Predicting the variations in the exhaustivity of embedded interrogatives

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1. Introduction Exhaustivity in embedded questions has played a central role in the semantic theories of interrogatives. One of the significant observations (dating back at least to Heim 1994) in this domain is that predicates vary with respect to the strength of exhaustivity involved in the interpretation of its interrogative complement. Specifically, *know* selects for a strongly-exhaustive (SE) reading (Groenendijk & Stokhof 1984) whereas emotive factives (EFs) like *surprise*, *pleased* and *annoy* select for a non-SE reading. This observation led the theories to adopt 'flexible' approaches to question-embedding, i.e., to allow optionality as to whether the reading of the embedded interrogative is SE or not (Heim 1994; Beck & Rullmann 1999, B&R; George 2011). However, there have been few theories that can *predict* the exhaustivity of interrogative complements given the lexical semantics of the embedding predicate despite the intuitive generalization that EFs select for non-SE readings. This paper shows that a simple neo-Gricean theory of quantity implicatures predicts such a variation in the readings of embedded interrogatives, building on the recent development concerning the 'intermediate' exhaustivity (IE) of embedded interrogatives (Klinedinst & Rothschild 2011, K&R; Cremers & Chemla 2014, C&C). The two crucial ingredients of the account is (i) that EFs are non-monotonic operators (Heim 1992) and (ii) that SE interpretation is derived by strengthening the IE reading (i.e., there is no embedded exhaustification).

2. Data Predicates vary with respect to the strength of exhaustivity in its interrogative complement. As discussed at length by G&S, *know* selects for a SE interpretation of its complement (example omitted) while EFs like *surprise* and *please* select for a non-SE reading. This can be shown in the following example (see B&R for the relevant data on *surprise*):

(1) (**Situation** For everyone among Ann, Bill and Carol, John will be pleased if she/he comes to the party, but not if she/he doesn't. At the party, only Ann and Bill showed up. John is aware that all the invitees are Ann, Bill and Carol.)
John was pleased by who came to the party, but wasn't pleased by who didn't come.

The fact that (1) sounds consistent despite the context that John is aware of the domain of *who* indicates that *be pleased* selects for a non-SE reading. Under the SE reading, the two conjuncts should express contradictory propositions.

In addition to the SE reading, it is recently argued that there is an 'intermediate' reading for embedded interrogatives (Spector 2005). C&C have experimentally validated that there are such readings for the predicates *predict* and *know*, as follows.

(2) $[\![\text{John predicted/knows who came}]\!]^w = 1$ iff for every individual x who came in w, John predicted/knows that x came, while for every individual y who didn't come in w, it is not the case that John predicted/believes that y came.

The empirical facts regarding the IE reading of EFs have not been investigated, but the fact that the first conjunct of (1) is true in the given scenario suggests that the IE reading is at least not obligatory for *please* since the situation makes its IE reading false.

3. Klinedinst & Rothschild (2011) K&R give an analysis for the IE reading of non-factive predicates like *predict* by positing the EXH-operator on the matrix clause:

(3) a. $[\![\text{EXH } \varphi]\!] = [\![\varphi]\!] \wedge [\bigwedge_{p \in [\![\varphi]\!]^{\text{Alt+}}} \neg p]$ b. [EXH [John predicted who came]]

For the semantics of the interrogatives, K&R assume that the ordinary semantic value of the interrogative is its WE reading, and that its alternative-semantic value is the set of possible WE readings (technical details are modified from K&R). Also, the alternative-value for the matrix clause is derived by Point-wise Function Application (Hamblin 1973):

(4) $[\![\text{who came}]\!]^w = \lambda w'.\forall x[\mathbf{came}(x)(w) \rightarrow \mathbf{came}(x)(w')]$

(5) $[\![\text{who came}]\!]^{\text{Alt}} = \{\, p \mid \exists w[p = \lambda w' \forall x[\mathbf{came}(x)(w) \rightarrow \mathbf{came}(x)(w')] \,\}$

(6) $[\![\text{John predicted who came}]\!]^{\text{Alt}}$
$= \{\, p \mid \exists w[p = \lambda w''.\mathbf{predicted}(\mathbf{j}, w'', \lambda w' \forall x[\mathbf{came}(x)(w) \rightarrow \mathbf{came}(x)(w')]) \,\}$

Given that EXH negates all the alternatives that are stronger than the prejacent (i.e., $[\![\varphi]\!]^{\text{Alt+}} := \{ p \in [\![\varphi]\!]^{\text{Alt}} \mid p \subset [\![\varphi]\!] \}$), we predict that (3b) is true iff John predicted that all people who actually came would come, and that, for any proposition p that says that John predicted that more people than those who actually came would come, p is false. This is equivalent to the IE reading in (2).

