Chapter 7

Hintikka 1962-inspired lexical entry for believe:

(1) \[ \text{believe}^w = \lambda_{p(s,t)} \lambda_{x,e} \forall w' : w' \in B^w_x \rightarrow p(w') \]
where \(B^w_x\) is the set of possible worlds \(w'\) such that everything that \(x\) believes in \(w\) is true at \(w'\).

**Extensional Functional Application:** If \(\alpha\) is a branching node, \(\{\beta, \gamma\}\) the set of its daughters, and \([\beta]^{w,a}\) is a function whose domain contains \([\gamma]^{w,a}\), then \([\alpha]^{w,a} = [\beta]^{w,a}(\gamma]^{w,a})\).

(Heim & Kratzer 1998: 44, mod.)

**How to interpret??** Add a new rule:

**Intensional Functional Application:** If \(\alpha\) is a branching node and \(\{\beta, \gamma\}\) the set of its daughters, then, for any possible world \(w\) and any assignment \(a\), if \([\beta]^{w,a}\) is a function whose domain contains \(\lambda w'.[\gamma]^{w',a}\), then \([\alpha]^{w,a} = [\beta]^{w,a}(\lambda w'.[\gamma]^{w',a})\).

(Heim & Kratzer 1998: 308)

Using IFA, \([\text{believes}]^{w,a}\) takes as its argument the type \(\langle s, t \rangle\) expression \(\lambda w'.[[s\text{Mary left}]]^{w',a}\).

(2) John believes that Sam’s abstract will be accepted.

a. *de dicto* (Latin, “about the word”): John has a belief that he might describe by saying “Sam’s abstract will be accepted”. E.g., he thinks Sam is very clever so whatever he wrote will get in.

b. *de re* (Latin, “about the thing”): John has a belief that he might describe by “The anonymous abstract I reviewed will get accepted”, where the abstract in question happens to be Sam’s. On this reading, John might think that Sam is a fool, but also think that the abstract he reviewed was stellar.
Note that these can only be distinguished if John has partial information or mistaken beliefs. If he knows that Sam wrote the abstract, the readings are true or false together.

Assume for the moment, with H&K, that nouns have lexical entries like this:

(3) \([\text{abstract}]^w = \lambda x.x\) is an abstract in \(w\)

The Hintikka-style semantics for \(\text{believes}\), together with H&K’s EFA/IFA rules and QR, could derive the two readings in the following way:

**de dicto:**

```
               t
              /
             /
            e   ⟨e, t⟩
           /
          /
         John ⟨⟨s, t⟩, ⟨e, t⟩⟩
               /
               /
              /
               believes
```

**de re:**

```
          t
         /
        /
      e    ⟨e, t⟩
     /
    /
   Sam's abstract λ₁ ⟨⟨s, t⟩, ⟨e, t⟩⟩
     /
     /
    /
    e  ⟨e, t⟩
     /
     /
    John ⟨⟨s, t⟩, ⟨e, t⟩⟩
         /
         /
        /
        believes
```

[If so, another counter-example to ban on QR out of a tensed clause...]

Sentences like (4) create additional headaches.

(4) Somebody must have been here last night.

   a. **de re:** “There’s some particular person who must have been here”
   b. **de dicto:** “It must be that somebody was here”
Simplifying a lot, we can treat \textit{must} as being more or less like \textit{believe}, except that the set of worlds quantified over is given in a different fashion: the modal has as sister a pronoun $R$ of type $(s, (s, t))$, giving the set of worlds that are “epistemically accessible” from an input world $w$. (We gloss over the difficult question of how $R$ is determined, since it’s not crucial for the compositional issue at hand.)

(5) $\text{[must]}^w = \lambda R_{(s, (s, t))} \lambda p_{(s, t)} . \forall w' \in R(w) : p(w')$

Here the straightforward derivation (assuming the VP-internal Subject Hypothesis!) gives us the \textit{de re} reading:

In order to get a \textit{de dicto} interpretation we need to somehow get \textit{somebody} to be interpreted as being in the scope of \textit{must} — e.g., in the SpecVP position where it started out. Here are some options that Heim & von Fintel discuss:

- Quantifier Lowering (May 1977). Lowering operations are generally no longer thought to be allowed, plus you have to make fairly ad hoc assumptions in order to explain why the trace of lowered \textit{somebody} is not interpreted.

- Recall the T-model: at some point the derivation splits and syntactic operations may feed only PF or only LF. Perhaps the raising of \textit{somebody} to the subject position is not by QR, as we were assuming, but happens only on the PF-branch. So then the tree that is interpreted is just

\begin{center}
\begin{tikzpicture}
  \node {t} child {node {$\langle (e,t), t \rangle$} child {node {somebody} edge from parent node[anchor=west] {$\lambda_4$}} child {node {$t$}} edge from parent node[anchor=west] {}},
  \node {$\langle (s,t), t \rangle$} child {node {must $R$}} child {node {e} child {node {$t_4$} edge from parent node[anchor=west] {have been here}} edge from parent node[anchor=west] {}},
  \node {$\langle (t), t \rangle$} child {node {e} edge from parent node[anchor=west] {have been here}} edge from parent node[anchor=west] {};
\end{tikzpicture}
\end{center}
everything works out swimmingly.

