Presupposition projection in (coordinations of) polar questions

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Outline

The motivating data

A problem for existing theories

Proposal: trivalent homogeneous questions

Possible extension to constituent questions

Common wisdom

- A well-known pattern, going back at least to Karttunen (1973): (1a) presupposes that Ann is married, but (1b) and (1c) do not.

(1) a. Ann's spouse is abroad.
    b. Ann is married and her spouse is abroad.
    c. Ann is unmarried or her spouse is abroad.

- Another well-known fact: presuppositions project from a polar question as from the corresponding assertion.

(2) a. Is Ann's spouse abroad?
    b. John doesn't know whether Ann's spouse is abroad.
    $\rightsquigarrow$ (It is taken for granted that) Ann is married.

Some new data

(3) a. John: Is Ann married and is her spouse abroad?

b. John wonders whether Ann is married and whether her spouse is abroad.

c. John: Is Ann unmarried or is her spouse abroad?

d. John wonders whether Ann is unmarried or whether her spouse is abroad.

$\not\rightsquigarrow$ John believes that Ann is married.

We observe a "filtering" of presuppositions that is strikingly similar to what is seen with declaratives!

(Note: (3c-d) are ambiguous between an "open" and a "closed" or "alternative" reading; the facts obtain under both readings.)

A further look at the data

- Asymmetry:

(4) a. #Is Ann unmarried and is her spouse abroad?
b. #Is Ann married or is her spouse abroad?

(So it's really like assertions!)

- Triviality effects:

(5) a. #Is Ann in Paris and is she in France?
b. #Is Ann in Paris and is she in London?

- *Or not* breaks it:

(6) a. #Is Ann married or not and is her spouse abroad?
b. #Is Ann unmarried or not or is her spouse abroad?

Modal subordination?

Groenendijk (1998) noticed the conjunction fact and suggested it was some kind of modal subordination. You are basically saying this:

(7) a. Is Ann married, and ~~*if so*~~ is her spouse abroad?
    b. Is Ann unmarried, or ~~*if not*~~ is her spouse abroad?

The question then is: why the pattern conjunction $\rightarrow$ “if so”, disjunction $\rightarrow$ “if not”? Why can't we say (8)?

(8) *Is Ann married, and ~~*if not*~~ is her spouse abroad?

Why we need question coordination

- Our examples have the apparent syntax of coordinations of questions. Concretely, there is inversion (or *whether*) on both sides of the connective.
- The pattern *and* $\rightarrow$ *grant that yes, or* $\rightarrow$ *grant that no* is well-known and relatively well-understood in declaratives, with a wealth of accounts that describe and explain it in various ways.
- If we try to reduce question coordination to proposition coordination, for instance by having "and"/"or" take very wide scope (a.o. Krifka 2001 for conjunction, Szabolcsi 2016 for disjunction), we make specific, incorrect predictions.

(9) John wonders whether Ann is married and whether her spouse is abroad.
Assumption: and $\gg$ wonder
Predicted presupposition: if John wonders whether Ann is married, he believes she is married (or something like that).

Full desiderata

- An “asymmetric” denotation for polar questions, making “is Ann married?” different from “is Ann unmarried?” (already argued for for other reasons by Bolinger (1978), Krifka (2001), Biezma and Rawlins (2012)...).
- “Real” coordination of questions with:
  - A uniform treatment of conjunction and disjunction.
  - Structures that map straightforwardly to the overt syntax.
  - A straightforward relation to coordinations of assertions.
- Empirically correct semantics and pragmatics for coordinated questions.
- A derivation of the presupposition projection patterns that follows the same lines as an established account for declaratives.

Desiderata: focus on presupposition projection

- *A derivation of the presupposition projection patterns that follows the same lines as an established account for declaratives.*

Some accounts of presupposition projection in declaratives:

- Static theories: Schlenker's (2008) transparency theory, trivalent theories (Beaver and Krahmer 2001; George 2014)...
- Dynamic theories: Heim 1983...

Ideally, we combine one of these accounts with a theory of what questions denote and how they can be coordinated, and the presupposition projection facts follow.

Hamblin-Karttunen semantics: basic issues

In H/K semantics, questions are sets of propositions, construed as sets of possible answers.

- Inconsistency: disjunction is set union, but conjunction applies pointwise inside the sets.

