

# PIED-PIPING & QUESTION COMPOSITION II

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## 1 Roadmap

The plan for today:

- ✓ Back to the question of how to compositionize Karttunen: an alternative approach based on selective scope-takers (Heim 1994, Cresti 1995).
- ✓ An examination of how to compose pied-piped material, starting with a simple example; the problem that our assumptions give rise to: the *total de re* interpretation (von Stechow's 1996 problem).
- ✓ Developing an analysis of pied-piping via cyclic scope (Charlow 2019b, Demirok 2019).
- ✓ How is the *ban* on totally *de re* readings derived?
- ✓ Logical properties of  $\star$  and  $?$ .
- ✓ *Wh-in-situ* and island pied-piping.
- Translating from selective scope-takers (Charlow 2019a) to the  $\exists$ -theory (Demirok 2019; this class).
- Nested questions, the limits of pied-piping, and Sudo's puzzle.
- De-dicto readings of *wh*-expressions.
- Baker's ambiguity.

### Reading (same as last time)

- Yasutada Sudo. 2017. De re readings of nested which-phrases in embedded questions. *Snippets* (31). 30–31. <http://www.ledonline.it/snippets/index.html> (30 September, 2019)
- Veneeta Dayal. 2017. *Questions* (Oxford Surveys in Semantics and Pragmatics). Oxford, New York: Oxford University Press. 352 pp.: chapter 7

## 2 Translation procedure

**Selective scope:** A  $\star$ -phrase must always occupy the specifier of  $?$ .  $?$  has a wider distribution than previously thought; it can be freely inserted at the edge of pied-piped constituents (Charlow 2019b).

- (1) Which artist's painting do you admire?
  - a. *Internal  $\star$ -phrase movement:*  
 $(\star \llbracket \text{which artist} \rrbracket^w) \lambda x ? x\text{'s painting}$
  - b. *External  $\star$ -phrase movement:*  
 $(\star (\star \llbracket \text{which artist} \rrbracket^w) \lambda x ? x\text{'s painting}) \lambda i ? \text{you admire } i$

**The  $\exists$ -theory:** All of the essential ingredients of the analysis can be replicated in a version of the theory laid out by Danny and Kai — Demirok calls this the  $\exists$ -theory of pied-piping.

The polymorphic  $?$  operator remains unchanged.<sup>1</sup>

<sup>1</sup> Demirok labels it *id*.

$$(2) \llbracket ? \rrbracket^w = \lambda p . \lambda q . p = q \quad \langle s\tau, \langle s\tau, t \rangle \rangle$$

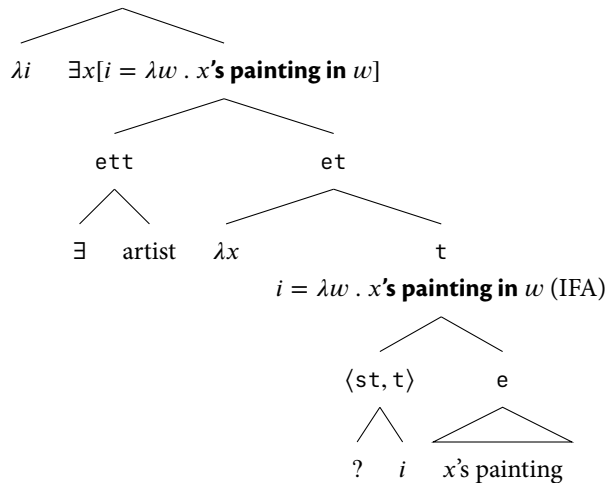
Instead of  $\star$ , we posit a polymorphic  $\exists$  operator.

$$(3) \llbracket \exists \rrbracket^w = \lambda P . \lambda k . \exists x \in P[k(x)] \quad \langle \sigma t, \langle \sigma t, t \rangle \rangle$$