- Or maybe we can use the Copy Theory of Movement: the tree is in fact, schematically,

```
  somebody
     /     \
    /      \
must R  somebody
     /      \
    /       \
have been here
```

and we have an additional operation that can delete either copy at LF, while also fixing up the tree so that, if the lower copy is deleted, it’s interpreted as a variable which is \(\lambda\)-bound just below the higher copy. [Obviously, non-trivial details to be worked out here.]

- Instead of lowering/reconstructing \textit{somebody} in covert syntax, raise \textit{must R} in covert syntax. But we have to do it without leaving a trace, generating the SS/LF pair

```
  t
 /\t
\l1\(\langle e,t\rangle\)
  \l1\langle e,t\rangle
  \\  \langle e,t\rangle
\l1\langle s,t\rangle
  \l4\langle e,t\rangle
   \l1\langle e,t\rangle
    \langle e,t\rangle
     \langle e,t\rangle
```

This would work but seems very ad hoc, given that movement is supposed to involve traces very generally (or something with the same interpretive effect, like special rules for interpreting deleted copies as variables co-indexed with the higher copy). Also, vF&H argue that this overgenerates modal scope ambiguities in sentences like \textit{I have to be allowed to graduate}.

- Semantic reconstruction \#1: the trace of moved \textit{somebody} can be of any type that renders the tree interpretable, e.g., \(e\) or \(\langle e,t\rangle\). As it turns out, the version with the \(\langle e,t\rangle\) trace will create the give the subject QP scope below the modal — but
it actually generates Fodor’s 3rd reading discussed below, with the restriction indexed to the utterance world.

– Is this a possible reading of *A neat-freak must have been here (last night)*? Pragmatics makes it a bit tricky to decide, but von Fintel & Heim argue no, on the following basis: if I say this, and I believe that only one person was in the room last night, I’m committed to the truth of *If Bill isn’t a neat-freak then he isn’t the one who was here*, even though I don’t know whether he is or not. This inference is expected on the true *de dicto* reading

\[ \forall w' \in R(w_0) : \exists x : NF(w')(x) \land here(w')(x) \]

but not on the mixed (‘3rd’) reading

\[ \forall w' \in R(w_0) : \exists x : NF(w_0)(x) \land here(w')(x). \]

• Semantic reconstruction #2: the trace of moved *somebody* can be of type \( (s,(e,t),t)) \). Then you can get low-scope *somebody* with the restrictor varying with epistemically accessible worlds being quantified over—the true *de dicto* reading—but it requires yet another variant of functional application (?: 95).

Choosing between syntactic and semantic reconstruction looks difficult; presumably the choice will depend on whether syntactic reconstruction can be motivated by other phenomena, e.g., coreference, binding, or idiom interpretation. vF&H favor syntactic reconstruction but the arguments they mention don’t strike me as especially compelling.

2 Chapter 8

2.1 The third (and fourth) readings

Before she became a famous psycholinguist, Fodor (1970) wrote an amazing semantics dissertation. She argued that the purely scopal treatment of *de re/de dicto* ambiguities that we just surveyed is insufficient, since the scope of a quantifier can vary independently of the world-boundedness of its restriction. She was (to my knowledge) the first to observe the existence of the ‘third reading’ (6c) — as well as (6d), which isn’t discussed by vF&H.

Here I give just the relevant truth-conditions for the labeled readings, and then we’ll discuss how they can be derived compositionally.

(6) Mary wanted to buy a hat just like mine.

a. Wide restriction, wide scope:

\[ \exists x : \text{hatLikeMine}(w_0)(x) \land \forall w' \in \text{Want}^{w_0}_{\text{Mary}} : \text{buy}(w')(x)(\text{Mary}) \]

‘There’s a hat just like mine that she saw and wanted to buy; she has no idea I have a similar hat.’
b. Narrow restriction, narrow scope:
\[ \forall w' \in \text{Want}_{\text{Mary}}^{w_0} : \exists x : \text{hatLikeMine}(w')(x) \land \text{buy}(w')(x)(\text{Mary}) \]

‘Mary is a copycat: she may not even know what kind of hat I have, but she intends to buy a similar hat as soon as she works out what kind I own.’

c. Wide restriction, narrow scope:
\[ \forall w' \in \text{Want}_{\text{Mary}}^{w_0} : \exists x : \text{hatLikeMine}(w_0)(x) \land \text{buy}(w')(x)(\text{Mary}) \]

‘Mary wants to buy a cowboy hat—any cowboy hat will do. She doesn’t know this, but I have a cowboy hat.’

d. Narrow restriction, wide scope (?):
\[ \exists x : \forall w' \in \text{Want}_{\text{Mary}}^{w_0} : \text{hatLikeMine}(w')(x) \land \text{buy}(w')(x)(\text{Mary}) \]

‘There’s something that Mary thinks is a hat like mine, and she wants to buy it.’