(10) a. $Q \wedge Q' = \{p \wedge p' \mid p \in Q, p' \in Q'\}$
b. $Q \vee Q' = Q \cup Q'$

- The (much criticized) traditional account is that a polar question denotes $\{p, \neg p\}$. This is not asymmetric, and therefore right out. We need to assume that it denotes $\{p\}$.

Dealing with conjunction in H/K semantics (1)

(11) Is Ann married, and is her spouse abroad?

(12) a. $[\![\text{is Ann married?}]\!] = \{p\}$
b. $[\![\text{is Ann's spouse abroad?}]\!] = \{q\}$

We are going to need a *closure operator* to put back the negative answers into the denotation (Biezma and Rawlins 2012):

(13) $\mathrm{C} = \lambda Q.\, Q \cup \{\neg(\bigcup Q)\}$

Many possibilities:

(14) a. $[\![(11)]\!] \stackrel{??}{=} \mathrm{C}(\{p\} \wedge \{q\}) = \{p \wedge q, \neg(p \wedge q)\}$
These are not the answers you can give to (11).
b. $[\![(11)]\!] \stackrel{??}{=} \mathrm{C}(\{p\}) \wedge \mathrm{C}(\{q\})$
$= \{p \wedge q, \neg p \wedge q, p \wedge \neg q, \neg p \wedge \neg q\}$
Not clear that these are the answers you can give to (11) either.

Dealing with conjunction in H/K semantics (2)

(11) Is Ann married, and is her spouse abroad?

(15) a. $\mathrm{C}(\{p\}) \wedge \mathrm{C}(\{q\}) = \{p \wedge q, \neg p \wedge q, p \wedge \neg q, \neg p \wedge \neg q\}$
b. $\mathrm{C}(\{p\} \wedge \mathrm{C}(\{q\})) = \{p \wedge q, p \wedge \neg q, \neg p\}$

The denotation in (15b) is such that:

(i) The answers look about right.

(ii) We can understand the lack of presupposition projection at least in the Transparency Theory (Schlenker 2008) and in trivalent theories (George 2014).

The denotation in (15a) lacks both these properties. But the overt syntax would suggest (15a)!
Additionally other possibilities like $\mathrm{C}(\mathrm{C}(\{p\}) \wedge \{q\})$ do not appear to correspond to a possible reading of conjunctive questions.

Dealing with disjunction in H/K semantics

(16) Is Ann unmarried, or is her spouse abroad?

(17) $\textsc{c}(\{p\}) \vee \textsc{c}(\{q?\} = \{p, \neg p, \neg q, q\}$
But "Ann is married" ($\neg p$) is not a good answer to (16).

(18) $\textsc{c}(\{p\} \vee \{q\}) = \{p, q, \neg q\}$
This is closer to the good answers, but why this structure? and it is not obvious how to derive the presupposition projection facts under any account.

Partition theory

In partition theory (Groenendijk and Stokhof 1984), questions are equivalence relations over worlds (type *sst*).

- No straightforward way to define disjunction over question denotations.
- Denotations of polar questions are fundamentally symmetric, no obvious way to make them asymmetric.

Inquisitive semantics

The problems in inquisitive semantics (Ciardelli, Groenendijk, and Roelofsen 2013) are very similar to those in H/K semantics.

- Inconsistency: conjunctions of polar questions are naturally analysed as $?p \wedge ?q$, but disjunctions are $?(p \vee q)$ or just $p \vee q$. $?p \vee ?q$ does not result in a question that can be expressed in natural language.
- We can derive the projection facts for conjunction based on Transparency Theory, but we need again to assume the weird structure $?(p \wedge ?q)$ (? in InqSem is just like C). But why this structure?
- *If we commit to Transparency Theory,* no obvious way to derive the projection facts for disjunction. It would have to be the case that if a state s does not support p, it supports $\neg p$. This is not actually the case (there is no excluded middle).

Categorial approaches

- Categorial approaches assign to question a more sophisticated type. This lets them give polar questions an asymmetric denotation.

- The main problem is that defining coordination over these complex types is not straightforward. Theories therefore fall back to partition semantics (Groenendijk and Stokhof 1984) or some kind of wide scope (Krifka 2001) to account for coordination, with all the problems we already pointed out.

Trivalent homogeneous questions: the basic idea

- Questions are predicates upon epistemic states (as in inquisitive semantics).
- But they are *trivalent* predicates.