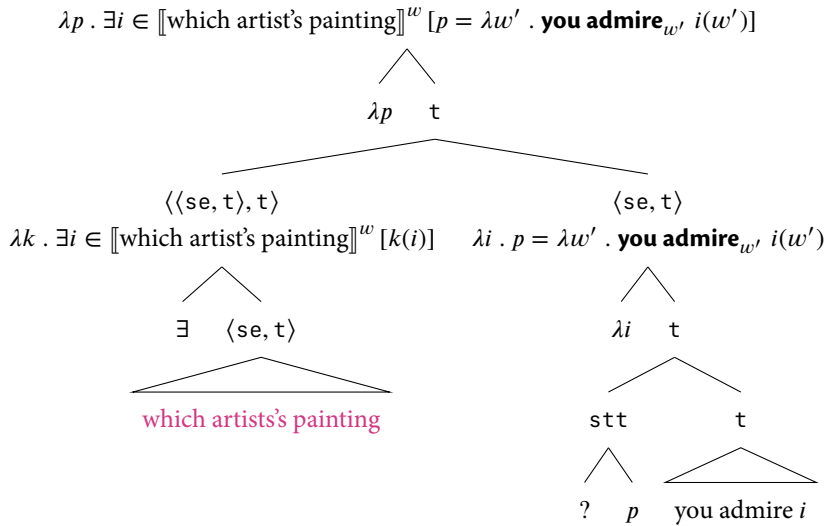
Sets of alternatives are constructed compositionally via null operator movement from the complement of  $?$ , and scoped out via  $\exists$ . The resulting LFs are isomorphic to the ones we've been dealing with.

### (4) Internal *wh*-movement

$$\lambda i . \exists x [i = \lambda w . x\text{'s painting in } w]$$



(5) External *wh*-movement



2.1 Nested questions: the limits of pied-piping

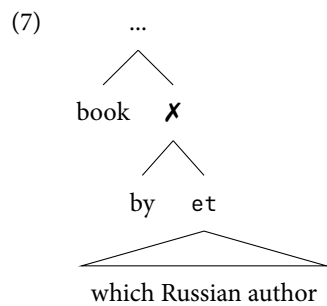
We've seen that this pied-piping machinery is very powerful; it can give rise to the (illusion of) island-insensitivity via island pied-piping at LF.

As we learned from Danny, *which*-phrases can *contained* other *wh*-expression; creating a configuration which we've been calling a *nested which-phrase*.<sup>2</sup>

<sup>2</sup> Richards (2004) evocatively calls these *Russian-doll questions*.

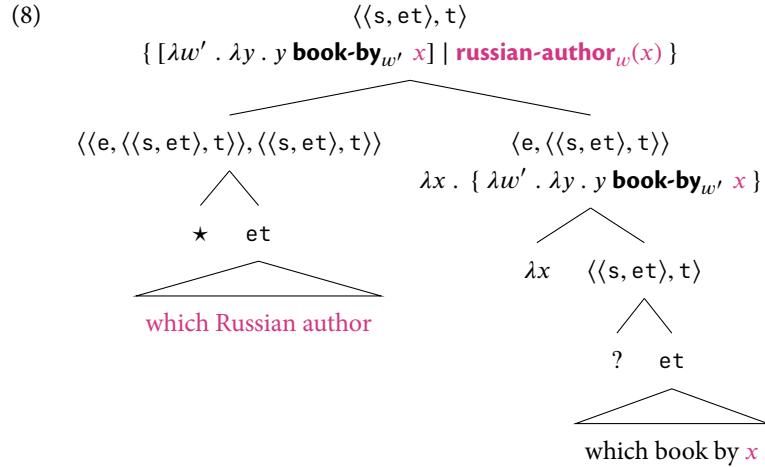
(6) Which book by which Russian author did you read?

Let's consider what the machinery we've assembled delivers.



The most conservative option would seem to be to scope the *in-situ wh-expression* (via  $\star$ ) to the edge of the containing *which*-phrase, with the help of a mediating  $?$ .<sup>3</sup>

<sup>3</sup> There might be independent reason to believe that nested *which*-phrases are *unnested*, as Danny will discuss.

