This paper is concerned with verbs that take declarative and/or interrogative complement clauses as their argument, exemplified in (1).

(1)  
   a. Mary knows that John left / who left.
   b. Mary wonders *that John left / who left.
   c. Mary believes that John left / *who left.

Verbs that license both kinds of complements, like know, are called responsive verbs, ones that only license interrogative complements, like wonder, are called rogative verbs, and ones that only license declarative complements, like believe, are called anti-rogative verbs. The selectional restrictions of rogative verbs like wonder have recently been given a semantic explanation [3, 8]. On the other hand, the selectional restrictions of anti-rogative verbs like believe have not yet received such an explanation (see [5] for discussion) and form the target of the present paper.

Our starting point is an old observation by Zuber [9] that many anti-rogative verbs, if not all, are neg-raising. For instance, Mary doesn’t believe it’s raining by default implies that Mary believes that it’s not raining. We show that the standard semantic account of neg-raising in terms of an excluded middle presupposition [7], when implemented in inquisitive semantics, directly predicts the selectional restrictions of neg-raising anti-rogative verbs.

Declarative and interrogative complements. In inquisitive semantics, both declarative and interrogative complements denote downward closed sets of propositions, i.e., if \( p \in [\varphi] \) and \( q \subseteq p \), then \( q \in [\varphi] \) as well. The maximal elements of \([\varphi]\) are called the alternatives generated by \( \varphi \), and are denoted as \( \text{ALT}(P) \). The union of all the elements of \([\varphi]\), i.e., \( \bigcup[\varphi] \), is called the informative content of \( \varphi \), denoted \( \text{INFO}(\varphi) \). A declarative clause always generates a single alternative, which typically does not cover the set of all possible worlds \( W \), while an interrogative clause typically generates multiple alternatives, which together cover \( W \) (for simplicity we leave the presuppositions that declarative and interrogative complements may have out of consideration here; the proposed account can be extended in a straightforward way to deal with such presuppositions). For instance, assuming that the domain of discourse consists of John, Mary, and Sue, we have that:

\[
\begin{align*}
\text{ALT}(\text{John left}) &= \{ \{w | \text{John left in } w\} \} \\
\text{ALT}(\text{who left}) &= \left\{ \begin{array}{l}
\{w | \text{John left in } w\}, \\
\{w | \text{Mary left in } w\}, \\
\{w | \text{Sue left in } w\}, \\
\{w | \text{nobody left in } w\}
\end{array} \right\}
\end{align*}
\]

Responsive verbs. Before turning to anti-rogative verbs like believe, we first give a baseline account of two closely related responsive verbs: know and its non-factive cousin be certain. Let \( \sigma^w_x \) denote the information state of \( x \) in \( w \), i.e., the set of worlds compatible with the information that \( x \) has in \( w \). As is common in doxastic logic, we assume that \( \sigma^w_x \) is always consistent (non-empty), and that individuals are always introspective (\( \sigma^w_x = \sigma^w_x \) for all \( v \in \sigma^w_x \)) but may have false information (it may be that \( w \notin \sigma^w_x \)). We assume the following entries for know and be certain (type \((s,t),t\) is abbreviated as \( T \); presuppositions are underlined; for simplicity, we give truth-conditional entries—these can easily be transformed into support-conditional entries which would be needed for a full-fledged inquisitive semantics, see e.g. [4]):

\[
\begin{align*}
[\text{know}]^w &= \lambda P_T. \lambda x : w \in \text{INFO}(P). \sigma^w_x \in P \\
[\text{be certain}]^w &= \lambda P_T. \lambda x. \sigma^w_x \in P
\end{align*}
\]
Note that these entries apply uniformly to declarative and interrogative complements. Further note that the only assumed difference between know and be certain is the factivity presupposition \( w \in \text{INFO}(P) \). Thus, it is correctly predicted that Mary knows that John left presupposes that John left, while Mary is certain that John left doesn’t. When the complement of know is interrogative, its factivity presupposition is trivially satisfied, because in this case \( \text{INFO}(P) = W \).

