# The grammar of exceptional scope

Simon Charlow

Rutgers, The State University of New Jersey

Maryland Linguistics Colloquium · November 20, 2015

[slides at tiny.cc/ges-umd]

# Goals for today

- A general theory of the **exceptional scope** (i.e., island-escaping) behavior of indefinites, focus, *wh*-in-situ.
- Based on a new kind of **alternative semantics**, where alternatives interact with their semantic context by **taking scope**.
- I'll argue that we should prefer this kind of approach to standard varieties of alternative semantics:
  - More compositional
  - Better predictions when multiple sources of alternatives
  - A more robust treatment of binding
  - Super modular, extensible (e.g., if we have time, to dynamics)

# More generally

- Someday, you might find yourself faced with a dilemma.
- You have a meat-and-potatoes semantics—maybe Fregean, maybe Neo-Davidsonian—but you decide you need some fancy stuff:
  - Alternatives
  - Intensionality
  - Dynamics
  - 2-dimensionality
  - ...
- Turns out the fanciness and the M&P don't play nice. Your choice:
  - Should you rewrite the meat-and-potatoes grammar wholeseale (i.e., specify a new lexicon and new semantics for combination)?
  - Or should you try to grease the skids?
- This talk: why you should choose door #2.

# Where we are

# Where we are

# Some data

- Each of the following can be interpreted in a way that gives the **bolded** thing apparent scope outside a syntactic ⟨island⟩.

(1) If ⟨**a rich relative of mine** dies⟩, I'll inherit a house. (∃ > if)

(2) I only complain when ⟨**BILL** leaves the lights on⟩.

(3) Taro-wa ⟨**dare**-ga katta mochi-o⟩ tabemasita ka?
Taro-TOP who-NOM bought rice cake-ACC ate Q
'Who is the x such that Taro ate rice cakes that x bought?'

[Examples after Reinhart 1997; Rooth 1996; Kratzer & Shimoyama 2002]

# What we might hope for

- Rooth (1985, 1992, 1996) developed a theory that countenanced island-sensitivity for focus (more on that shortly).
- However:

> The group of island-escaping operators does not appear to be an arbitrary one.... [Their] semantic similarity, together with the common insensitivity to scope islands, suggest that we should not be satisfied with a theory which treats focus as sui generis. (Rooth 1996)

- To date, hasn't happened:
  - Extant accounts are piecemeal accounts.
  - Even so, they over- and/or under- generate for their more narrowly construed empirical domains.

# Where we are

- Islands and alternatives
  - Exceptional scope
  - Standard alternative semantics
- Proposal: alternatives take scope
  - Basic pieces
  - Deriving exceptional scope
- Why scope?
  - Compositionality
  - Selectivity
  - Binding
- Horizons
  - Dynamics
  - Concluding

# Alternative semantics

- Some expressions introduce alternatives into the semantics, causing us to calculate a number of meanings in parallel.
- E.g., indefinites might be taken to denote **sets of individuals**:

$$[\![\text{a linguist}]\!]^g = \{x \mid \textsc{ling}\, x\}$$

- Cf. the standard generalized-quantifier semantics:

$$[\![\text{a linguist}]\!]^g = \lambda\kappa.\, \exists x.\, \textsc{ling}\, x \wedge \kappa\, x$$

# Composing alternatives

- **Compositional challenge:** $[\![\text{a linguist}]\!]^g$ is type $e \to t$, but occurs in places where something of type $e$ standardly expected.
- The usual way to go: first, suppose that **everything** denotes a set:

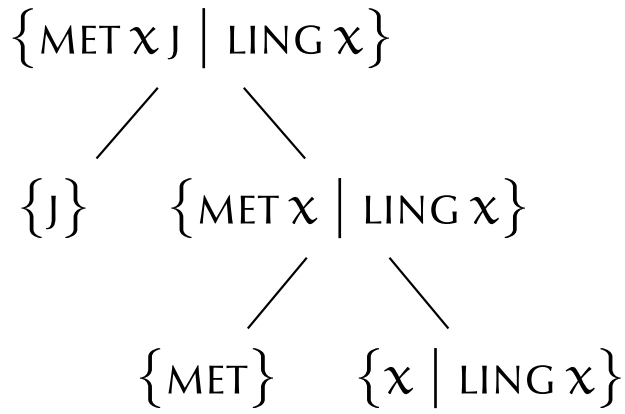
$$[\![\text{John}]\!]^g = \{\text{J}\} \qquad [\![\text{met}]\!]^g = \{\text{MET}\} \qquad [\![\text{a ling}]\!]^g = \{x \mid \text{LING}\, x\}$$

- Then, to compose these sets, use *point-wise* functional application (**PWFA**) (e.g. Hamblin 1973; Rooth 1985):

$$[\![\text{A B}]\!]^g = \{f\, x \mid f \in [\![\text{A}]\!]^g \wedge x \in [\![\text{B}]\!]^g\}$$

# An example

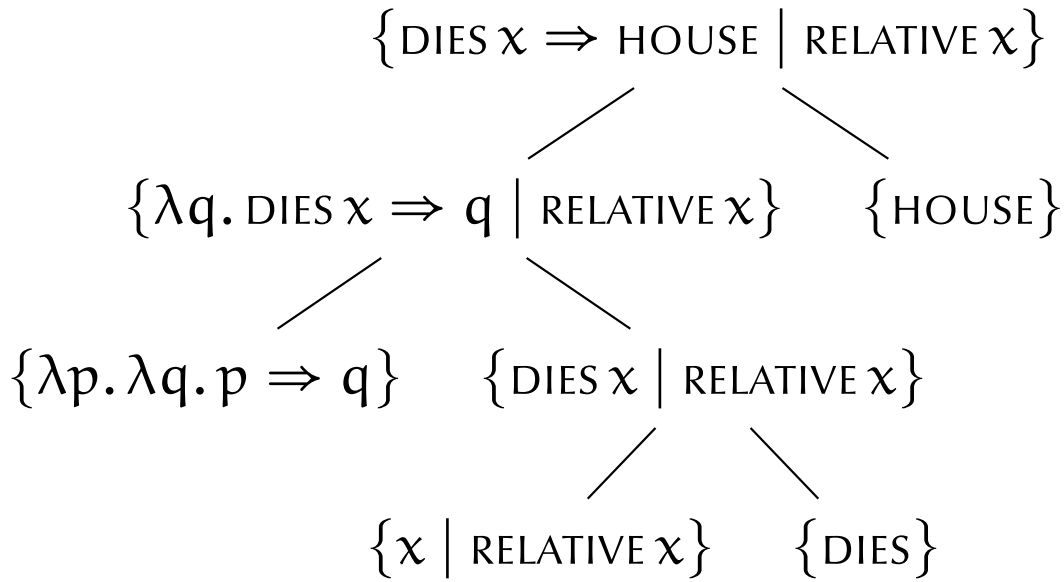
- A basic example, *John met a linguist*:




- As we climb the tree, the alternatives **expand**, eventually yielding a set of propositions, **one per linguist**.