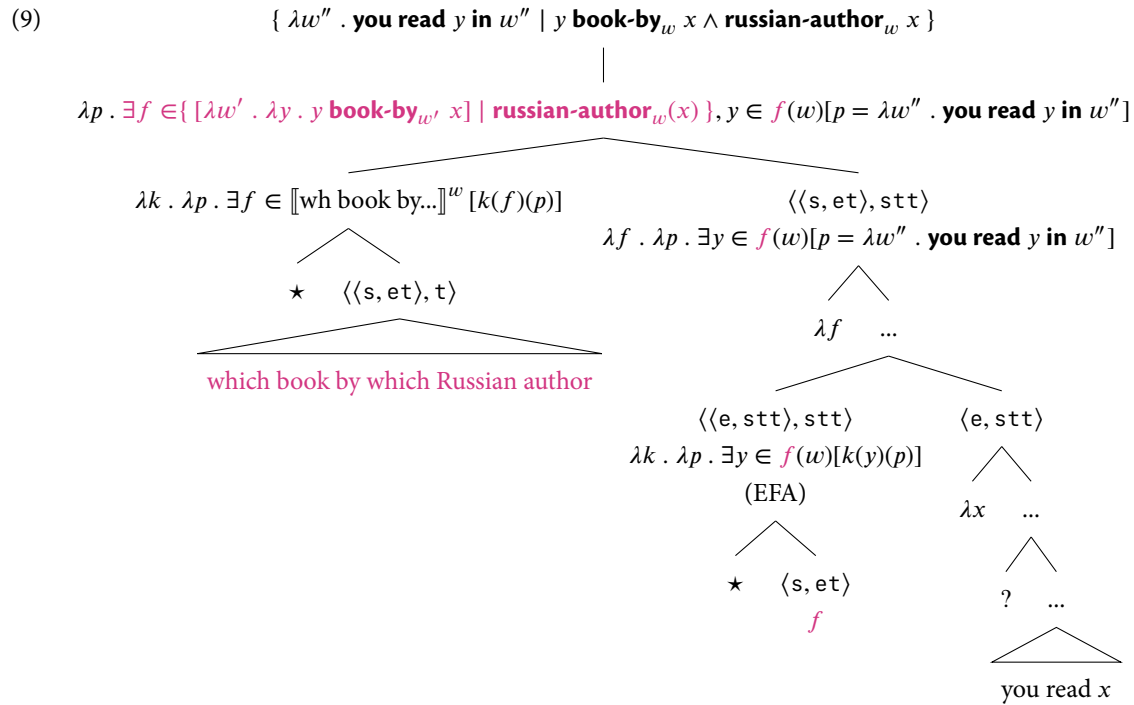


The result is a set of world-sensitive sets of books, which vary according to the Russian author they are by.<sup>4</sup>

If we shift the resulting constituent via  $\star$ , we will end up with a selective scope taker which leaves behind a trace of type  $\langle s, et \rangle$ .

<sup>4</sup> This is because *wh*-expressions ordinarily denote sets of alternatives; internal *wh*-movement creates a set of intensional values (a generalized *wh*-expression).

In order for composition to proceed, we must compose the trace with a  $\star$  operator via EFA, and scope it over a  $?$  operator.



We get back a set of propositions of the form *that you read y*, where *y* is a book

by a Russian author in the world of evaluation.

- (10)  $\llbracket$ which book by which Russian author did you read? $\rrbracket^w$   
 $= \{ \lambda w'' . \text{you read } y \text{ in } w'' \mid y \text{ book-by}_w x \wedge \text{russian-author}_w x \}$

Note that the entire nested *which*-phrase is interpreted *de re*!

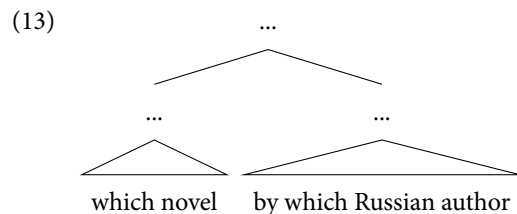
Sudo (2017) shows that nested *which*-phrases *cannot* have a totally *de re* reading — a striking instantiation of von Stechow’s problem.

- (11) *I reserve a part of my bookshelf for Russian novels, and my son doesn’t know what kind of book they are, or who wrote them, but knows which ones I haven’t opened (i.e.g. because they’re clean).*  
 a. ✓ My son knows **which novels by Russian authors** I haven’t opened.  
 b. # My son knows **which novels by which Russian authors** I haven’t opened.

