Interrogatives worksheet
Chris Potts, Ling 230b: Advanced semantics and pragmatics, Spring 2018
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1 Example calculations

- $W = \{w_1, w_2, w_3, w_4\}$

- $[\text{person}] = \begin{bmatrix} w_1 \mapsto \{a, b\} \\
                          w_2 \mapsto \{a\} \\
                          w_3 \mapsto \{a\} \\
                          w_4 \mapsto \{b\} \end{bmatrix}$

- $[\text{left}] = \begin{bmatrix} w_1 \mapsto \{a\} \\
                              w_2 \mapsto \{a, b\} \\
                              w_3 \mapsto \{b\} \\
                              w_4 \mapsto \{a\} \end{bmatrix}$

- $[\text{met}] = \begin{bmatrix} w_1 \mapsto \{(a, a), (a, b)\} \\
                              w_2 \mapsto \{(b, a), (b, b)\} \\
                              w_3 \mapsto \{\} \\
                              w_4 \mapsto \{(a, b), (b, a)\} \end{bmatrix}$

- $\text{Dox} = \begin{bmatrix} \langle a, w_1 \rangle \mapsto \{w_1, w_2\} & \langle b, w_1 \rangle \mapsto \{w_1, w_2, w_4\} \\
                        \langle a, w_2 \rangle \mapsto \{w_2\} & \langle b, w_2 \rangle \mapsto \{w_2, w_3\} \\
                        \langle a, w_3 \rangle \mapsto \{w_1\} & \langle b, w_3 \rangle \mapsto \{w_1, w_4\} \\
                        \langle a, w_4 \rangle \mapsto \{w_3, w_4\} & \langle b, w_4 \rangle \mapsto \{\} \end{bmatrix}$

(1) Who left? (No one.)

Hamblin:
\[ \lambda w \lambda p \ (\exists x ((\text{person } x w) \land p = (\text{left } x))) \]

at w1: \{[\text{left}()]\} = \{w_1, w_2, w_3\}
at w2: \{[\text{left}()]\}
at w3: \{[\text{left}()]\}
at w4: \{[\text{left}()]\}

Karttunen (as above, but further restricted to the propositions true at the world of evaluation):
\[ \lambda w \lambda p \ (p w) \land \exists x ((\text{person } x w) \land p = (\text{left } x)) \]

at w1: \{[\text{left}()]\}
at w2: \{[\text{left}()]\}
at w3: \{\}

G&S:
\[ \lambda w \lambda w' \ (\lambda x ((\text{person } x w) \land (\text{left } x w))) = (\lambda x ((\text{person } x w') \land (\text{left } x w')) ) \]

These sets can be thought of as determined by set of ordered pairs of worlds that agree on the extension of 'person and left'. As you can see here, when we localize to a world w, we return the set of worlds that agree with w in 'person and left'

Structured meanings
\[ \lambda x \lambda w \ ((\text{person } x w) \land (\text{left } x w)) \]

(2) Who met every entity?

The calculations for this example are of the same form as for (1). The special interest of this case is that all the proposition-set theories are clearly predicting that every entity cannot scope above who. This would result in something like 'For each x, tell me who met x', rather than 'Tell me who met everyone'. For discussion of this prediction, see the Krifka paper arguing for a structured meanings approach to questions. See also

(3) \[\text{know}_H = \lambda Q_{<s,<s,t,t>} \lambda x \lambda w (\forall q \in Q(w), \text{if } (q,w), \text{then } \text{Dox}(x,w) \subseteq q)\]

(4) \[\text{know}_K = \lambda Q_{<s,<s,t,t>} \lambda x \lambda w (\forall q \in Q(w), \text{Dox}(x,w) \subseteq q)\]

(5) \[\text{know}_{GS} = \lambda Q_{<s,<s,t,t>} \lambda x \lambda w (\text{Dox}(x,w) \subseteq Q(w))\]
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(6) B knows who left.

\[ \text{[know}_H(B, \text{who(left))}] = \text{[know}_K(B, \text{who(left))} \]

at w1: F; Dox(B, w1) = \{w1, w2, w4\} and, of \{left(a)\} = \{w1,w2,w3\} and \{left(b)\} = \{w2, w3\}, only \{left(a)\} is true at w1 and \{w1, w2, w4\} \nsubseteq \{w1,w2,w3\}
at w2: F Dox(B, w2) = \{w2, w3\} is not a subset of \{left(a)\} = \{w1,w2\}, the only member of the question meaning
at w3: T; Dox(B, w3) = \{w1, w4\}, but the real issue is that who(left)(w3) has no (true) elements at w3 on this theory
at w4: T; Dox(B, w3) = \{\}, but the real issue is that who(left)(w4) has no (true) elements at w4 on this theory

\[ \text{[know}_G(B, \text{who(left))}] \]

at w1: F; Dox(B, w1) = \{w1, w2, w4\} and who(left)(w1) = \{w1, w2\} on this theory, so the subset condition is not met
at w2: F; Dox(B, w2) = \{w2, w3\} and who(left)(w2) = \{w1, w2\} on this theory, so the subset condition is not met
at w3: F; Dox(B, w3) = \{w1, w4\} and who(left)(w3) = \{w3, w4\} on this theory, so the subset condition is not met
at w4: T; Dox(B, w4) = \{\}, so the subset condition is satisfied vacuously
2 Multiple constituent questions

Questions like *Who saw what?* are common in natural languages. (Sometimes all of the questioned constituents behave like normal interrogative phrases; sometimes just one moves, as in English; and sometimes they are in fact blocked.) Provide meanings for *Who saw what?* in the Hamblin, Karttunen, and G&S theories. Then work to differentiate the three treatments, by focusing on answerhood conditions and embeddability.