# Getting traction on island-insensitivity

- Island-insensitivity is a **consequence of PWFA**. Here's an alternatives-based derivation of the *relative-of-mine* conditional:




- The indefinite acquires a kind of "scope" over the conditional, yielding various conditional propositions "about" various relatives.

# Where we are

- Islands and alternatives
  - Exceptional scope
  - Standard alternative semantics
- Proposal: alternatives take scope
  - Basic pieces
  - Deriving exceptional scope
- Why scope?
  - Compositionality
  - Selectivity
  - Binding
- Horizons
  - Dynamics
  - Concluding

# Where we are

# Proposal summarized

- In general, when we posit enriched meanings (e.g., sets of alternatives), we have a choice:
  - A fancier lexicon, enriched modes of composition (i.e., PWFA).
  - Greasing the skids some other way.
- My proposal: door #2. **No** PWFA, **no** ubiquitous lexical sets.
- Reframe (and *generalize*) the compositional issue to a problem of integrating **fancy** things (e.g., things that denote sets) with **boring** things (e.g., things that do not).
- Resolve the type mismatch introduced by a set of alternatives by **scoping it** (cf. quantifiers in object position).

# Greasing the skids

- All this requires is a couple **type-shifters**.
- First, $\boxed{\cdot}$ turns a boring thing into a (minimally) fancy thing:

$$\boxed{x} := \{x\}$$

- Second: $\cdot^\star$ turns a set $\mathfrak{m}$ into a scope-taker by feeding each member of $\mathfrak{m}$ to a scope $\kappa$ and unioning the resulting sets.

$$\mathfrak{m}^\star := \lambda\kappa.\bigcup_{x \in \mathfrak{m}} \kappa\, x$$

- $\boxed{\cdot}$ and $\cdot^\star$ entail PWFA:

$$\mathfrak{m}^\star\left(\lambda f.\, \mathfrak{n}^\star\left(\lambda x.\boxed{f\, x}\right)\right) = \{f\, x \mid f \in \mathfrak{m} \wedge x \in \mathfrak{n}\}$$

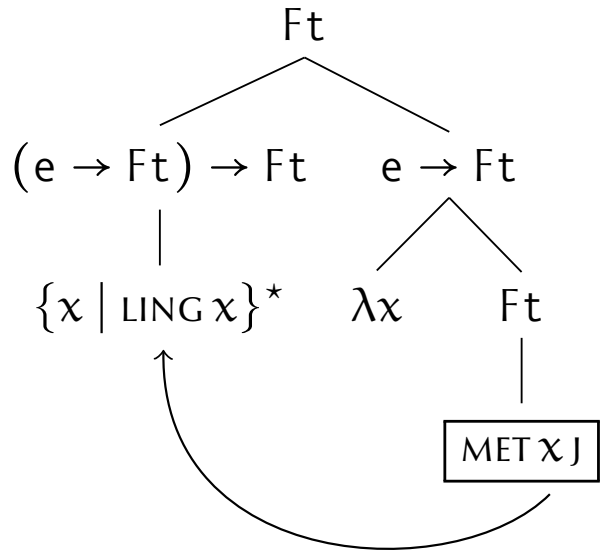
# Fancy, boring types

- Typing judgments, where $F\tau$ should be read as "a fancy $\tau$". In this case, a fancy $\tau$ is simply a set of $\tau$'s, so $F\tau ::= \{\tau\} ::= \tau \to t$:

$$\boxdot :: \tau \to F\tau \qquad \cdot^{\star} :: \underbrace{F\tau}_{\text{alternative generator}} \to \overbrace{(\tau \to F\sigma)}^{\text{scope}} \to \underbrace{F\sigma}_{\text{result}}$$

# An example

- An example of how this works to derive the same result as PWFA for *John met a linguist*:




- Gives the expected set of propositions, about different linguists:

$$\{\text{MET } x \text{ J} \mid \text{LING } x\}$$

- This pattern will be repeated time and again. The alternative generator takes scope via $\cdot^\star$, and $\boxdot$ applies to its remnant.

# Multiple alternative generators

- Cases with multiple sources of alternatives such as *a linguist met a philosopher* require two applications of $\cdot^\star$, and two scopings:

$$\textbf{A-LING}^\star\left(\lambda x.\,\textbf{A-PHIL}^\star\left(\lambda y.\,\boxed{\textsc{met}\,y\,x}\right)\right)$$
$$= \left\{\textsc{met}\,y\,x \mid \textsc{ling}\,x \wedge \textsc{phil}\,y\right\}$$

- This is the same result PWFA would give.

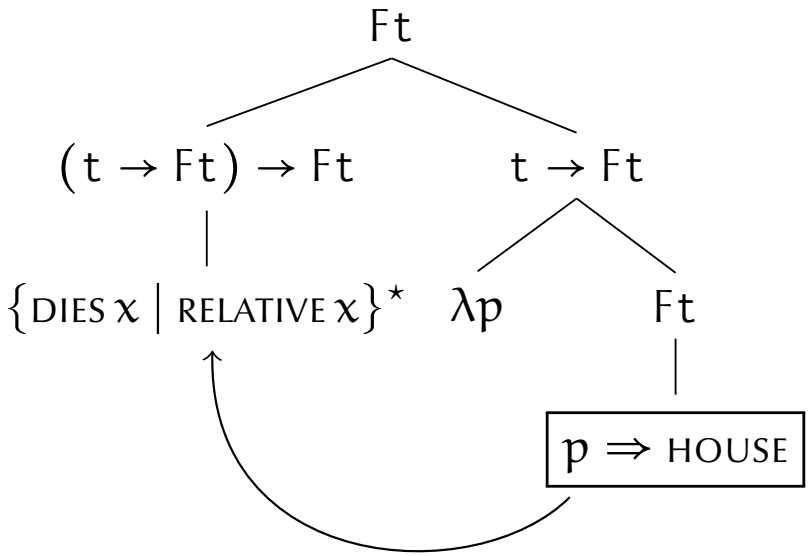
# Where we are

# Exceptional scope?

- Since we manage alternatives via scope, it may appear as if we have given up an account of exceptional scope-taking:

  (4) If ⟨**a rich relative of mine** dies⟩, I'll inherit a house.