Sudo characterizes the problem as follows: the *in-situ* *which*-phrase has to contribute to the *wh*-question as *wh*-phrases normally do.

- (12) **Which novel by which Russian author** author did you read for this class?  
 a. # The Master and Margarita.  
 b. ✓ The Master and Margarita by Bulgakov.

Sternefeld’s (2001) and Demirok’s (2019) solution: what appear to be nested *which*-phrases aren’t really nested to begin with.



As pointed out by Sauerland & Heck (2005), the Sternefeld/Demirok solution isn’t going to be general enough. Their counterexample:

- (14) **Which relative of which child** attended the pot luck?  
 a. # Heidi.  
 b. Nick’s mother.

Since *relative* is relational (type  $\langle e, et \rangle$ ), the same trick isn’t going to work.

Sauerland & Heck’s solution to the current setting: *wh*-movement leaves behind a copy; the restrictor is interpreted *in-situ* as a bound definite description (Sauerland 1998, Fox 2002).

- (15) [which relative of which child] which relative of which child attended the pot luck?
- (16) a. = { **that** the<sub>x</sub> **relative of the**, **child attended** |  $x, y \in D$  }  
 b. = {  $\lambda w' : \mathbf{child}_{w'}(y) \wedge x$  **relative-of**  $y$  **in**  $w' : \mathbf{attended}_{w'}(x)$  |  $x, y \in D$  }
- (17) =  $\left\{ \begin{array}{l} \textcircled{1} \lambda w' : \mathbf{Nick a child and Heidi relative of Nick in } w' . \mathbf{Heidi attended}_{w'} \\ \textcircled{2} \lambda w' : \mathbf{Joe a child and Heidi relative of Joe in } w' . \mathbf{Heidi attended}_{w'} \\ \dots \end{array} \right\}$

Remember that asserting a question in a context  $C$  amounts to a proposal that the question partition  $C$  (a simplified version of Kai's rule of assertion for questions):

- (18)  $C[\phi] := \mathbf{PART}(\llbracket \phi \rrbracket^w, C)$      $\phi$  an interrogative;  $w$  an arbitrary world in  $c$

Given a question  $Q$  the equivalence relation used to partition worlds in  $C$  was defined as follows:

- (19)  $w \sim_{Q,C} w'$  iff  $w, w' \in C \wedge \forall p \in Q[p(w) = p(w')]$
- $w_{nh}$ : Heidi attended the pot luck; she is Nick's mother and unrelated to Joe.
  - $w_{jh}$ : Heidi attended the pot luck; she is Joe's mother and unrelated to Nick.

$w_{nh}$  and  $w_{jh}$  are *not* equivalent relative to the question denotation in (19), since  $\textcircled{1}(w_{nh}) = 1, \textcircled{1}(w_{jh}) = \#,$  and  $\textcircled{2}(w_{nh}) = \#, \textcircled{2}(w_{jh}) = 1.$

This means that the resulting partition is  $\{ \{ w_{nh}, \dots \}, \{ w_{jh}, \dots \}, \dots \}.$

“Heidi attended the pot luck” will not count as a complete answer to the question, because at least two cells will survive.

## 2.2 De dicto readings of wh-expressions

So far, we've been focusing on *de re* readings of *wh*-expressions.

Under the *de re* reading of the *which*-phrase below, Josie knows which member of a particular set of entities I admire, and these entities happen to be self-portraits (but it isn't necessary that Josie knows this).

(20) Josie knows **which self-portraits** I admire.

In embedded contexts, the more salient reading of *which*-phrases is the *de dicto* one, according to which Josie knows which member of a particular set I admire, and also knows that these entities are self-portraits.

According to the current approach, the *de dicto* reading falls out automatically; since the embedded question is interpreted in the intensional context created by *know*.

In order to derive the *de re* interpretation of (22), the *wh*-expression must take scope over *know*, pied-piping the embedded clause with it and leaving behind a higher-type trace.

