Logic*. Dordrecht: Kluwer Academic Publishers.
Kratzer, Angelika. 1998. Scope or pseudoscope? Are there wide scope indefinites? In Susan Rothstein (ed.), *Events and Grammar*, 163–196. Dordrecht: Kluwer Academic Publishers.
Kratzer, Angelika & Junko Shimoyama. 2002. Indeterminate Pronouns: The View from Japanese. In Yukio Otsu (ed.), *Proceedings of the Third Tokyo Conference on Psycholinguistics*, 1–25. Tokyo: Hituzi Syobo.
Krifka, Manfred. 2001. Quantifying into Question Acts. *Natural Language Semantics* 9(1). 1–40. http://dx.doi.org/10.1023/A:1017903702063.
Mascarenhas, Salvador. 2009. *Inquisitive semantics and logic*: University of Amsterdam M.Sc. thesis.
Merchant, Jason. 2001. *The Syntax of Silence: Sluicing, Islands, and the Theory of Ellipsis*. Oxford: Oxford University Press.
Moltmann, Friederike & Anna Szabolcsi. 1994. Scope Interactions with Pair-List Quantifiers. In Merce Gonzalez (ed.), *Proceedings of the North East Linguistic Society 24*, 381–395. Amherst, MA: GLSA.
Montague, Richard. 1974. The proper treatment of quantification in ordinary English. In Richmond Thomason (ed.), *Formal Philosophy*, 247–270. New Haven: Yale University Press.
Muskens, Reinhard. 1996. Combining Montague semantics and discourse representation. *Linguistics and Philosophy* 19(2). 143–186. http://dx.doi.org/10.1007/BF00635836.
Nouwen, Rick. 2003. Complement Anaphora and Interpretation. *Journal of Semantics* 20(1). 73–113. http://dx.doi.org/10.1093/jos/20.1.73.
Partee, Barbara & Mats Rooth. 1983. Generalized conjunction and type ambiguity. In Rainer Bäuerle, Christoph Schwarze & Arnim von Stechow (eds.), *Meaning, Use and Interpretation of Language*, Berlin: Walter de Gruyter.
Partee, Barbara H. 1986. Noun Phrase Interpretation and Type-shifting Principles. In Jeroen Groenendijk, Dick de Jongh & Martin Stokhof (eds.), *Studies in Discourse Representation Theory and the Theory of Generalized Quantifiers*, 115–143. Dordrecht: Foris.
Reinhart, Tanya. 1997. Quantifier Scope: How labor is Divided Between QR and Choice Functions. *Linguistics and Philosophy* 20(4). 335–397. http://dx.doi.org/10.1023/A:1005349801431.
Rooth, Mats. 1992. Ellipsis redundancy and reduction redundancy. In Steven Berman & Arild Hestvik (eds.), *Proceedings of the Stuttgart Workshop on Ellipsis,* no. 29 in Arbeitspapiere des SFB 340, Stuttgart: University of Stuttgart.
Rooth, Mats & Barbara H. Partee. 1982. Conjunction, type ambiguity, and wide scope 'or'. In Daniel P. Flickinger, Marlys Macken & Nancy Wiegand (eds.), *Proceedings of the First West Coast Conference on Formal Linguistics*, 353–362. Stanford: Stanford Linguistics Association.
Ruys, Eddy. 1992. *The Scope of Indefinites*: OTS, University of Utrecht Ph.D. thesis.
Safir, Ken. 2004. *The Syntax of (In)dependence*. Cambridge, MA: MIT Press.
Schlenker, Philippe. 2006. Scopal Independence: A Note on Branching and Wide Scope Readings of Indefinites and Disjunctions. *Journal of Semantics* 23(3). 281–314. http://dx.doi.org/10.1093/jos/ffl005.
Schwarz, Bernhard. 2001. Two kinds of long-distance indefinites. In Robert van Rooy & Martin Stokhof (eds.), *Proceedings of the Thirteenth Amsterdam Colloquium*, 192–197. University of Amsterdam.

Schwarzschild, Roger. 2002. Singleton Indefinites. *Journal of Semantics* 19(3). 289–314. http://dx.doi.org/10.1093/jos/19.3.289.
Shan, Chung-chieh. 2004. Binding alongside Hamblin alternatives calls for variable-free semantics. In Kazuha Watanabe & Robert B. Young (eds.), *Proceedings of Semantics and Linguistic Theory 14*, 289–304. Ithaca, NY: Cornell University.
Shan, Chung-chieh & Chris Barker. 2006. Explaining Crossover and Superiority as Left-to-Right Evaluation. *Linguistics and Philosophy* 29. 91–134.
Shimoyama, Junko. 2006. Indeterminate Phrase Quantification in Japanese. *Natural Language Semantics* 14(2). 139–173. http://dx.doi.org/10.1007/s11050-006-0001-5.
Stone, Matthew D. 1992. *Or* and anaphora. In Chris Barker & David Dowty (eds.), *Proceedings of Semantics and Linguistic Theory 2*, 367–385. Columbus: Ohio State Department of Linguistics.
Szabolcsi, Anna. 2010. *Quantification*. New York: Cambridge University Press.
Takahashi, Shoichi & Danny Fox. 2005. MaxElide and the re-binding problem. In Effi Georgala & Jonathan Howell (eds.), *Proceedings of Semantics and Linguistic Theory 15*, 223–240. Ithaca, NY: Cornell University.
Tomioka, Satoshi. 1999. A sloppy identity puzzle. *Natural Language Semantics* 7(2). 217–241. http://dx.doi.org/10.1023/A:1008309217917.
Wadler, Philip. 1994. Monads and composable continuations. *Lisp and Symbolic Computation* 7(1). 39–56. http://dx.doi.org/10.1007/BF01019944.
Wescoat, Michael. 1989. Sloppy Readings with Embedded Antecedents. Unpublished ms., Stanford University.
Winter, Yoad. 1997. Choice Functions and the Scopal Semantics of Indefinites. *Linguistics and Philosophy* 20(4). 399–467. http://dx.doi.org/10.1023/A:1005354323136.