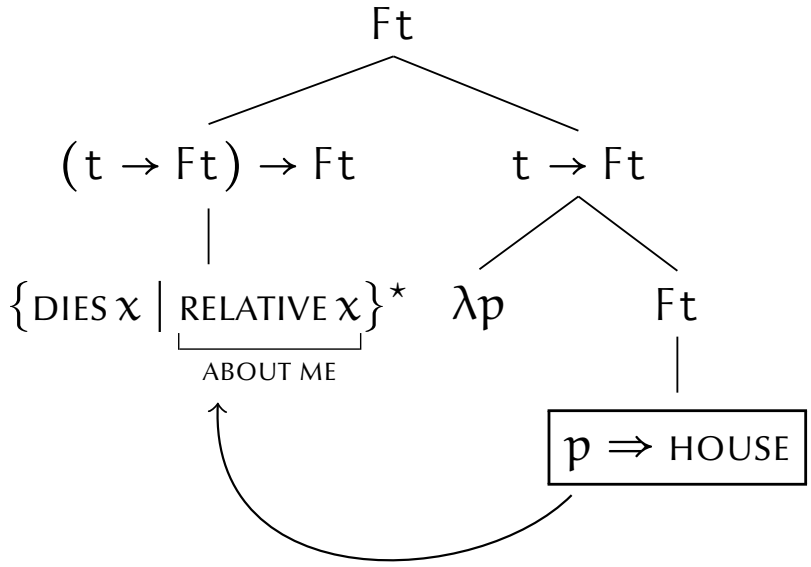
- In fact, this is not so! The grammar generates an exceptional scope reading for this case by *scoping the island*:




- The result is the same set of alternatives derived by PWFA:

$$\{\text{DIES}\,x \Rightarrow \text{HOUSE} \mid \text{RELATIVE}\,x\}$$

# Why does this work?




- The alternativeness induced by the indefinite is inherited by the island, and then transmitted to the conditional via $\cdot^\star$.
- In other words, the island is "about" relatives in **the same way** as the indefinite! $\cdot^\star$ simply passes this aboutness to the conditional.
- So we explain exceptional scope as the result of **LF pied-piping** (Nishigauchi 1990; von Stechow 1996): movement of the island gives the appearance of exceptional scope for things on the island.

# Antecedents

- These shifters are already familiar!
- $\boxdot$ is Karttunen 1977's $C_o$, aka Partee 1986's IDENT.
- $\{x \mid \textsc{ling}\, x\}^\star = \lambda\kappa.\bigcup_{\textsc{ling}\, x} \kappa\, x$ is the meaning Cresti 1995 assigns to *which linguist* (see also Heim 2000; Ciardelli & Roelofsen 2015).
  - But none of these folks factor out $\cdot^\star$ separately.

# The Monad Slide

- $\boxed{\cdot}$ and $\cdot^\star$ are decompositions of LIFT (e.g. Partee 1986):

$$\boxed{x}^\star = \text{LIFT}\, x = \lambda\kappa.\, \kappa\, x$$

- They also form something known in category theory & computer science as a **monad** (e.g. Moggi 1989; Wadler 1992, 1995).
  - In general, monads are *really* good at allowing (arbitrarily) fancy things to interact with boring things.
  - See e.g. Shan 2002; Giorgolo & Asudeh 2012; Unger 2012; Charlow 2014 for discussions of monads in natural language semantics.

# Where we are

Islands and alternatives

- Exceptional scope
- Standard alternative semantics

Proposal: alternatives take scope

- Basic pieces
- Deriving exceptional scope

Why scope?

- Compositionality
- Selectivity
- Binding

Horizons

- Dynamics
- Concluding

# Where we are

# Getting closure

- We can define a categorematic **closure** operation to extract a truth-condition from a set of propositions:

$$!\mathfrak{m} \coloneqq \exists \mathfrak{p} \in \mathfrak{m}.\, \mathfrak{p}$$

- For example, applying ! to what we obtained for *a linguist met a philosopher* yields:

$$\exists \mathfrak{x}.\, \textsc{ling}\, \mathfrak{x} \wedge \exists \mathfrak{y}.\, \textsc{phil}\, \mathfrak{y} \wedge \textsc{met}\, \mathfrak{y}\, \mathfrak{x}$$

# Compositionality (YMMV)

- PWFA-based grammars rely on syncategorematic rules for closure operations (see e.g. Rooth 1992; Kratzer & Shimoyama 2002):

$$[\![!X]\!]^g_{\text{PWFA}} := \{\exists p \in [\![X]\!]^g . p\}$$

- The reason: PWFA-style grammars are simply *built to point-wise compose sets*. If ever you want to do anything else (like quantify over a set), you need a new composition rule.
  - Cf. Simons 2005; Rooth & Dong 2011.

# Where we are

- Islands and alternatives
  - Exceptional scope
  - Standard alternative semantics
- Proposal: alternatives take scope
  - Basic pieces
  - Deriving exceptional scope
- Why scope?
  - Compositionality
  - Selectivity
  - Binding
- Horizons
  - Dynamics
  - Concluding

# Selective exceptional scope for indefinites

- Datum: indefinites can take *selective* scope outside islands. E.g., the following allows an any-old-lawyer, one-rich-relative reading:

  (5) If ⟨**a good lawyer** visits **a relative of mine**⟩, I'll get a house!

- The reading of interest, truth-conditionally:

$$\exists y.\ \textsc{relative}\ y \wedge \Big( \big( \exists x.\ \textsc{lawyer}\ x \wedge \textsc{visits}\ y\ x \big) \Rightarrow \textsc{house} \Big)$$

# Selective exceptional scope for *wh*-in-situ

- It's possible for a *wh*-island-bound in-situ *wh* to take matrix scope, even as its island-mate takes local scope (Baker 1970):

  (6) *What do you know ⟨who bought _⟩?

  (7) Who knows ⟨who bought what⟩?

  *A knows who bought X, B knows who bought Y, ...*

- Possible even in *wh*-in-situ languages with otherwise robust *wh*-island effects (Dayal 1996; Nishigauchi 1999). E.g., Japanese:

  (8) Dare-ga ⟨Mary-ga doko-de nani-o katta ka⟩ sitte imasu ka?
  who-NOM Mary-NOM where-at what-ACC bought KA know be-HON KA
  'Who knows where Mary bought what?'

# Selective exceptional scope for focus

- A closely related case in the domain of focus interpretation (cf. examples in Rooth 1996; Wold 1996; Beck 2006; Krifka 2006):

(9) A: [John only gripes ⟨when MARY leaves lights on⟩]$_3$.
B: No, $C_3$ ~ [he only gripes ⟨when SUE leaves lights on⟩].

# Selectivity and PWFA

- Circling back to the multiple-indefinites example:

  (5) If ⟨**a good lawyer** visits **a relative of mine**⟩, I'll get a house!