(21) [**which self-portraits I admire**] Josie knows *t*

Extracting a *which*-phrase from out of an intensional context also gives rise to a *de re/de dicto* ambiguity.

(22) *Sam thought he saw two ghosts, a pale one, and an ethereal one.*  
 a. Which ghost did Sam want to talk to?  
 b. Which ghost did Sam think he saw?

Rullmann & Beck (1998) suggested that, in order to achieve the *de dicto* reading, *which*-phrases can be interpreted as definite descriptions *in situ*.

Their analysis gives rise to question denotations of the following kind:

(23)  $\llbracket \text{which ghost did Sam want to talk to?} \rrbracket$   
 $= \{ \lambda \omega' . \mathbf{Sam\ want}_{\omega'} (\lambda \omega'' . \mathbf{talk-to}_{\omega''} (t y [\mathbf{ghost}_{\omega''}(y) \wedge y = x])) \mid x \in D \}$

Demirok (2019) suggests a way of compositionally constructing a Rullmann & Beck-style Logical Form using a type-shifter *e-ident*.<sup>5</sup>

(24)  $\llbracket \mathbf{e-ident} \rrbracket^w = \lambda y . \lambda P . t z : P(z) \wedge y = z$

The idea is that *which*-phrases allow for two different representations:

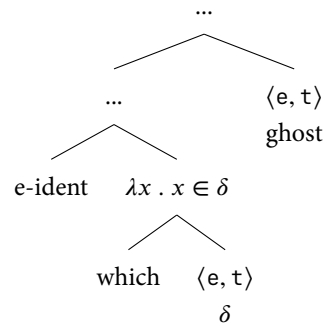
(25) *Restricted which-phrases*  $\lambda x . \mathbf{ghost}_w(x)$

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    graph TD
      A["λx . ghost_w(x)"] --- B["id"]
      A --- C["<e, t>"]
      B --- D["which"]
      C --- E["ghost"]
    
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<sup>5</sup> The idea is based on mechanisms proposed in Heim (2012); Demirok's *e-ident* operator is just the composition of Heim's polymorphic THE and IDENT type-shifters.

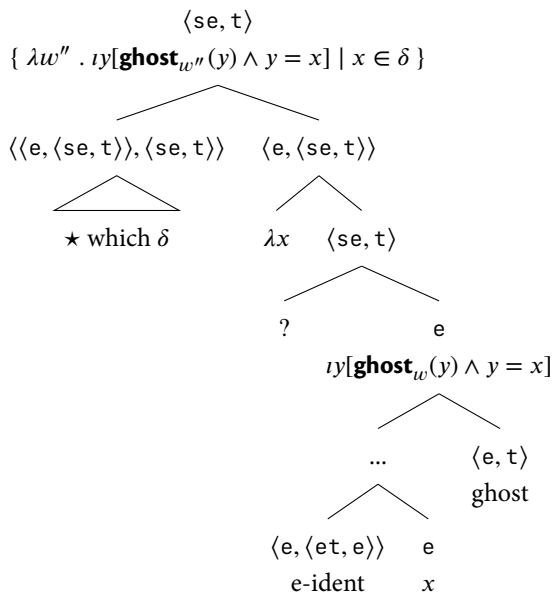
(26) *Unrestricted which-phrases*



Recall that *e-ident* is looking for a type *e* argument; in order to interpret structures like (28), *which* needs to take scope.

Just as in pied-piping configurations, *which* can undergo internal *wh*-movement to the edge of the *which*-phrase; here, the movement is string vacuous.

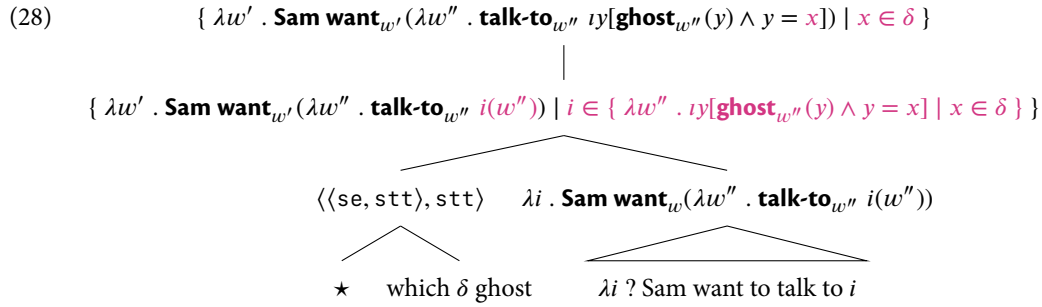
(27)



Note that the resulting meaning of the unrestricted *which*-phrase is a *set of individual concepts*; the same type as a canonical case of pied-piping such as *whose painting*.

