In the first part of this paper* I discussed two central notions concerning questions, aboutness and resolvedness, and proposed an analysis of these notions which I used to provide a situation semantics account for both query and embedded uses of interrogatives (see ‘Resolving Questions, I’ for discussion and for the notation assumed below; all sections numbered 5.x and less are in part I.). In this part of the paper, I discuss two main issues: first, the modification of interrogatives by adverbs of extent. Second, the ontological nature of embedded interrogative and declarative sentences: an ontology that distinguishes propositions, questions, and facts is motivated, while at the same time a specification is provided for a semantics that captures an important commonality between questions and propositions: facts prove propositions and resolve questions.

6. THE QVE

6.1. Introduction

I turn now to a phenomenon that brings out the connection between aboutness and resolvedness, namely partial resolvedness. Intuitively, information \( \tau \) partially resolves a question \( q \) iff \( \tau \) is factual and subsumes at least some of the information that is required to resolve \( q \). Consequently, as we shall see, any factual information about the question will typically constitute partially resolving information.

One class of phenomena that bring out the need for such a notion, I argue, are the readings triggered by adverbial modification of interrogative clauses, related to which is the quantificational variability effect (QVE) discussed extensively in the work of Berman (1990, 1991, 1994), Lahiri (1991), and Groenendijk and Stokhof (1993).

Berman (1990, 1991) argues that sentences such as those in (1a–b) exemplify a fundamental bifurcation among interrogative clauses (the

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`quantificational variability effect` (QVE)). His claim is that whereas in (1a) the adverb can only be interpreted as quantifying over cases/events/situations (henceforth the cases reading), (1b) displays an additional reading, (the qv reading), paraphrasable as (1c):

(1)a. Jill to some extent/usually/for the most part wonders which students cheat on the exam.

b. Jill to some extent/usually/for the most part knows which students cheat on the exam.

c. For some/most students x that cheat on the exam, Jill knows that x cheaters on the exam.

Subsequent accounts of the QVE, Lahiri 1991 and Groenendijk and Stokhof 1993, differ from Berman and from each other in a number of important ways. However, all three accounts are united in assuming

- **Quantificational Variability (QV):** (1c) is a correct paraphrase/entailment of the qv reading;
- **Question/Answer predicate bifurcation (QAPB):** there is a class of interrogative-clause embedding predicates that do not display qv readings. This includes `question predicates` such as `wonder`, `ask`, `investigate`, and `discuss`.

In this section, I argue that both assumptions are false. I start by considering the truth conditions of sentences like (1b) involving adverbial modification of resolutive predicates. I show how the notion of partial resolvedness provides the basis for an account that avoids the inadequacies introduced by assuming QV, and allows the requisite pragmatic relativisation to be captured. Following that, I consider QAPB: my claim is that once one moves away from a view of qv readings as involving quantificational variability, one notices that question predicates also trigger the cases/qv ambiguity. In fact, I suggest that the qv reading is independent of the nature of the embedded complement and arises equally with declaratives and NP's. Finally, I sketch an account of the phenomenon, one that ties qv readings to adverbial modification of the embedding predicate.

### 6.2. Truth Conditions

The first issue I consider is whether the paraphrase Berman proposes for this reading, which his account is designed to provide, and which both Groenendijk and Stokhof and Lahiri in their distinct ways also provide, is, in fact, correct. On the quantificational variability approach, what the
adverb in examples such as (2) is affecting is quantification over the role associated with the wh-phase.¹

(2)a. Bill for the most part knows who came to the party.

b. Bill remembers to some extent which students failed the exam.

Thus, on this approach these sentences are assumed to involve the following logical forms respectively:

(3)a. For most x, x a human that came to the party Bill knows that x came to the party.

b. For some students x that failed the exam, Bill remembers that x failed the exam.

My claim is simply this: the paraphrases typified in (3) are incorrect; rather, I suggest that the effect of the adverbial modification is to require information so disquoted to be resolving to the extent specified by the adverb.

To see this consider first example (4):

(4) Celia: All I know is that some rather unruly linguists showed up, though I don’t know who.