- PWFA has a problem. It doesn't do selective scope-taking, since it only generates **flat** alternative sets.example:

$$[\![\langle \cdots \rangle]\!]^{g}_{\text{PWFA}} = \{\textsc{visits}\ y\ x \mid \textsc{lawyer}\ x \wedge \textsc{relative}\ y\}$$

- Using this set, there's no way to give one indefinite scope over the conditional without bringing the other along for the ride.[1]

[1] Though you *could* posit an existential closure operator somewhere inside the island in (5), this isn't a general solution.

- Considering examples like these, Rooth concludes:

> [Their] theoretical imact is quite dramatic: the recursive definition of alternatives [SC: i.e. PWFA-based semantics] has no advantage over the scoping approach to the logical form of focus. (Rooth 1996)

# How about our theory?

- It might seem that we're similarly out of luck.
- Suppose we derived a meaning for *a persuasive lawyer visits a relative of mine* along these lines:

$$\textsc{a-relative}^{\star}\left(\lambda y.\,\textsc{a-lawyer}^{\star}\left(\lambda x.\,\boxed{\textsc{visits}\,y\,x}\right)\right)$$
$$= \left\{\textsc{visits}\,y\,x \mid \textsc{lawyer}\,x \wedge \textsc{relative}\,y\right\}$$

- But LF pied-piping this meaning over the conditional gives **both** indefinites widest scope!

$$\left\{\textsc{visits}\,y\,x \mid \textsc{lawyer}\,x \wedge \textsc{relative}\,y\right\}^{\star}\left(\lambda p.\,\ldots \Rightarrow \ldots\right)$$

# Selectivity lurks

- However! An alternative derivation for the island lurks.

$$\textsc{a.relative}^{\star}\left(\lambda y.\ \boxed{\textsc{a.lawyer}^{\star}\ (\lambda x.\ \boxed{\textsc{visits}\ y\ x}\ )}\right)$$

- The key bit is the extra $\boxed{\cdot}$. This gives rise to a *higher-order* alternative set, type $\mathrm{FFt}$ (cf. e.g. Dayal 1996, 2002; Fox 2012):

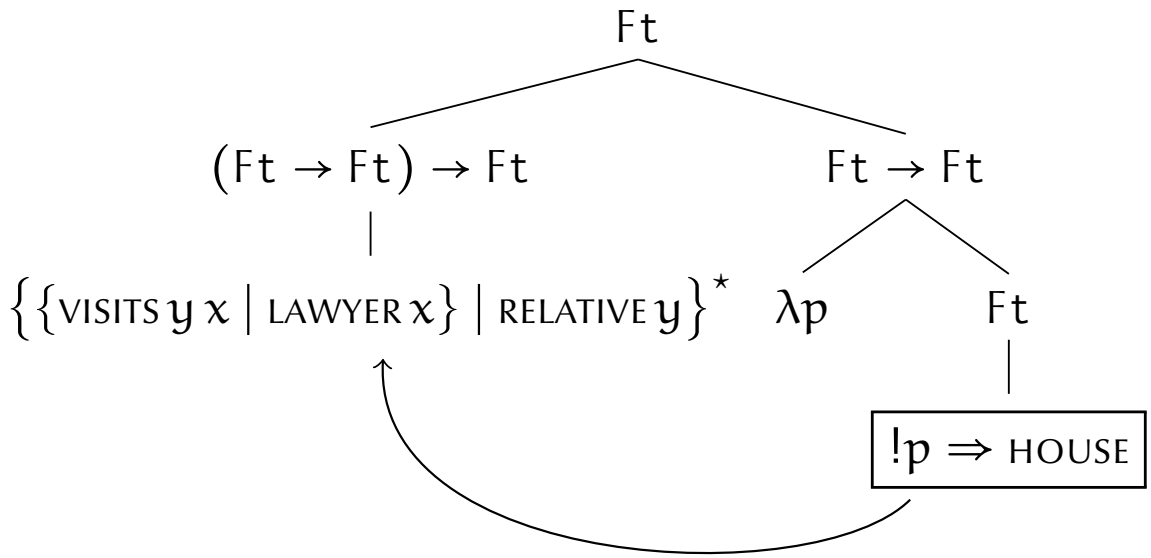
$$\left\{\left\{\textsc{visits}\ y\ x \mid \textsc{lawyer}\ x\right\} \mid \textsc{relative}\ y\right\}$$

- I.e., if the lawyers are $L_1$ and $L_2$, and my relatives are $R_1$ and $R_2$:

$$\left\{\left\{\textsc{visits}\ R_1\ L_1, \textsc{visits}\ R_1\ L_2\right\},\right.$$
$$\left.\left\{\textsc{visits}\ R_2\ L_1, \textsc{visits}\ R_2\ L_2\right\}\right\}$$

# How it works

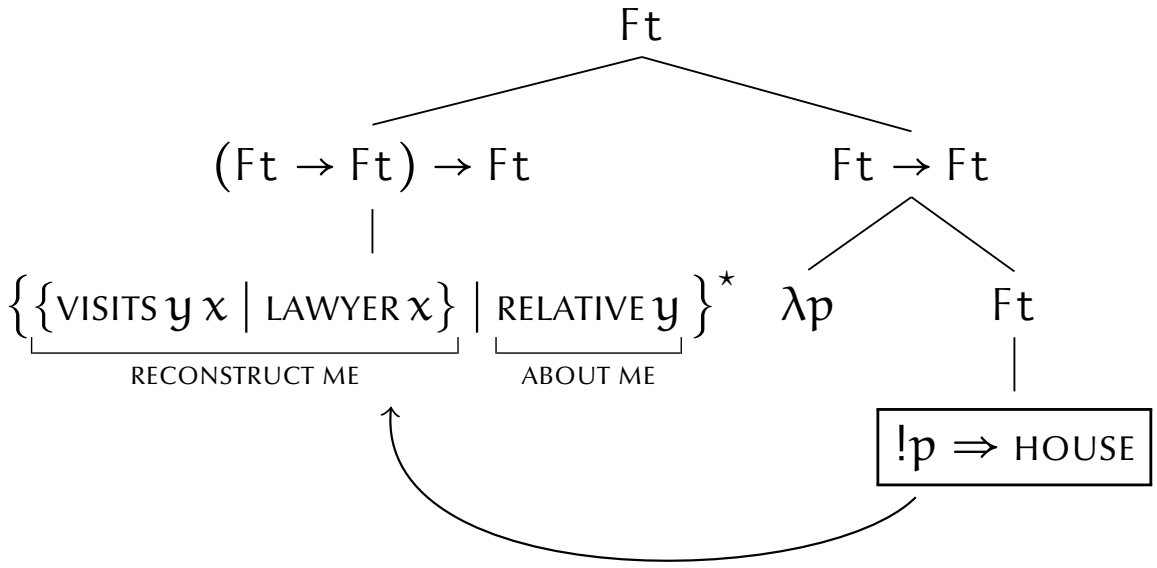
- LF pied-piping the higher-order alternative set derives the selective exceptional scope reading:




- The result is exactly what we're looking for (any-old-lawyer, one-rich-relative):

$$\left\{(\exists x.\ \textsc{lawyer}\ x \wedge \textsc{visits}\ y\ x) \Rightarrow \textsc{house} \mid \textsc{relative}\ y\right\}$$

# Why it works




- The finely-articulated higher-order alternative set lets us separate the relative-alternatives from the lawyer-alternatives.
- The island, when derived in this way, **is "about" relatives in a way it *isn't* "about" lawyers**. $\cdot^\star$ spreads this aboutness to the conditional.
- The inner layer of alternatives **semantically reconstructs** (Cresti 1995) — i.e., gets sent back down the tree to meet !.