(19) $$?p = \lambda s. \begin{cases} 1 & \text{if } s \vdash p, \\ 0 & \text{if } s \vdash \neg p, \\ \# & \text{in all other cases.} \end{cases}$$

Compare to the inquisitive denotation:

(20) $$?p = \lambda s. \begin{cases} 1 & \text{if } s \vdash p \text{ or } s \vdash \neg p, \\ 0 & \text{otherwise.} \end{cases}$$

Notice how we added asymmetry. The basic idea of adding asymmetry to inquisitive semantics is already explored by Roelofsen and Farkas (2015), but in a conceptually quite different way.

Some definitions (1)

- The *domain* of a question is the inquisitive denotation, i.e. intuitively the set of states where the question is resolved.

(21) a. $\textsc{dom}(Q) := \{s \mid Q(s) \in \{0, 1\}\}$
b. $\textsc{dom}(?p) = \{s \mid s \vdash p\} \cup \{s \mid s \vdash \neg p\}$

- The *alternatives* of a question are maximal elements of the domain. Intuitively, they correspond to the possible answers (in the H/K sense).

(22) a. $\textsc{alt}(Q) := \{s \mid s \text{ is maximal in } \textsc{dom}(Q)\}$
b. $\textsc{alt}(?p) = \{p, \neg p\}$

Notice how the system is strictly an extension of inquisitive semantics or H/K semantics.

Some definitions (2)

The *informational commitment* of a question is the set of worlds where the question can be answered. Intuitively, it is what the question presupposes.

(23) a. $\textsc{info}(Q) := \bigcup \textsc{dom}(Q)$
b. $\textsc{info}(?p) = \pi(p)$

Where:

(24) $\pi(p) = \{w \mid p(w) \in \{0, 1\}\}$
($\pi(p)$ is the presupposition of p)

Note that we assume propositions are trivalent sets of worlds (type $\langle s, t_{\#} \rangle$).

Concrete example

(25) p: John stopped smoking.
$p(w) = \#$ iff John never smoked in w

(26) $?p$: Did John stop smoking?
$?p(s) = 1$ iff s supports "John stopped smoking"
$?p(s) = 0$ iff s supports "John didn't stop smoking"
$?p(s) = \#$ if s is undecided but also if s does not support "John used to smoke"

(27)
$$\begin{aligned}
\textsc{info}(?p) &= \bigcup \textsc{dom}(?p) \\
&= \Big(\bigcup\{s \mid ?p(s) = 1\}\Big) \cup \Big(\bigcup\{s \mid ?p(s) = 0\}\Big) \\
&= \underbrace{\underbrace{\{w \mid p(w) = 1\}}_{\text{John stopped smoking}} \cup \underbrace{\{w \mid p(w) = 0\}}_{\text{John still smokes}}}_{\text{John used to smoke}} \\
&= \pi(p)
\end{aligned}$$

Behaviour of connectives: main assumptions

- A question Q is resolved when the Common Ground is in $\textsc{dom}(Q)$.
- A question Q, when uttered, pragmatically presupposes $\textsc{info}(Q)$ (Stalnaker's bridge).
- *and* and *or* are left-to-right biased lazy trivalent connectives, a.k.a. "Middle Kleene". This assumption is going to make question denotations and presupposition projection linked to one another.

(28)

$\wedge$	0	1	#
0	0	0	0
1	0	1	#
#	#	#	#

$\vee$	0	1	#
0	0	1	#
1	1	1	1
#	#	#	#

Behaviour of connectives: conjunction

(29) $$?p\wedge?q = \lambda s.\begin{cases} 1 & \text{if } s \vdash p \wedge q, \\ 0 & \text{if } s \vdash \neg p \text{ or if } s \vdash p \wedge \neg q, \\ \# & \text{in all other cases.} \end{cases}$$

(30) $\textsc{alt}(?p\wedge?q) = \{\neg p, p \wedge \neg q, p \wedge q\}$

(31) $\textsc{info}(?p\wedge?q) = \pi(p) \wedge [p \rightarrow \pi(q)]$

- We derive the tripartition we were looking for, without assuming a non-surface-like structure.
- If we want to also derive a reading where both conjuncts need to be fully answered, we might assume wider scope for "and". However, at least some questions clearly have the 3-way resolution conditions:

(32) Context: *Mary applied for a grant; the decision is due to come by mail.*
Has the mail arrived yet, and did Mary get her grant?