(4) would appear to license (5a,b). Nonetheless, given the context of (4), it is clear that the de re nature of the paraphrase in (5c) is not warranted.²

¹ This description reflects, in broad terms, the intuition underlying both Berman’s and Groenendijk and Stokhof’s DRT and DMG accounts. However, although similar truth conditions are achieved by Lahiri’s account, the underlying intuition is quite different. In fact, the notion of Q-extent resolveness proposed here can be viewed as contextually parametrising his notion of an answer being Q-extent exhaustive. See Section 8.3 for more detailed comparison.

² Berman (1994) reacting to an earlier version of this paper suggests an alternative explanation of this case, namely that ‘. . . [this] is a use of many adverbial quantificational expressions that is logically independent of the individual quantifying analysis I [Berman-J. G.] have analysed’ (Berman 1994, p. 32). As evidence for this, Berman offers the following (Berman 1994’s (62)):

(i) For the most part, Celia knows only to some extent who showed up last night.

This, Berman claims, is evidence that ‘the same sentence may without contradiction contain adverbs with conflicting quantificational forces’. Berman explains that he ‘understands this as asserting that for most people who showed up Celia has only limited knowledge of who they are. But on Ginzburg’s account, this sentence should assert that Celia’s knowledge simultaneously resolved the question of who showed up both to a majority degree and to a minority degree, which appears to be contradictory’ (Berman 1994, p. 32).

The informants that I have consulted do find the sentence distinctly odd and hard to evaluate. Putting these dialectal differences to one side, nonetheless, it seems that there is no reason to reach Berman’s conclusion that a contradictory reading is predicted by the current proposal. Extent adverbials do have an illocutionary use paraphrasable as

(ii) ‘To Q-extent p’ ↔ I am to Q-extent willing to commit myself to claiming that p.
(5)a. Celia could tell (only) to some extent/to a limited extent who showed up last night.
b. Celia knew (only) to some extent/to a limited extent who showed up last night.
c. For some x who showed up last night Celia told me/knew that x showed up last night.

Second, consider the following scenario: Jill is about to step out of a taxi in Helsinki.

(6)a. Driver: Do you know where you are now?
   b. Jill: South West Helsinki.

In many contexts, i.e. unless Jill’s purpose is to locate a specific destination, Jill’s response in (6b) licenses the statement in (7):

(7) Jill knows pretty much/to a large extent where she is.

If we identify the quantificational force of ‘pretty much’/‘to a large extent’ with ‘most/many’, paraphrase of (7) as per the assumption (QV) seems clearly incorrect:

(8) For most/many places x where Jill is, Jill knows that she is in x.

Third, consider (9).

(9)a. Jill: If there’s a likelihood that Millie will come, I’ll bake a cake. Could you tell me: is Millie coming tomorrow?
   Bill: She’s not overworked, so I’d say she might come.

One can predict that (i) has a sensible reading paraphrasable as (iii). (iv) offers one possible context consistent with this reading which seems also consistent with the reading Berman intuits:

(iii) I am to a large extent willing to commit myself to the claim that Celia knows only to some extent who showed up last night.

(iv) It is more or less true to say that Celia knows only to some extent who showed up last night, but not entirely accurate. She does know that Bill and Mary showed up and she can give you a long lecture about who they are.

The analysis I offer for qv readings with declaratives will suggest a source for such readings. Furthermore, let us observe that Berman’s analysis actually predicts that (i) should have the reading in (v), or perhaps (vi):

(v) For most x that showed up to the party, Celia knows only to some extent that x showed up last night.

(vi) For some x that showed up to the party, Celia knows for the most part that x showed up last night.

However, neither (v) nor (vi) seems to constitute a reading of (i). In fact, both seem to be quite distinct from the reading Berman intuits.
b. Bill’s response indicated to a certain extent whether Millie would be coming tomorrow.

If non-resolving information about y/n-questions also licenses adverbially modified interrogative disquotation, there does not seem to be any obvious way to relate this to the quantification over individuals view of the QVE. It is also problematic for an approach like Lahiri’s given that the Hamblin semantics for interrogatives on which his account is based does not accommodate partial answers for y/n interrogatives.