# Where we are

- Islands and alternatives
  - Exceptional scope
  - Standard alternative semantics
- Proposal: alternatives take scope
  - Basic pieces
  - Deriving exceptional scope
- Why scope?
  - Compositionality
  - Selectivity
  - Binding
- Horizons
  - Dynamics
  - Concluding

# Abstraction

- Binding creates headaches for PWFA (e.g. Shan 2004; Romero & Novel 2013; Charlow 2014; Ciardelli & Roelofsen 2015).
- E.g., Kratzer & Shimoyama 2002's abstraction definition, below, over-generates alternative functions. $[\![\mathfrak{n}\ X]\!]^g$ is no longer guaranteed to be "about" the same things as $[\![X]\!]^g$.

$$[\![\mathfrak{n}\ X]\!]^g_{\text{PWFA}} := \{f \mid \forall x.\, f\, x \in [\![X]\!]^{g[\mathfrak{n} \to x]}\}$$

- Problematic prediction: *nobody met a linguist* can mean that nobody met *every* linguist. See Charlow 2014 (§5.5) for details.
- Jettisoning PWFA in favor of standard FA (with $\boxdot$ and $\cdot^\star$ greasing the skids) gives us access to a standard abstraction operation.

# Glass houses, etc.

- Yet it may appear that we have binding issues of our own.
- Ex. (10) has a reading giving the island-bound indefinite widest scope, even as the pronoun on the island is bound by the subject.

  (10) Every linguist$_i$ is overjoyed whenever ⟨**a famous expert on indefinites** cites her$_i$⟩.

- How is this consistent with our theory? Shouldn't scoping the island over the quantifier unbind the pronoun?

:(

- It's true: we can't handle data like this if binding requires LF c-command (as in e.g. Heim & Kratzer 1998). Given the situation with two indefinites on an island, this comes as a surprise.

:)

- What we require is a (minimal) shift in perspective, to a semantics that allows **binding reconstruction** à la Sternefeld 1998, 2001.
- The key is allowing things to denote *functions from assignments* into values (cf. Montague 1974; Bennett 1979; Rooth 1985[!]).
- An example of how this goes for *her$_i$ mother, Polly$_i$ likes*:

$$\underbrace{\left(\lambda F.\,\lambda g.\,\textsc{likes}\,(F\,g[0\to \textsc{p}])\,\textsc{p}\right)}_{\text{Polly}_0\text{ likes }\_}\;\underbrace{(\lambda g.\,g_0\text{'}\textsc{s mom})}_{\text{her}_0\text{ mom}}$$

$$= \lambda g.\,\textsc{likes}\,(\textsc{p's mom})\,\textsc{p}$$

# Generalized fanciness

- Implementing this perspective simply means tweaking our notion of what a "fancy" meaning is.
- Echoing the theory of binding reconstruction, we'll now take fancy $\tau$'s to be **functions from assignments** (type $s$) into sets of $\tau$'s.

$$F\tau ::= s \to \{\tau\}$$

- This in turn implies minimally tweaked versions of $\boxed{\cdot}$ and $\cdot^\star$:[2]

$$\boxed{x} := \lambda g.\, \{x\} \qquad\qquad m^\star := \lambda \kappa.\, \lambda g.\, \bigcup_{x \in m\, g} \kappa\, x\, g$$

- Such that (cf. $[\![A\ B]\!]^g_{\mathrm{PWFA}} = \{f\, x \mid f \in [\![A]\!]^g \wedge x \in [\![B]\!]^g\}$):

$$m^\star \left(\lambda f.\, n^\star \left(\lambda x.\, \boxed{f\, x}\right)\right) = \lambda g.\, \{f\, x \mid f \in m\, g \wedge x \in n\, g\}$$

[2] Still a monad, still decompositions of LIFT!

# Decomposing

- How granular should you be? Could further decompose.
- One set of shifters for nondeterminsm:

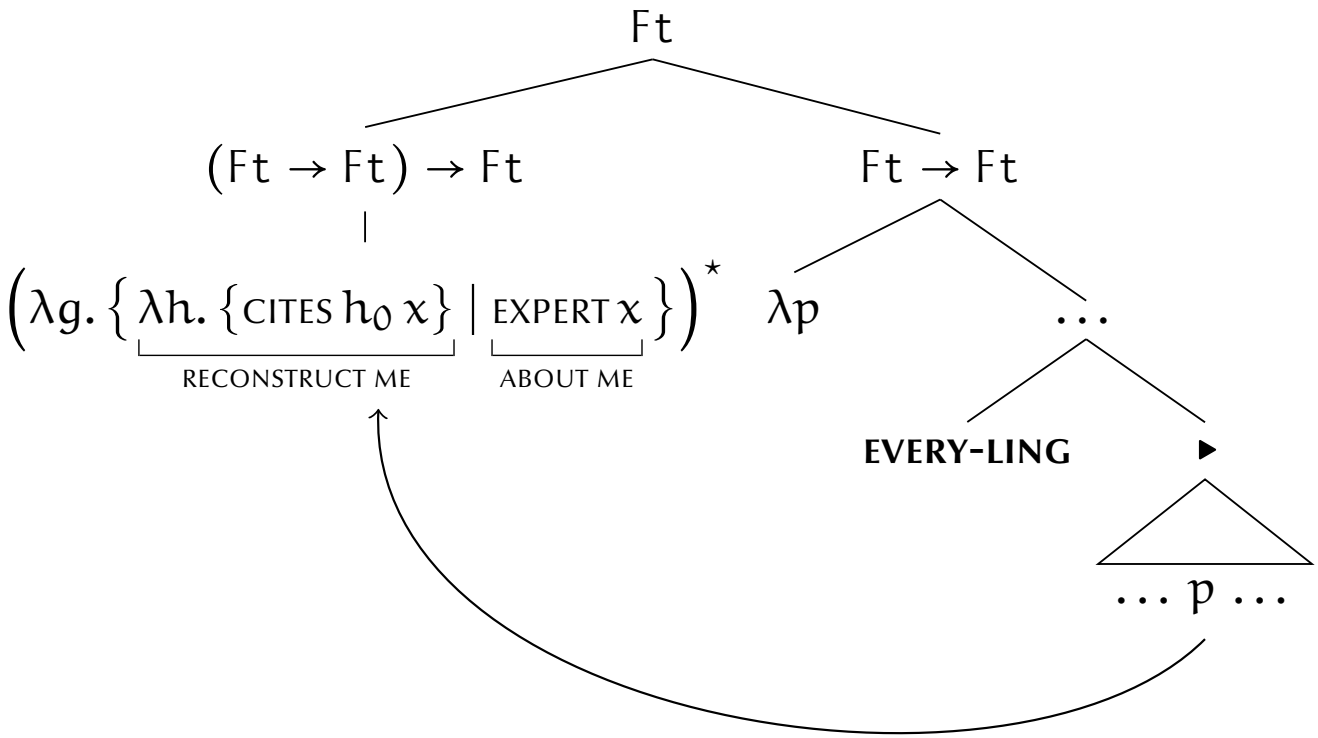
$$\boxed{x}_1 := \{x\} \qquad\qquad m^{\star 1} := \lambda\kappa.\bigcup_{x \in m} \kappa\, x$$