K&R's analysis does not directly extend to factive predicates like *know* since the stronger alternatives are trivially false in the case of factive predicates. To derive the IE reading for *know*, we assume a two-dimensional theory of presuppositions (Sudo 2012) in which only the assertive components are in the alternative value, i.e., propositions without factivity in the case of *know*.

4. Extension to EFs Note that we can view the contribution of EXH above given specific alternatives as a Gricean reasoning for Quantity implicatures. This is so because EXH negates the alternatives that are stronger than the prejacent (as opposed to non-weaker ones, as assumed in the grammatical view of quantity implicatures; Chierchia, Fox and Spector 2012) and that EXH only applies to the matrix position (see below for the SE reading). We will see below that this Gricean picture provides a straightforward account of the reading of interrogatives under EFs.

Following Heim (1992) and much subsequent literature, we adopt the counterfactual ordering-based semantics for emotive predicates. For example, the denotation of *be pleased* is defined as follows, where $>_{x,w}$ is a preference ordering between sets of worlds for x in w.

(7) $[\![\text{be pleased}]\!]^w(p)(x)$ is defined only if $p(w) = 1$ and x knows that p, if defined, is True iff $\forall w' \in DOX_{x,w} : Sim_{w'}(p) >_{x,w} Sim_{w'}(\neg p)$

(8) $Sim_w(p) := \{ w' \in W \mid w' \in p$ and w' resembles w no less than any other world in $p \}$

Crucially, this semantics predicts that EFs are non-monotonic. E.g., *John is pleased that Ann and Bill came* does not entail *John is pleased that Ann came* since it could be that John is pleased only if Bill comes, and that the closest worlds where Ann comes are the worlds where Bill doesn't.

Given the non-monotonicity of EFs, we predict that EXH or the Gricean reasoning does not contribute an additional content to sentences where EFs embed interrogative complements since there is no stronger alternatives to be negated. Thus, we predict that EFs lack IE readings.

5. SE reading K&R derive SE-readings by placing EXH in the embedded position. However, in the current Gricean perspective, this is not possible since a Gricean reasoning is a *global* reasoning. We thus claim that the SE readings for non-EF predicates arise from the IE reading with strengthening mediated by the opinionatedness assumption wrt the subject. That is, given the assumption that the subject is opinionated for each possible answer of the embedded question, the IE reading can be strengthened into the SE reading. This view thus indicates that a predicate allows a SE reading only if it has a IE reading. This leads to the correct prediction that EFs don't allow a SE reading.

6. Implicature with declarative embedding One might object to the current view given the seemingly correct observation that EFs do generate implicatures in declarative embedding:

(9) John is pleased that Ann came. $\rightsquigarrow$ John is not pleased that Bill came.

We do assume that the grammatical mechanism is in play for generating this implicature i.e., there is an operator O that negates all non-weaker and innocently excludable alternatives (Fox 2007). However, we claim that O leads to a trivial implicature in interrogative embedding for the following reason: O is sensitive to *structural alternatives* (Katzir 2007), which is the set of singular replacement of *who* in the case of *who came*, but any of these alternatives are not innocently excludable given the existence presupposition associated with the interrogative clause.

7. Conclusion This paper has shown that a Gricean perspective together with the distinction between non-monotonic ordering-based predicates and other attitude predicates such as *know* (cf. Anand & Hacquard 2013) provide a predictive theory of the exhaustivity of embedded interrogatives.

Selected References: Anand & Hacquard 2013. *S&P* 6 ⋄ Cremers & Chemla 2014. Ms. ⋄ Heim 1992. *JoS* 9 ⋄ Heim 1994. *IATL* 1 ⋄ Klinedinst & Rothschild 2011. *S&P* 4 ⋄ Spector 2005. Ms. for LSA 2005.