We can scope the unrestricted *which*-phrase via  $\star$  which leaves behind an *intensional* (se) trace in the embedded clause, which composes via EFA.





**Homework exercise**

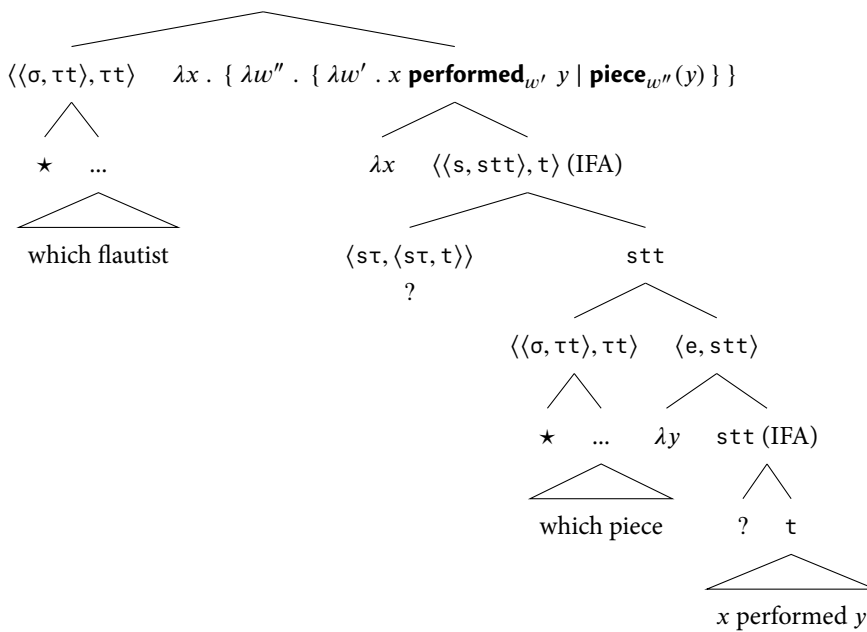
Adapt this solution to Sudo's puzzle for nested *which*-phrases while avoiding Sauerland & Heck's objection.

2.3 Pair-list

You may have noticed that the *polymorphism* of both  $\star$  and  $?$  allows us to compose higher-order denotations (which as we've seen, are useful for pair-list readings) without further ado.<sup>6</sup>

(29) Which flautist performed which piece?

(30)  $\{ [\lambda w'' . \{ \lambda w' . x \mathbf{performed}_{w'} y \mid \mathbf{piece}_{w''}(y) \}] \mid \mathbf{flautist}_{w'}(x) \}$



<sup>6</sup> There's a complication here - what Demirok's semantics actually delivers is a set of question *intensions* which piece did x play, for each flautist x in the world of evaluation.

In order to get facts concerning domain exhaustivity right (modulo empirical

disagreements from last time), we must assume that covert movement of the *in-situ wh*-expression tucks in below the overtly moved *wh*-expression.

Another way of thinking about this: domain exhaustivity tells us that *wh*-expressions always take *surface scope*.<sup>7</sup>

### 3 Baker's ambiguity/the *wh*-triangle

Baker (1968) originally observed an ambiguity in questions like the following:<sup>8</sup>

- (31) Which one of our friends remembers where we bought which book?  
 a. ① Alice remembers where we bought War and Peace.  
 b. ② Alice does  $\Delta$ .