- And a second set for assignment-sensitivity:

$$\boxed{x}_2 := \lambda g.\, x \qquad\qquad m^{\star 2} := \lambda\kappa.\,\lambda g.\,\kappa\,(m\,g)\,g$$

# How this works

- The derivation of (10) is **entirely parallel** to the two-indefinites case. We build a higher-order FFt and reconstruct the inner layer:




- The tree invokes ▸, a placeholder for your fave way to do binding (e.g. Partee 1973's Derived VP Rule, Büring 2005's β-binding).

# Roofing

- We shouldn't be able to wide-scope the indefinite in **roofing** configurations (e.g. Schwarz 2001; Brasoveanu & Farkas 2011):

  (11) No candidate$_i$ submitted a paper he$_i$ wrote.

- We make the correct prediction. Here's how we'd go about trying to give this indefinite scope over the subject:

$$\Big(\overbrace{\lambda g.\,\{y \mid \underbrace{\textsc{wrote}\; y\; g_0}_{\textsc{about me}}\}}^{[\![\text{a paper he}_0\text{ wrote}]\!]}\Big)^{\star}\;\Big(\lambda y.\,\textbf{NO-CAND}\;\big(\lambda x.\,\boxed{\textsc{submitted}\; y\; x}\big)^{\blacktriangleright}\Big)$$

- The resulting set of propositions are "about" things that $g_0$ wrote (given an assignment $g$). Binding fails!

# Roofing (cont.)

- This improves on choice-functional accounts of exceptional scope (e.g. Reinhart 1997), which can assign roofed indefinites a kind of wide scope (Schwarz 2001; see also Geurts 2000):

$$\exists f.\ \textbf{NO-CANDIDATE}\left(\lambda x.\ \textsc{submitted}\left(f\left\{y \mid \textsc{wrote}\ y\ x\right\}\right)x\right)$$

$$\approx \textsc{no candidate submitted } \textit{every} \textsc{ paper he wrote}$$

- About which Heim 2011 remarks:

> We may have to concede what Fodor and Sag and most subsequent authors wanted to avoid: indefinites are existential quantifiers that enjoy a greater degree of scopal mobility... (Heim 2011: 1022)

- I hope to have shown that we *don't* have to concede this.

# Where we are

# Where we are

# Basic data

- A familiar data point: Indefinites behave more like names than quantifiers with respect to anaphoric phenomena.

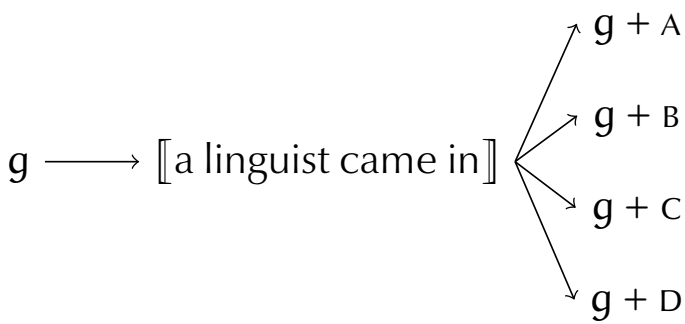
  (12) {Polly$_i$, a linguist$_i$, *every linguist$_i$} came in. She$_i$ sat.

# Discourse referents

- Dynamic semantics: sentences add discourse referents to the "conversational scoreboard" (e.g. Groenendijk & Stokhof 1991):

$$g \longrightarrow [\![\text{Polly came in}]\!] \longrightarrow g + \text{P}$$

- Indefinites (but not quantifiers) also set up discourse referents. In case four linguists came in — A, B, C, and D — we'll have:




- Formally captured by modeling meanings as relations on states. For example, here is a candidate meaning for *a linguist came in*:

$$\lambda g.\,\{g + x \mid \text{LING}\,x \wedge \text{CAME}\,x\}$$

# Incorporating dynamics

- Dynamics relies on the ability to output modified assignments (indeed, given indefinites, to output *alternative* assignments).
- One way to think of this is in terms of a new "fancy" type:

$$F\tau ::= s \to \{\langle \tau, s \rangle\}$$

- The relevant $\boxed{\cdot}$ and $\cdot^\star$ again essentially follow from the types:[3]

$$\boxed{x} := \lambda g.\, \{\langle x, g \rangle\} \qquad\qquad m^\star := \lambda \kappa.\, \lambda g.\, \bigcup_{\langle x, h \rangle \in m\, g} \kappa\, x\, h$$

- Gives the following enriched functional application:

$$m^\star \left(\lambda f.\, n^\star \left(\lambda x.\, \boxed{f\, x}\right)\right) = \lambda g.\, \{\langle f\, x, i \rangle \mid \langle f, h \rangle \in m\, g \wedge \langle x, i \rangle \in n\, h\}$$

[3] *Still* a monad, *still* decompositions of LIFT!