Behaviour of connectives: disjunction

(33) $$?p\vee?q = \lambda s.\begin{cases} 1 & \text{if } s \vdash p \text{ or if } s \vdash \neg p \wedge q, \\ 0 & \text{if } s \vdash \neg p \wedge \neg q, \\ \# & \text{in all other cases.} \end{cases}$$

(34) $$\textsc{alt}(?p\vee?q) = \{p, \neg p \wedge q, \neg p \wedge \neg q\}$$

(35) $$\textsc{info}(?p\vee?q) = \pi(p) \wedge [\neg p \rightarrow \pi(q)]$$

- The 3-way partition we derive does sound like the "open" reading. Unlike the inquisitive account based on $?(p \vee q)$ (cf. Roelofsen and Farkas 2015), we derive a left/right asymmetry. This might be correct:

  (36) A: Is John↗ here or is Mary?↗

  a. B: John is here. $\rightsquigarrow$ Mary might be here too.

  b. B: Mary is here. $\overset{?}{\rightsquigarrow}$ (B thinks) John is not here.

- How to deal with the "closed" reading unclear at this point.

Back to the desiderata

- An "asymmetric" denotation for polar questions: yes.
- "Real" coordination of questions with:
  - A uniform treatment of conjunction and disjunction: yes.
  - Structures that map straightforwardly to the overt syntax: yes, $?p \wedge ?q$ and $?p \vee ?q$.
  - A straightforward relation to coordinations of assertions: yes, the trivalent connectives can be used for classical propositions as well.
- Empirically correct semantics and pragmatics for coordinated questions: arguably.
- A derivation of the presupposition projection patterns that follows the same lines as an established account for declaratives: yes, the trivalent connectives account for presupposition projection in assertions (Beaver and Krahmer 2001; George 2014).

What about constituent questions?

(37) Who came?

Let's assume that *wh*-words are existential quantifiers (as there is morphological support for):

(38) $?x.\, P(x) = \lambda s.\, \exists x.\, ?P(x)(s)$

Let's further assume that trivalent existential quantification works like George (2014) predicts:

(39) $$\exists x.\, P(x) = \begin{cases} 0 & \text{if for all } y,\ P(y) = 0, \\ 1 & \text{if there is } y \text{ such that } P(y) = 1, \\ \# & \text{in all other cases.} \end{cases}$$

Trivalent existential quantification: consequences

Results:

(40) $\textsc{dom}(?x.\, P(x)) = \{s \mid [s \vdash \forall x.\, \neg P(x)] \vee [\exists x.\, s \vdash P(x)]\}$

(41) $\textsc{alt}(?x.\, P(x)) = \{\forall x.\, \neg P(x)\} \cup \{P(x) \mid x\}$

(42) $\textsc{info}(?x.\, P(x)) = [\exists x.\, P(x)] \vee [\forall x. \neg P(x)]$

- The alternatives are the usual H/K answers, plus the negative answer ("nobody came").
- We predict some kind of existential projection for presuppositions, like George (2014) does for existential quantification.

Going forward conservatively

We can define answerhood operators (in many ways, in fact):

(43) $$\textsc{ans}_S(Q)(w) = \left(\bigwedge\{p \mid p \in \textsc{alt}(Q), p(w) = 1\}\right) \wedge \left(\bigwedge\{\neg p \mid p \in \textsc{alt}(Q), p(w) = 0\}\right)$$
(Strongly exhaustive answer)

(44) $$\textsc{ans}_W(Q)(w) = \bigwedge\{p \mid p \in \textsc{alt}(Q), p(w) = 1, Q(p) = 1\}$$
(Weakly exhaustive answer)

Or:

(45) $$\textsc{ans}'_W(Q)(w) = \min\{p \mid p \in \textsc{alt}(Q), p(w) = 1, Q(p) = 1\}$$
(closer to Dayal 1996)

Another path forward: strongly-exhaustive answers as homogeneity implicatures

(46) a. John knows who came.
≈ For all people, John knows whether they came.

b. John doesn't know who came.
≈ For no person is John certain that (if?) they came.

An existential entry for *know*:

(47) $$[\![\text{know}]\!]^{w} = \lambda Q.\, \lambda x : w \in \text{INFO}(Q).\\ \exists p \in \text{DOM}(Q).\, p(w) \wedge \text{Dox}^{w}(x) \vdash p$$

Then, the basic meaning is what transpires in (46b), and (46a) can be derived as an implicature due to exhaustification over domain alternatives, as per Bar-Lev (2018).

(Note: a similar thing can probably be done in H/K theory; my motivation is that I find this entry for *know* natural given the idea of questions being predicates upon epistemic states.)

Thank you!

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