Putting the pair-list/single-pair distinction to one side,<sup>9</sup> (33) is two-ways ambiguous, corresponding (Baker suggests) to two potential scope sites for the *in-situ wh*-expression.<sup>10</sup>

- (32) ① Which friend  $\lambda x$  which book  $\lambda y$   $x$  remembers [where we bought  $y$ ]  
 (33) ② Which friend  $\lambda x$   $x$  remembers [where which book  $\lambda y$  we bought  $y$ ]

As pointed out by Dayal (1996), there's good reason to be skeptical of Baker's analysis.

First, note that although extraction of a *which*-phrase from a *wh*-island is marginally acceptable, extraction of a simplex *wh*-expression is much worse.<sup>11</sup>

- (34) a. ?Which book does Alice remember [where we bought  $t$ ]?  
 b. \*What does Alice remember [where we bought  $t$ ]?

Baker's ambiguity persists with simplex *wh*-expressions:

- (35) Who remembers where we bought what?  
 a. ① Alice remembers where we bought War and Peace.  
 b. ② Alice does  $\Delta$ .

Applying Baker's analysis to (37) what amount to the claim that covert, unlike overt movement of simplex *wh* out of a *wh*-island is possible.<sup>12</sup>

#### 3.1 Deriving the ambiguity

The reading in (33b) is easy.<sup>13</sup>

<sup>7</sup> See Shan 2002 for a way of cashing out this intuition without making commitments regarding the syntax of covert movement.

<sup>8</sup> Dayal (1996) evocatively calls this configuration the *wh*-triangle.

<sup>9</sup> We'll come back to this.

<sup>10</sup> Something important to keep in mind: overtly moved *wh*-expressions take scope exactly over the clause they are overtly raised to, hence (33) is only two-way ambiguous, not four or eight.

<sup>11</sup> *Wh*-islands are *weak*.

<sup>12</sup> Although this is a good reason to be cautious, I should note that one can find claims in the literature that locality constraints do not apply to movement at LF (e.g., Huang 1982).

Dayal (1996, 2017) gives several more arguments against Baker's analysis, although I believe that many of them are problematic.

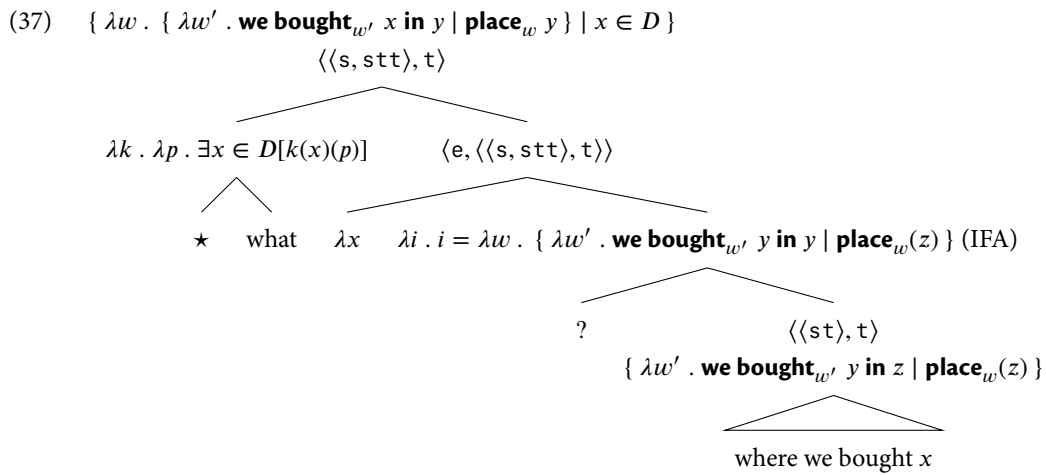
<sup>13</sup> I make the simplifying assumption that responsive predicates take questions as complements (Uegaki 2015).

(36) ( $\star$  who)  $\lambda x ? x$  remembers (( $\star$  where)  $\lambda y$  ( $\star$  what)  $\lambda z ?$  we bought  $z$   $y$ )

The reading in (33a) is more challenging.