Let us, for the moment, restrict ourselves to providing a reading that captures the truth conditions of sentences such as (5a,b) and generalizes to deal with sentences such as (7) and (9b).

In general, a partial ordering $\Rightarrow$ such as the one used for modelling informational subsumption, which is transitive and reflexive, satisfies:

\[(10) \quad \tau \Rightarrow \sigma \text{ if and only if for all } \psi \text{ such that } \sigma \Rightarrow \psi, \text{ it is also the case that } \tau \Rightarrow \psi.\]

In this light, it is natural to define for any partial ordering $\Rightarrow$, a corresponding notion of “$\Rightarrow$ to Q-extent”, notated $\Rightarrow^{Q\text{-extent}}$:

\[(11) \quad \tau \Rightarrow^{Q\text{-extent}} \sigma \text{ iff for } Q \text{ many } \psi \text{ such that } \sigma \Rightarrow \psi, \text{ it holds that } \tau \Rightarrow \psi.\]

A fact will consequently be taken to resolve a question $q$ to Q-extent relative to $ms$ iff it $\Rightarrow^{Q\text{-extent}}_{ms}$ a fact that fully resolves $q$. The definition is provided in Figure 1.

My suggestion further motivated below is that adverbs can modify the resolutive entailment carried by predicates such as know so that we have the following inference schema:

\[(12) \quad \text{A certain fact has been V’ed.} \]
\[\text{Which fact? A fact that to Q-extent resolves } q. \]
\[\text{So, it’s been V’ed to Q-extent } q.\]
Given the approach I have taken to resolutive predicates hitherto, we would appeal to the following constraint in order to capture the inference:

\[
\langle P_{\text{question}}^{\text{Q-extent}}, P'_{\text{er}} : x, \text{content-role} : q, \text{cog-role} : ms \rangle \leftrightarrow \\
\exists f [\text{RESOLVES}^{\text{Q-extent}}(f, q, ms) \wedge \langle P_{\text{fact}}, P'_{\text{er}} : x, \text{content-role} : f, \text{cog-role} : ms \rangle]
\]

Things are somewhat subtler than this since there exist two distinct behaviours of resolutive predicates, as we shall subsequently see. Nonetheless, a number of consequences follow directly. First, it is easy to see why an inference such as the one from (4) to (5c) need not hold. Assume as given a question \(q = (s?/\mu)\) and a fact \(\chi\) that resolves \(q\) relative to \(ms\). If a fact \(\tau\) is \(aboot \ q\), then by the definition in (Figure 5, 'Resolving Questions, I'), it follows that (14a) holds. Since a fact that resolves \(q\) is, in particular, \(aboot q\), \(\chi\) will also satisfy (14b):

\[
\begin{align*}
\text{(14)a.} & \quad \text{For any } s, \text{ if } s \vdash \tau, \text{ then } s \vdash \bigvee \text{APPL-INST}(\mu) \lor \bigvee \text{APPL-INST}(\mu) \\
\text{b.} & \quad \text{For any } s, \text{ if } s \vdash \chi, \text{ then } s \vdash \bigvee \text{APPL-INST}(\mu) \lor \bigvee \text{APPL-INST}(\mu)
\end{align*}
\]

We can't quite convert this into a 'proof' that any factual information \(aboot q\), to some extent resolves \(q\). This almost goes through, but not quite. The main point is that in (14) the notion of informational subsumption involved is agent independent, whereas in the definition of Q-extent resolvedness in Figure 1, I have explicitly assumed that the notion of subsumption needed, just like for resolvedness, is mental situation dependent. What we can conclude is that any factual information \(aboot\) the question which satisfies, e.g. (15a), i.e. which, relative to \(ms\), can be demonstrated to be \(aboot q\), will in such a case to-some-extent resolve \(q\), since then (15b) holds:

\[
\begin{align*}
\text{(15)a.} & \quad \tau \Rightarrow_{ms} \bigvee \text{APPL-INST}(\mu) \lor \bigvee \text{APPL-INST}(\mu) \\
\text{b.} & \quad \text{There exists some } \sigma \text{ such that } \chi \Rightarrow_{ms} \sigma \text{ and also } \tau \Rightarrow_{ms} \sigma
\end{align*}
\]

Moving to (4) in particular: if \(\tau\) is an application-instance of \(\lambda x (\text{SHOW-UP}, x)\) for any normal agent we could expect the analogue of (15a) to hold, so for her \(\tau\) to some extent resolves the question. However, in order to satisfy (15a), nothing forces \(\tau\) to be an application instance; quantifications over \(\lambda x (\text{SHOW-UP}, x)\) can equally satisfy this. Hence the inference to (5c) is blocked.

