1. General Considerations (obvious stuff, but easy to forget)

Issues that might be relevant in assessing proposals for the semantics of questions:

1. Can the proposed semantic object (together with principles of language use) account for the way questions are answered in various contexts?
2. Can the proposed semantic object serve as input to determine the semantics (and in particular the truth conditions) of larger constituents?
3. Can the semantic objects be derived from the syntactic pieces in a theoretically pleasing way?

We've been focusing mainly on 2, and we plan to continue with that for a while. We should however return to 1 at some point (after all, this is a pragmatics class). We will say very little, if anything, about 3.

2. Four Proposals and intrusion of false beliefs (from Paula's presentation)

(1) S:= Which NP VP
Q:= the denotation of S

Hamblin 58
$Q_{H58}(w^0)$ = {that x is the only/maximal member of NP in w^0 s.t. x VP: x is NP in w^0}
Abbreviation
{that only $X_{NP,w0}$ VP: x is NP in w^0}

Hamblin 73
$Q_{H73}(w^0)$ = {that x VP: x is NP in w^0}

Karttunen 77
$Q_K(w^0)$ = {that x VP: x is NP in w^0 and x is VP in w^0}

Groenendijk and Stokhof 82
$Q_{G\&S}(w^0) = \lambda w.$ the set of individuals that are NP and VP in w is identical to the set of individuals that are NP and VP in w^0.

Figure out which individuals are in the intersection of NP and VP in w^o, collect them in a set A:

$Q_{G\&S}(w^0)$ = that A is the set of NPs that VP.

Groenendijk and Stokhof's first objection to Karttunen (section 5.1.1. in Paula's handout; intrusion of false beliefs)

Scenario: x, y, z are all the (relevant) cats; x ate, y ate, and z didn't eat.
Mary believes (correctly) that x and y ate, and believes (incorrectly) that z also ate.

Problem: Karttunen predicts that the following is true

(2) Mary knows which cat ate.

3. Heim 94

Two Claims:

1. There are cases for which Karttunen makes the right prediction, but G&S do not.
2. One can deal with Karttunen's problem once we notice that there is a simple mapping between Q_K to $Q_{G\&S}$.[1]
3. The situation is not symmetric. There is no mapping from $Q_{G\&S}$ to Q_K.

3.1. Argument for Karttunen's semantics (examples copied from Paula's handout, references there)

(3) a. It surprised John who was at the party.
b. The video displays which of those animals the man fed.
c. I was better at predicting who would come than at predicting who wouldn't.

Something to think about (to which we might return with Kratzer): Imagine a documentary film that attempts to tell the story a famous trial of three defendants x, y, and z, a trial which ended in the execution of x, and y, and the acquittal of z. The film however gets the facts wrong. In the film x, y, and z are all executed. How would we then judge: *The film displays which of the defendants got executed.*

3.2. Mapping from Karttunen's semantics to G&S's

K's ideas about the semantics of question embedding verbs (of the type that also take propositions):

(4) a. $[\![\text{John knows } S_p]\!]^w = 1$ iff John knows p in w. (i.e., iff p is true in w and in all $w' \in B_{j,w}$)
b. $[\![\text{John knows } S_Q]\!]^w = 1$ iff John knows *the* answer to Q in w.

(5) a. $[\![\text{John V } S_p]\!]^w = 1$ iff John V p in w. (i.e.,…)
b. $[\![\text{John V } S_Q]\!]^w = 1$ iff John V *the* answer to Q in w.

For K, $[\![S_Q]\!]^w$ is a set of propositions (the true answers to Q), so we must have a method of moving from a set of propositions to a single proposition, and K suggests: $\cap[\![S_Q]\!]^w$.

(6) a. $[\![\text{John knows } S_p]\!]^w = 1$ iff John knows $\lambda w[\![S_p]\!]^w$ in w.
b. $[\![\text{John knows } S_Q]\!]^w = 1$ iff John knows $\cap[\![S_Q]\!]^w$ in w.

[1] This is not totally true. See section 6 of Heim's paper and section 5 and 6 of Beck and Rullmann (1999).

(7) a. $[\![\text{John V } S_p]\!]^w = 1$ iff John V $\lambda w [\![S_p]\!]^w$ in w.
b. $[\![\text{John V } S_Q]\!]^w = 1$ iff John V $\cap [\![S_Q]\!]^w$ in w.