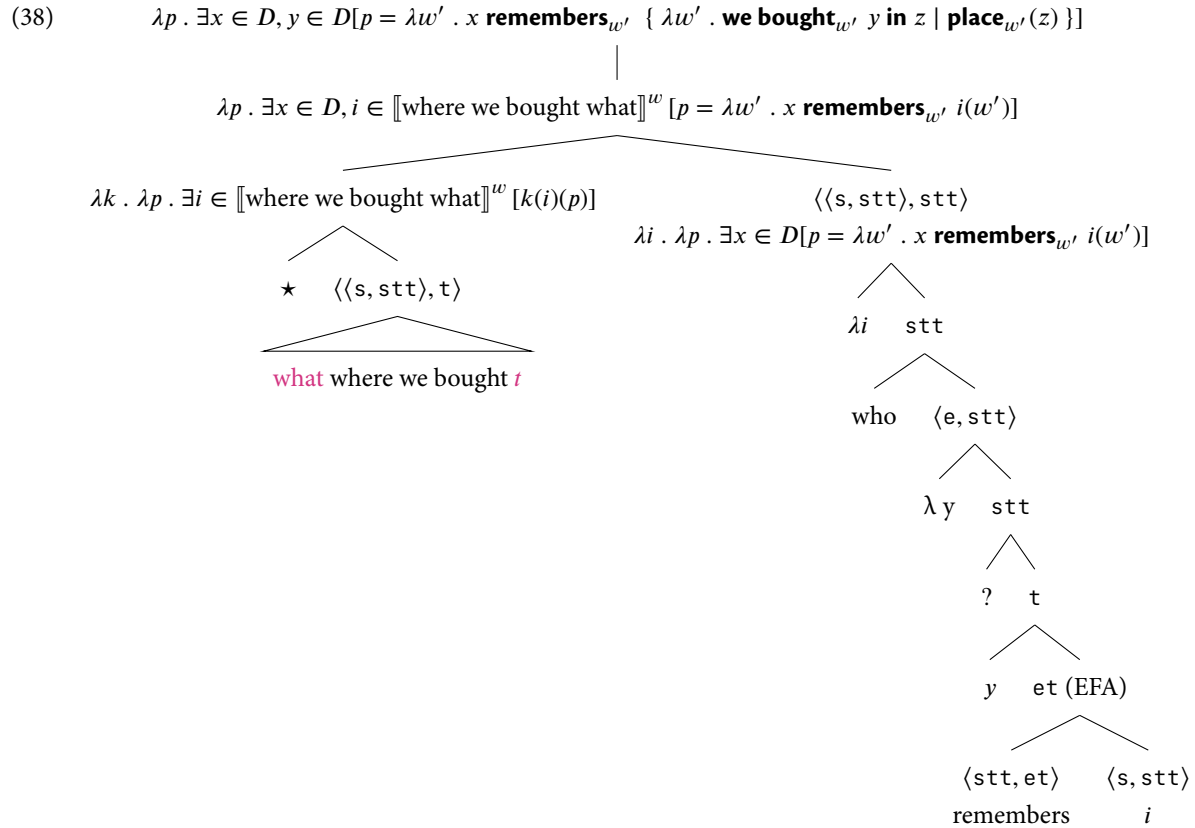
Recall that our algorithm for pied-piping says that we can convert any constituent into a kind of *generalized wh-expression* by scoping a contained *wh* to its edge.

Let's apply this algorithm, and turn the embedded interrogative clause into a generalized *wh-expression*.



The result is a *set of question intensions* which vary according to what is bought.

We can scope out the generalized *wh* via  $\star$ , leaving behind a trace which has the type of a question intension, which composes with *remember* via EFA.



**Pesetsky's problem:** (cited in Dayal 2017) Baker's ambiguity only arises if the embedded multiple question is a complement of the matrix verb.

- (39) Which student believes that  
 John knows where Mary bought which book?  
 a. ??Frank believes that John knows where Mary bought Moby Dick,...  
 cf. Frank believes that John knows where Mary bought which book.

The mechanism of *cyclic scope* is sufficiently powerful that this is derivable:

- (40)  $\text{Wh}_x \lambda x \llbracket [\text{wh}_y \lambda y \text{ where M bought } y] \lambda Q \text{ J knows } Q \rrbracket \lambda p ? x \text{ believes } p$

Homework exercise

Go through the computation step by step.

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