# Decomposing

- Again, how granular should you be? Could further decompose.
- One set of shifters for nondeterminsm:

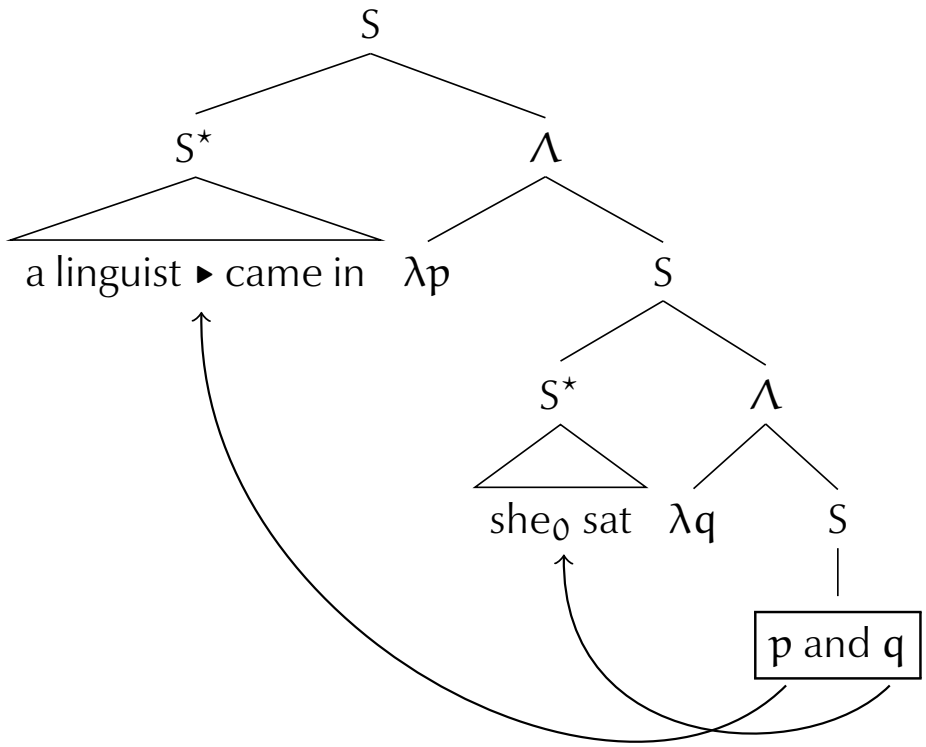
$$\boxed{x}_1 \coloneqq \{x\} \qquad\qquad m^{\star_1} \coloneqq \lambda\kappa.\bigcup_{x \in m} \kappa\, x$$

- And a second set for assignment update:

$$\boxed{x}_2 \coloneqq \lambda g.\langle x, g\rangle \qquad\qquad m^{\star_2} \coloneqq \lambda\kappa.\lambda g.\,\kappa\,(m\,g)_L\,(m\,g)_R$$

# Dynamic binding via LF pied-piping

- Remarkably, rejiggering the semantics in this way predicts that dynamic binding *also* arises via a kind of LF pied-piping:




- Unlike standard dynamic approaches, this derivation doesn't require a notion of dynamic conjunction.
  - In keeping with the approach I've been advocating, conjunction is boring and interacts with fancy things via $\boxed{\cdot}$ and $\cdot^{\star}$.

# Dynamics and exceptional scope: binding and sloppiness

- Proper names can bind pronouns, no matter how embedded:

  (13) If e.o. ⟨who hates Walt$_i$⟩ comes, I'll feel bad for him$_i$
  If e.o. ⟨who hates PETE$_j$⟩ comes, I won't (feel bad for him$_j$).

- Predicted: so long as the ⟨island⟩ can scope over the pronoun, the proper name can bind the pronoun.

# Dynamics and exceptional scope: max discourse anaphora

- **Maximal drefs** contributed by deeply embedded quantifiers:

  (14) Everyone heard the rumor that ⟨at most six [senators]$_i$ [supported Cruz's filibuster]$_j$⟩. It turned out to be erroneous: they$_{i \cap j}$ numbered at least ten.

- Suggests even quantifiers take a kind of exceptional scope.
- Predicted if quantifiers introduce maximal drefs, as is standard in modern dynamic semantics (Kamp & Reyle 1993):

$$\textsc{at-most-six-senators} = \lambda\kappa.\,\lambda g.\,\left\{\left\langle |\textsc{sen} \cap X| \leqslant 6,\, g + X\right\rangle\right\} \quad \text{where } X = \textsc{sen} \cap \{x \mid \exists\langle p, h\rangle \in \kappa\, x\, g.\, p\}$$

# Summing up

| $F\tau$ | $\boxed{x}$ | $m^*$ | $[\![\text{a linguist}]\!]_{Fe}$ | $[\![\text{she}_0]\!]_{Fe}$ |
|---|---|---|---|---|
| $\tau$ | $x$ | $\lambda\kappa.\,\kappa\,m$ | N/A | $g_0$ |
| $\{\tau\}$ | $\{x\}$ | $\lambda\kappa.\,\bigcup_{x\in m}\kappa\,x$ | $\{x \mid \text{LING}\,x\}$ | $\{g_0\}$ |
| $s \to \{\tau\}$ | $\lambda g.\,\{x\}$ | $\lambda\kappa g.\,\bigcup_{x\in m g}\kappa\,x\,g$ | $\lambda g.\,\{x \mid \text{LING}\,x\}$ | $\lambda g.\,\{g_0\}$ |
| $s \to \{\langle\tau, s\rangle\}$ | $\lambda g.\,\{\langle x, g\rangle\}$ | $\lambda\kappa g.\,\bigcup_{\langle x,h\rangle\in m g}\kappa\,x\,h$ | $\lambda g.\,\{\langle x, g\rangle \mid \text{LING}\,x\}$ | $\lambda g.\,\{\langle g_0, g\rangle\}$ |

Progressively enriching a grammar with alternatives, alternatives + assignment-sensitivity, and alternatives + assignment modification.

# Where we are

# Concluding

- My bottom line: use alternatives, and let them take scope.[4]
- $\boxdot$ and $\cdot^\star$ allow a robust account of alternatives, avoiding many of the pitfalls of PWFA (and other theories of exceptional scope).
- The approach is **really** flexible:
  - Folding in dynamics is a piece of cake. Other extensions similarly straightforward (e.g., to Potts 2005-style 2-dimensionality).
  - Suggests that dynamic and alternative semantics have all along been palping different parts of the indefiniteness elephant.
- More generally, there's a systematic way to deal with enrichments to meat-and-potatoes semantic regimes that systematically predicts exceptional scope phenomena.

[4]The centrality of scope-taking to natural language semantics has likewise been emphasized in work on *continuations* (e.g. Barker & Shan 2014).

# Last words

- I focused on English indefinites, but the same strategy allows us to give parallel, empirically robust accounts of focus and in situ *wh* (and, potentially, of how they *interact*):

> The group of island-escaping operators does not appear to be an arbitrary one.... [Their] semantic similarity, together with the common insensitivity to scope islands, suggest that we should not be satisfied with a theory which treats focus as sui generis. We would like to replace the focus-specific definition with a theory in which focus is one of a family of island-insensitive operators.... It is not at all clear to me how this should be done. (Rooth 1996)

- I hope to have shed some light on this.

THANKS!

# References


Baker, C. L. 1970. Notes on the description of English questions: The role of an abstract question morpheme. *Foundations of Language* 6(2). 197–219.