For G&S, $[\![S_Q]\!]^w$ is a proposition, so we can have just a single lexical entry for *know*, and for all the Q embedding verbs.

(8) a. $[\![\text{John knows } S_p]\!]^w = 1$ iff John knows $\lambda w [\![S_p]\!]^w$ in w.
b. $[\![\text{John knows } S_Q]\!]^w = 1$ iff John knows $[\![S_Q]\!]^w$ in w.
(9) a. $[\![\text{John V } S_p]\!]^w = 1$ iff John V $\lambda w [\![S_p]\!]^w$ in w.
b. $[\![\text{John V } S_Q]\!]^w = 1$ iff John V $[\![S_Q]\!]^w$ in w.

This is an advantage for G&S. However, $[\![S_Q]\!]^w$ is too strong to derive the correct truth conditions for the sentences in (3).

Under K's semantics, we can derive the correct truth conditions for the sentences in (3), but not for other sentences.

Heim: adopt K's semantics for questions, but different types of semantics for Q-embedding verb.

(10) a. $[\![\text{John knows } S_p]\!]^w = 1$ iff p is true in w and in all $w' \in B_{J,w}$.
b. $[\![\text{John knows } S_Q]\!]^w = 1$ iff the *exhaustive* answer to Q in w is true in w and in all $w' \in B_{J,w}$.

(11) a. $[\![\text{The video displayed } S_p]\!]^w = 1$ iff p is true in all $w' \in D_{v,w}$,
b. $[\![\text{John knows } S_Q]\!]^w = 1$ iff the *positive* answer to Q in w is true in all $w' \in D_{v,w}$.

(12) a. Positive answer to Q_K (weakly exhaustive)
$Ans_1(Q_K)(w) = \cap [Q_K(w)]$
b. Exhaustive answer to Q_K (strongly exhaustive)
$Ans_2(Q_K)(w) = \lambda w'. [Q_K(w) \text{ is identical to } Q_K(w')] \approx Q_{G\&S}(w)$

Ans_1 cannot be defined based on Ans_2. Hence if the facts are correctly understood, $Q_{G\&S}$ cannot be the basic meaning of the question.

Homework (not required to hand in)
a. Prove that Ans_1 cannot be defined based on Ans_2.
b. Could Q_{H58} or Q_{H73} serve as the basic meaning of a Question (given the facts discussed)? Provide appropriate mapping from basic meaning to $Ans_{1/2}(Q_K)$, or prove that there is no mapping.

5. Alya's Question

Scenario: x, y, z are all the (relevant) cats; x ate, y ate, and z didn't eat.
Mary believes correctly that x and, but she doesn't know that y ate.

Problem: Both of the sentences in (13) seem to be false.

(13) a. Mary knows who ate.
b. Mary doesn't know who ate.

It seems that in general, negation of *x V Q* in w entails the negation of *x V p* for all $p \in Q_K(w)$:

(14) Mary didn't tell anyone which student Sue dated.

6. Definite plurals and Questions

Potentially related:

(15) a. Mary saw the boys.
$\forall x[boy(x) \rightarrow saw(m,x)]$
b. Mary didn't see the boys.
$\forall x[boy(x) \rightarrow \neg saw(m,x)]$

6.1. Wny not wide scope universal?

One possible account: *the boys* is a universal quantifier which must outscope negation.

Problems:
1. Why?
2. Doesn't give us the right meaning for complex cases such as (16).

(16) The teacher didn't demand that we read these books.
a. $\forall$x[x is one of these books $\rightarrow$ $\neg$demand(t, that we read x)]
b. $\neg$demand(t, that $\exists$x[(x is one of these books) & (we read x)]

(16b) seems to be the right meaning. (16a) is too weak.

Questions seem to be similar.

(17) a. Mary told us which students slept in the department.
$\forall$x[x a student that slept in the department $\rightarrow$
Mary told us that x slept in the department]
b. Mary didn't tell us which student slept in the department.
$\forall$x[x a student that slept in the department $\rightarrow$
$\neg$(Mary told us that x slept in the department)]

One possible account: *Q* is a universal quantifier which must outscope negation.

