The problem of presupposition projection in question-embedding

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**Problem:** Despite recent progress in the analysis of embedded questions (e.g., Guerzoni & Sharvit 2007; George 2011; Klinedinst & Rothschild 2011; Spector & Egré 2015; Theiler et al. 2016) the treatment of presuppositions in question-embedding sentences remains problematic. This paper specifically concerns the following question: how to uniformly analyze the presuppositions of ‘NP V s Q’ and ‘NP V s that p’, where the two sentences share a responsive predicate V (Lahiri 2002); Q is an interrogative complement and p is a declarative complement. Sentences in (1-2) exemplify this problem with the veridical predicate know and the non-veridical predicate be certain.

(1) a. Does Max know that Pat smokes? \(\Rightarrow\) presup. ‘Pat smokes.’
   b. Does Max know which student smokes? \(\Rightarrow\) presup. ‘Exactly one student smokes.’

(2) a. Is Max certain that Pat smokes? \(\Rightarrow\) presup. ‘Max considers it possible that Pat smokes.’
   b. Is Max certain (about) which student smokes?
      \(\Rightarrow\) presup. ‘Max believes that exactly one student smokes.’

Existing accounts cannot account for these patterns. A simple extension of Dayal’s (1996) account of (1b) in terms of the uniqueness presupposition triggered by the Ans(werhood)-operator would predict the same uniqueness presupposition as (1b) regardless of embedding responsive predicates. This makes an incorrect prediction for (2b). The fact that (2b) does not presuppose unique existence of a true answer, in contrast to (1b), is further evidenced by (3).

(3) No student smokes. But, Max believes that there is a student smoker.
   Only, he isn’t certain / #doesn’t know which student smokes.

A more recent formulation of Ans by Uegaki (2015) accounts for the presupposition in (2b). However, since he analyzes declarative-embedding to be the singleton case of question-embedding, he predicts the following presupposition for (2a): Max believes that ‘Pat smokes’ has exactly one true answer. This is incorrect, as (2a) would then presuppose that Max believes that Pat smokes.

**Two presupposition triggers:** By considering the behavior of agree, we get a clearer picture:

(4) a. Does Max agree with Kim that Pat smokes? \(\Rightarrow\) presup. Kim believes that Pat smokes.
   b. Does Max agree with Kim on which student smokes?
      \(\Rightarrow\) presup. There is exactly one student such that Kim believes that she smokes.
      \(\Rightarrow\) presup. Max believes that there is exactly one student who smokes.

Here, the declarative-embedding case in (4a) only has a presupposition concerning Kim’s beliefs while the interrogative-embedding case in (4b) has presuppositions concerning Kim’s beliefs and Max’s beliefs. This suggests that there are two sources of presuppositions in question-embedding sentences: (i) the embedding verb (whose presuppositional effect is also observed in the declarative embedding case) and (ii) the interrogative complement (whose presuppositional effect cannot be observed in the declarative embedding case). Roughly, in (4b), the presupposition about Kim’s belief corresponds to (i) while the one about Max’s belief corresponds to (ii).

**Proposal outline:** We propose our analysis following the above idea. It goes as follows. We treat each question-embedding predicate as presupposing existence of an answer that meets a lexically-specific condition: know presupposes that there is a true answer; be certain presupposes that there is an answer that the subject considers possible; agree presupposes that there is an answer that the ‘with’-argument believes. Following Uegaki (2015), we treat declarative complements as singleton questions. Thus, these presuppositions manifest themselves in the declarative-embedding cases: know-that presupposes that the complement is true; be certain-that presupposes that the subject considers the complement possible; agree-that presupposes that the ‘with’-argument believes the complement. At the same time, each answer in the denotation of an interrogative complement presupposes uniqueness (Rullmann and Beck 1998). This presupposition projects according to
the lexical semantics of the embedding predicate, resulting in different manifestations of uniqueness presuppositions. The reason why we don’t always see two independent presuppositions in interrogative-embedding is that one of the two presuppositions may be stronger than the other. Below, we formalize this idea.