Barker, Chris & Chung-chieh Shan. 2014. *Continuations and Natural Language*. Oxford: Oxford University Press.

Beck, Sigrid. 2006. Intervention effects follow from focus interpretation. *Natural Language Semantics* 14(1). 1–56.

Bennett, Michael. 1979. Questions in Montague Grammar. Indiana University Linguistics Club.

Brasoveanu, Adrian & Donka F. Farkas. 2011. How indefinites choose their scope. *Linguistics and Philosophy* 34(1). 1–55.

Büring, Daniel. 2005. *Binding Theory*. New York: Cambridge University Press.

Charlow, Simon. 2014. *On the semantics of exceptional scope*: New York University Ph.D. thesis.

Ciardelli, Ivano & Floris Roelofsen. 2015. Alternatives in Montague Grammar. In Eva Csipak & Hedde Zeijlstra (eds.), *Proceedings of Sinn und Bedeutung 19*, 161–178.

Cresti, Diana. 1995. Extraction and reconstruction. *Natural Language Semantics* 3(1). 79–122.

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.

Fox, Danny. 2012. Lectures on the semantics of questions. Unpublished lecture notes.

Geurts, Bart. 2000. Indefinites and choice functions. *Linguistic Inquiry* 31(4). 731–738.

# References (cont.)


Giorgolo, Gianluca & Ash Asudeh. 2012. $\mathrm{M}, \eta, \star$: Monads for conventional implicatures. In Ana Aguilar Guevara, Anna Chernilovskaya & Rick Nouwen (eds.), *Proceedings of Sinn und Bedeutung 16*, 265–278. MIT Working Papers in Linguistics.

Groenendijk, Jeroen & Martin Stokhof. 1991. Dynamic predicate logic. *Linguistics and Philosophy* 14(1). 39–100.

Hamblin, C. L. 1973. Questions in Montague English. *Foundations of Language* 10(1). 41–53.

Heim, Irene. 2000. Notes on interrogative semantics. Unpublished lecture notes.

Heim, Irene. 2011. Definiteness and indefiniteness. In Klaus von Heusinger, Claudia Maienborn & Paul Portner (eds.), *Semantics: An International Handbook of Natural Language Meaning*, vol. 33 (HSK 2), chap. 41, 996–1025. Berlin: de Gruyter.

Heim, Irene & Angelika Kratzer. 1998. *Semantics in generative grammar*. Oxford: Blackwell.

Kamp, Hans & Uwe Reyle. 1993. *From Discourse to Logic*. Dordrecht: Kluwer Academic Publishers.

Karttunen, Lauri. 1977. Syntax and semantics of questions. *Linguistics and Philosophy* 1(1). 3–44.

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. 2006. Association with focus phrases. In Valéria Molnár & Susanne Winkler (eds.), *The Architecture of Focus*, 105–136. Mouton de Gruyter.

Moggi, Eugenio. 1989. Computational lambda-calculus and monads. In *Proceedings of the Fourth Annual Symposium on Logic in computer science*, 14–23. Piscataway, NJ, USA: IEEE Press.

# References (cont.)


Montague, Richard. 1974. Universal Grammar. In Richmond Thomason (ed.), *Formal Philosophy*, chap. 7, 222–246. New Haven: Yale University Press.

Nishigauchi, Taisuke. 1990. *Quantification in the theory of grammar*. Dordrecht: Kluwer Academic Publishers.

Nishigauchi, Taisuke. 1999. Quantification and *wh*-constructions. In Natsuko Tsujimura (ed.), *The Handbook of Japanese Linguistics*, chap. 9, 269–296. Blackwell.

Partee, Barbara H. 1973. Some transformational extensions of Montague grammar. *Journal of Philosophical Logic* 2(4). 509–534.

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.

Potts, Christopher. 2005. *The logic of conventional implicatures*. Oxford: Oxford University Press.

Reinhart, Tanya. 1997. Quantifier scope: How labor is divided between QR and choice functions. *Linguistics and Philosophy* 20(4). 335–397.

Romero, Maribel & Marc Novel. 2013. Variable binding and sets of alternatives. In Anamaria Fălăuș (ed.), *Alternatives in Semantics*, chap. 7, 174–208. Houndsmills, Basingstoke, Hampshire: Palgrave Macmillan.

Rooth, Mats. 1985. *Association with focus*: University of Massachusetts, Amherst Ph.D. thesis.

Rooth, Mats. 1992. A theory of focus interpretation. *Natural Language Semantics* 1(1). 75–116.

# References (cont.)


Rooth, Mats. 1996. Focus. In Shalom Lappin (ed.), *The Handbook of Contemporary Semantic Theory*, 271–298. Oxford: Blackwell.

Rooth, Mats & Hongyuan Dong. 2011. A recursive phonology interface for WH-F alternative semantics. Poster presented at Semantics and Linguistic Theory 21.

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.

Shan, Chung-chieh. 2002. Monads for natural language semantics. In Kristina Striegnitz (ed.), *Proceedings of the ESSLLI 2001 Student Session*, 285–298.

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.

Simons, Mandy. 2005. Dividing things up: The semantics of *or* and the modal/*or* interaction. *Natural Language Semantics* 13(3). 271–316.

von Stechow, Arnim. 1996. Against LF pied-piping. *Natural Language Semantics* 4(1). 57–110.

Sternefeld, Wolfgang. 1998. The semantics of reconstruction and connectivity. Arbeitspapier 97, SFB 340. Universität Tübingen and Universität Stuttgart, Germany.

Sternefeld, Wolfgang. 2001. Semantic vs. Syntactic Reconstruction. In Christian Rohrer, Antje Roßdeutscher & Hans Kamp (eds.), *Linguistic Form and its Computation*, 145–182. Stanford: CSLI Publications.

# References (cont.)


Unger, Christina. 2012. Dynamic semantics as monadic computation. In Manabu Okumura, Daisuke Bekki & Ken Satoh (eds.), *New Frontiers in Artificial Intelligence JSAI-isAI 2011*, vol. 7258 Lecture Notes in Artificial Intelligence, 68–81. Springer Berlin Heidelberg.

Wadler, Philip. 1992. Comprehending monads. In *Mathematical Structures in Computer Science*, vol. 2 (special issue of selected papers from 6th Conference on Lisp and Functional Programming), 461–493.

Wadler, Philip. 1995. Monads for functional programming. In Johan Jeuring & Erik Meijer (eds.), *Advanced Functional Programming*, vol. 925 Lecture Notes in Computer Science, 24–52. Springer Berlin Heidelberg.

Wold, Dag E. 1996. Long distance selective binding: The case of focus. In Teresa Galloway & Justin Spence (eds.), *Proceedings of Semantics and Linguistic Theory 6*, 311–328. Ithaca, NY: Cornell University.