Problems:
1. Why?
2. Doesn't give us the right meaning for complex cases such as (18)

(18) We didn't demand that Mary tell us which students slept in the department.
a. $\forall x$[x a student that slept in the department $\rightarrow$
$\neg$demand(we, Mary tell us that x slept in dept.)]
b. $\neg$demand(we, that $\exists x$[x a student that slept in the department &
Mary tell us that x slept in dept])

(18b) seems to be the right meaning. (18a) is too weak.

6.2. Embedding under questions

(19) **Gajewski (2005): Yes no questions give us a very good hint as to what might be going on**
a. Did Mary read these books?
b. He knows whether Mary read these books.

(19) seems to imply that Mary either read all of the books or read none of them.

(20) Possible answers to (19)a
B. Yes (= she read all of them).
B'. No (= she didn't read any of them).
B''. Well, she didn't read War and Peace, though she did read the other books.

(21) **Questions are analogous**
a. Did Mary tell us who sleeps in the department?
b. I wonder whether Mary knows who sleeps in the department.

(21) seems to imply that Mary either read all of the books or read none of them.

(22) Possible answers to (21)a
B. Yes (= she told us who sleeps in the dept).
B'. No (= she didn't tell us for any student that/whether-or-not he sleeps in the dept).
B''. Well, she didn't tell us that Bill sleeps in the dept. Though she did tell us which are the other students that sleep in the dept.

7. Fodor/Gajewski on definite plurals

Basic idea: definite description have a homogeneity presupposition:

(23) $[\![\text{the } NP_{pl}\ P]\!]$ is defined only if either
a. $\forall x \in [\![NP_{pl}]\!]: [\![P]\!](x) = 1$, or
b. $\forall x \in [\![NP_{pl}]\!]: [\![P]\!](x) = 0$

Implementation: expanding the domain of individuals to include plural individuals; the method: introducing an operation of sum formation, $\oplus$, and defining D_e as closure under sum formation of the domain of atomic individuals, AT (also defining an ordering $\leq$ in the obvious way $y \leq x$ *iff* $\exists z[y=x\oplus z]$)

(24) $[\![NP_{pl}]\!]$ = closure under sum formation of $[\![NP_{singl}]\!]$
If $x \in [\![NP_{singl}]\!]$, $x \in [\![NP_{pl}]\!]$
If $x, y \in [\![NP_{pl}]\!]$, $x \oplus y \in [\![NP_{pl}]\!]$

(25) $[\![the]\!] = \lambda P{:}\exists! x \in P[\forall y \in P[\ y \leq x]].\ (\iota x \in P)(\forall y \in P[\ y \leq x])$

(26) The boys left.
LF: [[D the boys] left]

(27) $[\![D]\!] = \lambda X_e.\lambda P_{et}{:}\forall x,y \in Singl(X)[P(y)=P(x)].\forall x \in Singl(X)[P(y)=1]$
$Singl(X) = \{x \leq X{:}x \in AT\}$

$[\![(26)]\!]$ is defined only if either (a) every boy left, or (b) no boy left. If defined $[\![(26)]\!]$ =1 iff every boy left.

7.1. negation

The negation of S inherits the presuppositions/definedness-conditions of S.
Hence, the negation of (26) also has the homogeneity presupposition. When (26) is defined it is true iff it's not the case that every boy left. In other words, the negation of (26) would be true (i.e., defined and true) iff no boy left.

Same for (15b)

(15b) Mary didn't see the boys.
Not[[D [the boys]][λx. Mary saw x]]

7.2. yes/no questions

(19a) Did Mary read these books?

Hamblin denotation:

$[\![(19)]\!]$ = {that Mary read these books, that Mary didn't read these books}

A question Q at least presupposes that ONE member of its Hamblin denotation is true. (See Lahiri 2002, Heim 2001? class notes, Guerzoni 2003. We will soon see a possible explanation for this projection property)

7.3. *demand*

(16) The teacher didn't demand that we read these books.
a. $\forall x[x$ is one of these books $\rightarrow \neg$demand(t, that we read x)]

b. $\neg$demand(t, that $\exists$x[(x is one of these books) & (we read x)]

(16b) seems to be the right meaning. (16a) is too weak.

In order to see whether we get the right results, we need to have a theory of presupposition projection.

Since we don't have one (yet), let's try to come up with an appropriate independent observation about *demand*.

(28) a. John demanded that we send our taxes to the king of France.
b. John believed that France is (going to become) a Monarchy and demanded that we send our taxes to the king.