Note: You needn’t develop a compositional theory. It’s the final meanings (and their associated semantic types) that we’re primarily interested in. That said, we can easily have a compositional theory as long as we allow ourselves intermediate questions of the form *Who saw x*, where *x* is bound by a higher wh-phrase. (Thus, in situ wh-phrases must move.)

**Hamblin:**
\[
\lambda w \lambda p (\exists x \exists y ((\text{thing } x \ w) \land (\text{person } y \ w) \land p = (\text{see } x \ y)))
\]

**Karttunen:**
\[
\lambda w \lambda p ((p \ w) \land \exists x \exists y ((\text{thing } x \ w) \land (\text{person } y \ w) \land p = (\text{see } x \ y)))
\]

**G&S**
\[
\lambda w \lambda w' ( (\lambda x \lambda y ((\text{thing } x \ w) \land (\text{person } y \ w) \land (\text{see } x \ y \ w')) \land (\text{see } x \ y \ w')) )
\]

**Structured meanings**
\[
\lambda x \lambda w ((\text{thing } x \ w) \land (\text{person } y \ w) \land (\text{left } x \ w))
\]

**Observations**

* No type changes from single constituent questions for Hamblin, Karttunen, and G&S, but structured meanings types change based on the arity of the question. This seems to predict that there will be predicates that select for questions of specific arities.

* Structured meanings seem to come closest to what we think of as natural answers to these questions: lists of pairs of entities.
3 Questions and entailment

There is an important sense in which questions can be said to support entailments. In (7)–(8), it seems clear that the (a) cases entail the (b) cases:

(7)  a. Who attended? ⇒
     b. Which students attended?

(8)  a. Who attended? ⇒
     b. Did Sal attend?

For each pair, a complete answer to (a) is also a (more than) complete answer to (b).

i. Does Karttunen’s approach to questions support a definition of entailment that matches the pattern in (7) and (8)? If yes, provide the relevant definition and show how it works for (7) and (8). If no, explain why it does not.

ii. Does G&S’s approach to questions support a definition of entailment that matches the pattern in (7) and (8)? If yes, provide the relevant definition and show how it works for (7) and (8). If no, explain why it does not.

K gets (7) right in virtue of the fact that student entails person. Thus, (7a) will denote a superset of the propositions in (7b), and the intersection of the propositions in (7a) will thus be a subset of the intersection of the propositions in (7b).

However, K does not get (8) right. Suppose it is false that Sal attended. Then the proposition that Sal attended will not be a member of (8a), and (8b) will denote the singleton containing the proposition that Sal did not attend. Extending the notion of question entailment used for (7), we thus have that (8a) is not a superset of (8b).

G&S gets both of the entailments correct as long as we assume that person and student don’t vary by world.

If we assume these properties are fixed across all worlds, then (7) follows because student entails person, so worlds that agree on person & attended also agree on student & attended. The relevant notion of entailment is just that Q1 entails Q2 iff all world pairs that are in the same cell in Q1 are also in the same cell in Q2.

If we don’t assume person and student have constant denotations, then the reasoning doesn’t go through. For example, suppose Sal is an attending student in w and an attending professor in w’. Then w and w’ are together in the partition for (7a) but not the one for (7b).

Similarly, assuming Sal is a person, worlds that agree on person & attended will also resolve the issue of whether Sal attended. Again, we have to assume that Sal is a person in all worlds for this to go through.
4 ‘Mention-some’ interrogatives

The question *Who has a pencil?* is often used in situations in which the questioner is seeking to borrow a pencil from one of the listeners. Thus, the questioner does not require an exhaustive listing of all the listeners with pencils, but rather the identity of just one such person. Provide meanings for *Who has a pencil?* in the Hamblin, Karttunen, and G&S theories and assess the extent to which these theories properly account for these ‘mention-one’ or ‘mention-some’ readings. Answerhood conditions are an essential ingredient of this assessment. You can think flexibly about them. To make things concrete, suppose that \( \text{person}(d) = \{w_1, w_2, w_3, w_4\} \) for \( d \in \{a, b, c\} \) and that *has a pencil* has a denotation equivalent to the following:

\[
\begin{array}{c}
w_1 & \rightarrow & \{a, b, c\} \\
w_2 & \rightarrow & \{a, b\} \\
w_3 & \rightarrow & \{a, c\} \\
w_4 & \rightarrow & \emptyset
\end{array}
\]

For Hamblin and Karttunen, the proposition set denotations contain propositions *d has a pencil* for *d* in \{a, b, c\}. These propositions have a lot of overlap. For example, the proposition that *a* has a pencil is \{w1, w2, w3\}, and the proposition that *b* has a pencil is \{w1, w2\}. Thus, in responding with "*B has a pencil*", one is not excluding others from having one. It’s naturally a mention-some kind of response that aligns well with the denotation.

For G&S, the cells of the question are much more fine-grained. The propositions are more like “*All and only A and B have pencils*”. Thus mention-some answers do not correspond to cells in the partitions, suggesting that they are somehow marked.