Fodor (1970) argued that the fourth reading in (6d) is real too, so that scope and world-boundedness of predicates is totally independent. This wasn’t really picked up on, unlike (6c), which generated a big literature and some considerable change to assumptions about the treatment of scope/intensionality interactions. Szabó (2010) argues that it exists too, and proposes a modified version of QR that can generate it by QRing the quantifier without its restriction [not covered here for time’s sake, but well worth looking at].

(7) Mary hopes that a friend of mine will win the race.

vF&H elucidate: “To bring out this rather exotic reading, imagine this: Mary looks at the ten contestants and says I hope one of the three on the right wins - they are so shaggy - I like shaggy people. She doesn’t know that those are my friends. But I could still report her hope as in [(7)].”

2.2 Overt world variables

A common solution: add world variables to all predicates. (Anticipating this issue, we set things up this way from the beginning of the class, even adding world variables to functional vocabulary in the service of having very simple composition rules. Heim & Kratzer/von Fintel & Heim have avoided it up to now, favoring simpler lexical entries and more complex composition principles.)

(8) a. \[ [\text{Canadian}]^a = \lambda w \lambda x. \text{canadian}(w)(x) \]
b. \[ [\text{farmer}]^a = \lambda w \lambda x. \text{farmer}(w)(x) \]
c. \[ [\text{leave}]^a = \lambda w \lambda x. \text{leave}(w)(x) \]
d. ...
They prefer to stay extensional wherever possible, though it makes little difference, as we’ve seen.

(9) a. \[\text{[Mary]}^a = \text{Mary}\]
b. \[[\text{every}]^a = \lambda P\lambda Q\forall x.P(x) \rightarrow Q(x)\]
c. ...

Composition rules: abolish IFA, use Extensional Functional Application, \(\lambda\)-Abstraction, Predicate Modification.

- \([\text{vp}\text{John leave}]\) can’t be composed, so we need a covert world variable: \([\text{vp}\text{John}[\text{vp}\text{leave w}_3]]\).
- We have to also introduce a variable-binder at the top level to make the whole thing a proposition: type \(\langle s, t \rangle\). (We could make other assumptions that are equivalent for present purposes, e.g., tie unbound world-variables to the utterance world.)

- Presumably trees representing full utterances, with teacher and left indexed to different worlds, are ruled out by some general principle, e.g., “No free world variables”.
But the fact that we can generate them is useful in embeddings: this can generate the 'Wide restriction, narrow scope' reading, with the world variable of *teacher* indexed by the matrix world variable binder.

Of course, we can just as easily generate a reading where the verb indexed to the matrix world-binder and the embedded subject is bound low.
• Percus (2000) points out that this reading does not seem to exist:

(10) Mary thinks that my brother is Canadian.
   a. OK: “Mary thinks that guy is Canadian. She doesn’t know this, but he’s my
      brother.”
   b. Unavailable: “Mary thinks that guy is my brother. She doesn’t know this, but
      he’s Canadian.”

• Percus proposes “Generalization X: The situation [world] pronoun that a verb selects
  for must be coindexed with the nearest $\lambda$ above it.”

• Obviously this is a descriptive generalization, not an explanation! Why would it hold?

• There are many differences between subjects and verbs that could be involved, even if
  they’re similar in this respect: syntactic and information-structural, for example.

2.3 Indexed operators

We could have world-shifting operators instead of variables, as described by (Cresswell 1990).

vF&H ask: “Does natural language have a multitude of indexed world-shifters or a multitude
of indexed world-variables?” The systems are equivalent in expressive power, and look a
whole lot alike too: both have lots of phonetically unrealized material in their trees. It’s
hard to see how you could tell them apart, but maybe there are some clever (probably very
theory-internal) syntactic arguments that could be given.

2.4 Scope again

• Generate the wide-restriction, narrow-scope reading by QRing just the restricting NP.
  This can only generate the wide-restriction, narrow scope “third reading”. [NEXT
  PAGE]

• Szabó (2010): Generate this reading by modifying QR so that it can leave behind the
  restriction and insert a silent $THING$, or bring the restrictor along and put $THING$ in
  the lower NP site. With some other modifications to the grammar and lexicon, this can
  be made to work for both the narrow-restriction, wide scope and the wide-restriction,
  narrow scope readings.

• Open-ended question: What would we have to do to generate the four readings in (6)
  in a Jacobson-style CCG?
References