(29) $[\![\text{John demands that S}]\!]^C = \lambda w{:}\ \forall w' \in D_{J,w,tc}\ [w' \in \text{Domain}([\![\text{that S}]\!]^C)].$
$\forall w' \in D_{J,w,tc}\ [\![\text{that S}]\!]^C(w') = 1.$

Question to think about: does the set of worlds satisfying the demands have to be a sub-set of the subjects belief worlds?

(28) John demands that we send our taxes to the king of France.
λw. in w at t_c John demands
[λw' we send our taxes to the KoF in w' at t_f] where t_f follows t_c

(28) presupposes that in John's demand-wolrds France is going to have a unique King (at the contextually relevant future time).

(30) The teacher demands that we read these books.
λw. in w at t_c the teacher demands
[λw'. [D these books][λx. we read x in w' at t_f]] where t_f follows t_c

(30) presupposes that in each of the teacher's demand-wolrds, we will either read all of the books or none of them (at the contextually relevant future time). (30) asserts that among these two options only the option of reading all of the books satisfies the demands.

(31) The teacher doesn't demand that we read these books.
λwλt. in w at t Neg [the teacher demands
[λw'λt'.$\exists_C$t'' > t' [D these books][λx. we read x in w' at t'']]]

(31) presupposes the same thing. Furthermore, it asserts that there is an allowed world, w_a, (a world that satisfies the demands) where we don't read all of the books. Given the presupposition it follows that there is an allowed word where we read none of the books.

Angela's Question: But the reading is too strong. We predict the presupposition that we are not allowed to read just a proper subset of the books.

A potentially related problem…

(32) The teacher allowed us to write a squib instead of a long paper. Furthermore, he didn't demand that we hand in the squib we write.

There's a lot that I don't understand, and I will stop here.

8. Question denote definite plurals (Lahiri 2002)

(33) John knows who came.
LF:
$[D_Q$ [who came]] [λp. John knows p]] (Interrogative Raising; Lahiri 2002)

Assumption: Questions receive a Karttunen denotation.

(34) $[\![D_Q]\!] = \lambda Q_{st,t}.\lambda v_{st,t}{:}\forall p,q\in Singl(Q)[v(p)=v(q)].\ \forall p\in Singl(Q)[v(p)=1]$
$Singl(Q) = \{p\in Q{:}\neg\exists q\in Q[p\Rightarrow q\}$

Note: We haven't provided a unified definition of D?

We might want closer parallelism between definite plurals and questions. In particular, we might think that questions *are* definite plurals. In other words, we might postulate a covert operator *the*, which takes a Karttunen denotation and returns its maximal member:

(35) $[\![the]\!] = \lambda Q_{\alpha,t}\,{:}\exists! p \in Q[\forall q \in Q\ [q\leq p].\ (\iota p \in Q)[\forall q \in Q\ [q\leq p].$[2]

and then define D in the following way:

(36) $[\![D]\!] = \lambda Q_{\ \alpha}.\lambda v_{\ \alpha,t}{:}\forall p_{\ \alpha},q_{\ \alpha}\in Singl(Q)[v(p)=v(q)].\ \forall p\in Singl(Q)[v(p)=1]$
$Singl(Q) = \{p\leq Q{:}\ \forall q\leq Q[q\leq p \rightarrow q = p\}$

This won't work as is. (Homework: why?)

Here's a proposal made in Magri 200x, which could be useful. (See also Bale 200x, and Lahiri 2002.) Magri adopts the proposal made in Fox (2000, 2003) and Sauerland (2002,…) that every predicate is defined only for individual which satisfy the restrictor of the DP with which the predicate combines.

(37) Every boy left.
Every boy λx. left the boy x [trace conversion]

(38) λx. left the boy x = λx: x is a boy. x left

[2] $p \leq q$ iff p is logically weaker than q ($q \Rightarrow p$). In work in progress by von Fintel, Fox and Iatridou, we argue for a possible generalization to all domains (sketched in von Fintel and Iatridou 2004, and Fox and Hackl in press).

With this assumption in place he defines distributivity as follows:

(39) $[\![D]\!] = \lambda Q_{\alpha}.\lambda v_{\alpha,t}: \forall p_{\alpha}, q_{\alpha} \in Singl(Q, v)[v(p)=v(q)].\ \forall p \in Singl(Q, v)[v(p)=1]$
$Singl(Q, v) = \{p \leq Q: \forall q \leq Q[q \in domain(v)\ \&\ q \leq p \rightarrow q = p\}$

9. What's with Exhaustification?

The Homogeneity presupposition makes reference to the singular members of Q. But Heim's Ans_2 takes us from a set of propositions to a single proposition. We want something different.