**The presupposition of Ans:*** Extending Cremers (2016), we analyze the Ans-operator to take an extra argument \( C \) which restricts the set of answers. Given a question \( Q \) and a restriction \( C \), \( \text{Ans} \) presupposes that there is an answer in \( Q \cap C \), and returns the set of maximally strong answers in \( Q \cap C \) (cf. Fox 2013; Xiang 2016):

\[
\text{Ans}(C_{(st,t)}) = \lambda Q_{(st,t)} \lambda x_r. \exists p \in Q \cap C. \{ p \in C \cap Q | \neg \exists p' \in Q \cap C [ p' \Rightarrow p \land p' \not\equiv p] \}
\]

Responsive predicates encode \( \text{Ans} \) in their meanings with lexically specific restrictors, as in (6). Given \( Q \) and \( x \), they return true iff \( x \) believes an answer in the answer-set provided by \( \text{Ans}(C)(Q) \).

\[
\begin{array}{|l|l|l|}
\hline
\text{predicate} & \text{presup. of } [x \Vs Q] & \text{presup. of } [x \Vs Q \text{ that } p]\0
\text{know} & \exists q \in Q[q(w)] & \exists q \in \{p\}[q(w)] & \equiv p(w) \\
\text{be certain} & \exists q \in Q[q \cap \text{Dox}_x^{w} \neq \emptyset] & \exists q \in \{p\}[q \cap \text{Dox}_x^{w} \neq \emptyset] & \equiv p \cap \text{Dox}_x^{w} \neq \emptyset \\
\text{agree with } y & \exists q \in Q[\text{Dox}_y^{w} \subseteq q] & \exists q \in \{p\}[\text{Dox}_y^{w} \subseteq q] & \equiv \text{Dox}_y^{w} \subseteq p \\
\hline
\end{array}
\]

**Uniqueness from answers:** In addition, each answer of a \( w \)-complement denotation presupposes uniqueness. E.g., answers of \( \text{which student smokes} \) presupposes that exactly one student smokes:

\[
[\text{which student smokes}]^{w} = \{ p \mid \exists x \text{st}_x(x) \land p = \lambda w' : \exists ! y [\text{st}_w(y) \land \text{smk}_w(y)] \land \text{smk}_w(x) \}
\]

Since \( \text{Dox}_x^{w} \subseteq p \equiv \forall w'[w' \in \text{Dox}_x^{w} \rightarrow p(w')] \), the presupposition of \( p \) in \( \text{Dox}_x^{w} \subseteq p \) projects universally into \( \text{Dox}_x^{w} \) (Chemla 2009; Sudo 2012). This gives us the subject’s belief of uniqueness. Compositonally, (8) is derived by applying the following constituent-question operator to the Hamblin denotation: \([]?_{\text{const}}^{w} = \lambda Q_{(st,t)} \{ p \mid \exists p' \in Q[p = \lambda w' : \exists ! p''[\text{StrongestTrue}_w(p'',Q)].p''(w')] \}\)

**Illustration:** The presuppositions of the declarative cases in (1a,2a,4a) are explained by the existential presupposition of \( \text{Ans} \), as summarized in (7). The presuppositions of the interrogative cases are explained as follows. \( \text{Re (1b): } \text{Ans}(C)(Q) \) presupposes that (8) contains a true answer, which is equivalent to ‘exactly one student smokes’. In addition, the uniqueness in (8) projects into Max’s belief: ‘Max believes that exactly one student smokes’ (not shown in (2b), but a plausible prediction). \( \text{Re (2b), Ans}(C)(Q) \) presupposes that (8) contains an answer that Max considers possible. Also, again, the uniqueness in (8) projects into Max’s belief: ‘Max believes that exactly one student smokes’. The latter presupposition entails the former, so we only observe the latter. \( \text{Re (4b), Ans}(C)(Q) \) presupposes that (8) contains an answer that Kim believes. Conjoining this with the projection of uniqueness into Kim’s belief (i.e., ‘Kim believes that exactly one student smokes’), we get ‘There is exactly one student such that Kim believes that she smokes’. In addition, the uniqueness is projected into Max’s belief: ‘Max believes that exactly one student smokes’.

**Other predicates:** In the full paper, we will discuss how the analysis extends to other representational (i.e., ‘non-preferential’) predicates by varying the restriction \( C \) and the attitude representation corresponding to \( \text{Dox} \). For example, the veridical version of \( \text{guess} \) would have the same \( C \) as \( \text{know} \) and the set of worlds compatible with the subject’s guessing as the attitude representation.
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References


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