**Anti-rogative verbs.** We will focus here on believe, but will also indicate how the account can be extended to other neg-raising anti-rogative verbs. There is a large body of work in which neg-raising effects are accounted for in terms of so-called excluded middle presuppositions [e.g., 2, 7]. That is, a sentence of the form \( x \text{ believes that } p \) is taken to come with a soft presupposition (see [1]) that \( x \) either believes that \( p \) or that \( \neg p \). Since presuppositions survive under negation, \( x \) does not believe that \( p \) still has the same presupposition. In the case of the positive sentence, the asserted content is stronger than the presupposed content, but in the case of the negative sentence, the asserted content and the presupposed content are logically independent, and together they imply that \( x \) believes \( \neg p \). This accounts for the neg-raising effect.

In inquisitive semantics, the excluded middle presupposition of believe amounts to \( \sigma^w_x \in P \lor \sigma^w_x \in \neg P \), where \( \neg P \) is the inquisitive negation of \( P \), i.e., the set of propositions that are incompatible with any element of \( P \) itself: \( \{p' \mid p' \cap p = \emptyset \text{ for all } p \in P\} \). Assuming that believe is just like be certain, but then with an excluded middle presupposition, we get the following entry.

\[
(6) \quad \text{[believe]}^w = \lambda P_T, \lambda x : \sigma^w_x \in P \lor \sigma^w_x \in \neg P, \sigma^w_x \in P
\]

If the complement of believe is declarative, this entry predicts neg-raising effects, as expected. Interestingly, however, the entry also enables us to account for the fact that believe does not license interrogative complements, without any further stipulations. Namely, since the set of propositions \( P \) denoted by an interrogative complement always covers \( W \), its inquisitive negation is always contradictory, i.e., \( \neg P = \{\emptyset\} \). Since \( \sigma^w_x \) is required to be consistent (non-empty), it can never be the case that \( \sigma^w_x \in \neg P \). So the second disjunct in the presupposition of believe can never be true. Thus, if believe takes an interrogative complement, its semantics reduces to \( \lambda P_T, \lambda x : \sigma^w_x \in P, \sigma^w_x \in P \). But this means that whenever \( \text{[believe}(P)(x)]^w \) is defined, it is true. In other words, when the verb takes an interrogative complement, its assertive component is trivial, given its presupposition. We propose that this systematic triviality explains why combining believe with interrogative complements results in ungrammaticality (see [6] for a general discussion of explaining ungrammaticality in terms of systematic triviality or contradictoriness).

An analogous explanation can be given for close relatives of believe such as think and clause-embedding feel, but also for other neg-raising anti-rogative verbs. For instance, instead of demanding that the subject’s information state is in \( P \), we might require, roughly, that the set of worlds in line with the subject’s expectations is in \( P \) (expect), that the subject’s bouletic state is in \( P \) (want), or that the set of worlds in accordance with the contextually available information is in \( P \) (seem). The selectional restrictions of all these verbs can be derived from their excluded-middle presupposition, which, just as for believe, systematically trivializes the assertive component of sentences in which those verbs combine with an interrogative complement.
References


Additional submission. The result presented in this abstract has been obtained within a larger project on clause-embedding verbs. We have submitted a long paper (60+ pages) reporting the main results of this project to the Journal of Semantics on the 1st of December 2016 (4 days before the SALT deadline). Because of its length, we expect that the journal paper will be in the pipeline for quite a while. The result presented in the current abstract is also contained in the journal paper, but the implementation there is much more complex, because our aims there are to account for many other properties of clause-embedding verbs as well. We believe that presenting the idea in its current, isolated form would make it much more transparent and more accessible to colleagues interested in selectional restrictions but not necessarily in all the other aspects of clause-embedding verbs that are covered in the journal paper. If the abstract is accepted, we intend to keep our discussion of the selectional restrictions of anti-rogative verbs in the final version of the journal paper to a minimum, referring to the SALT paper for further details. This way the SALT paper will make its own distinctive contribution and the journal paper will become a bit shorter and easier to digest.