(40) $EX(Q_K)(w) = (Q_K)(w) \cup (Q_K^{\neg})(w)$
$(Q_K^{\neg})(w) = \{\neg p: p(w)=0\ \&\ \exists w'\ p \in (Q_K)(w')\}$
$= \{\neg p: p(w) = 0\ \&\ p \in Q_H\}$

10. Evidence for definite descriptions

Cumulative Interpretations (Lahiri 2002)

(41) The linguists figured out which rules are involved in such processes.

Maximality effects

(42) I know which boy came to the party.
Presupposes that Just one boy came to the party.
(See Dayal 1996, Higginbotham and May 1981, among others)

(43) a. *Before when did John arrive?
(von Fintel and Iatridou)
b. Before when does he have to arrive?
(Fox and Hackl)

11. Problem with Strongly Exhaustive interpretation

The set of propositions that we get from (40) will (almost always) not have a most informative member.

(44) Who came.

Imagine that in w, x came, y came, and z didn't come.
$(Q_K)(w) = \{x, y, x\&y\}$
[shorthand for the propositions, that x came, that y came, and that x and y came, resp.]
$EX(Q_K)(w) = \{x, y, x\&y, \neg z\}$

But this has no strongest member.

We need something like the following:

(40)' $EX(Q_K)(w) = (Q_K)(w) \cup (Q_K{}^{\neg})(w) \cup \{p \wedge q: p \in (Q_K)(w) \;\&\; q \in (Q_K{}^{\neg})(w)\}$

Now we get:
$EX(Q_K)(w) = \{x, y, x\&y, \neg z, x\&(\neg z), y\&(\neg z), x\&y\&(\neg z)\}$

And this does have a most informative member.

But how do we get this.

11. Hope: this relates to an independent problem with multiple questions

(45) I know which boy came to the party.
Presupposes a non-conjunctive answer.

(46) I know which boy came to which party.
Doesn't presuppose a non-conjunctive answer. (Dayal, H&M)

For (45) we get, $(Q_K)(w)$ = {that x came to the party: x a singular individual)
For (46) we don't want the following, $(Q_K)(w)$ = {that x came to y: x a singular individual, y a singular individual)

Modification of point-wise composition:

a. $F(B) = \{f(b): b \in B, f \in F\}$, if either F or B are singletons

Otherwise

b. $F(B) = \{f_1(b_1) \wedge \ldots f_n(b_n): \forall i\ [(f_i \in F) \;\&\; (b_i \in B) \;\&\; \forall j \neq i\ (f_i \neq f_j \;\&\; b_i \neq b_j)]\}$[3]

We might now eliminate $EX(Q_K)(w)$, and derive (40)' as the ordinary denotation of a multiple *who whether* question (cf. Guerzoni 2003).

Plural questions

(47) Who came
LF: whether who came

(48) a. $[\![\text{whether}]\!] = \{\lambda p\,.\,p, \lambda p.\lambda w.\neg p(w)\}$
b. $[\![\text{who came}]\!] = \{x, y, x \wedge y\}$
c. $[\![\text{whether who came}]\!] = \{x, y, x \wedge y, \neg x, \neg y, \neg(x \wedge y)\ (=\neg x \wedge \neg y)$[4],

[3] As pointed out by Emanuel (a) follows from (b), hence can be dropped. However, (a) is easier to apply in the simple case, hence will be kept (for ease of application).
[4] By homogeneity

$x\wedge\neg y$, $y\wedge\neg x$,
$x\wedge\neg (x\wedge y) = \varnothing$, $y\wedge\neg (x\wedge y)\}$

We would now need an operator moving from Hamblin to Karttunen denotations:

(49) $[\![\text{True}]\!](Q)(w) = \{p\in Q: p(w)=1\}$

Suppose: x and $\neg y$ are true in w:

$[\![\text{True}]\!]([\![\text{whether who came}]\!])(w) = \{x, \neg y, x\wedge\neg y\}$

(50) John knows who came.
LF:
[D_Q the True [whether who came]]
[λp.John knows p]]