Now reconsider (7). Assume a goal plausible for this context, say that Jill be able to find her way from where she alights. Then, as is easily verifiable, the reading the above definition generates is one paraphrasable as follows:
(16) Jill knowing that she is in South West Helsinki constitutes most/a large extent of the information needed for her to be able to find her way from where she alights.

Let us now move to consider adverbial modification of embedded interrogatives in a more general perspective, starting with the putative qv reading asymmetry.

6.3. Which Predicates Manifest qv Readings?

Berman (1990, 1991) assumes that the relevant distinction among embedding predicates is factivity: factive predicates do and non-factive predicates do not display the qv reading. The proper characterisation of the class of predicates that (putatively) do not display qv readings is a matter of some controversy among the three accounts, though there is broad agreement that it should include 'predicates of questions' such as 'wonder', 'ask', 'investigate', and 'discuss'. I will henceforth dub the complement of this class, those predicates that do exhibit qv readings, the class of "answer predicates".

The first issue of data raised here concerns which adverbs actually exhibit a qv as distinct from cases reading. Here I follow Lahiri, who argues carefully and in detail, that adverbs of frequency show no QVE effect: there is no question/answer bifurcation for these adverbs, no reading distinct from the cases reading. It is only adverbs of quantity that bring out an additional reading: Thus, (17a) (Lahiri's (218)) should be paraphrased as (17b) (Lahiri's (224)), not (17c) (Lahiri's (219)):

(17)a. John usually knows who does well on the exam.
   b. For most exams, John knows more or less who does well on the exam.
   c. Most x, x does well on the exam, John knows that x does well on the exam.

I now attempt to demonstrate that question predicates such as 'wonder', 'ask', 'investigate', and 'discuss' also exhibit a qv reading. Some care is required here: it is clear that such predicates do not display a reading such as that paraphrased in (3a). This is hardly surprising given my claim that answer predicates also do not actually exhibit such a reading. Further-

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3 This was also noted, independently, in Srivastav (1991) and Ginzburg (1992).
more, question predicates are not *applicable* to declaratives for such a reading to be available in principle.\(^4\)

Nonetheless, my claim is that such predicates certainly do allow for readings distinct from the cases reading, readings which for both question and answer predicates can be paraphrased as follows:

\begin{enumerate}
\item[(18)a.] Jill adverb V q = Jill had adverb-many Nom(V) of q.
\item[(18)b.] Jill for the most part/hardly/to some extent knows q = Jill had almost complete/very partial/partial knowledge of q.
\item[(18)c.] Jill for the most part/hardly/to some extent discussed q = Jill had almost complete/very partial/partial discussion of q.
\end{enumerate}

Consider first (19):

\begin{enumerate}
\item[(19)a.] This issue, who to hire for the position, is highly complex. We have managed so far to discuss it only to a very limited extent/partially.
\item[(19)b.] Hence, what has taken place is: a limited/partial discussion of who to hire for the job ensued.
\end{enumerate}

It seems clear that (19a) has a \(qv\) reading, paraphrasable as in (19b). Consider now (20):\(^5\)

\begin{enumerate}
\item[(20)a.] There have been many issues for us to investigate, far too many for us to do a thorough job. We have to some extent investigated who committed the crime, we have fully investigated who was at the scene of the crime, but only to a limited extent when the suspects were in town.
\item[(20)b.] Hence, what has taken place is: partial investigation of the first issue, complete investigation of the second issue, limited investigation of the third issue.
\end{enumerate}

(20a) has a reading paraphrasable as in (20b), one quite distinct from the cases-reading. A similar reading can be found for the predicate 'depend':

\(^4\) Berman (1991) is aware of this point, as his discussion on p. 34 makes clear. However, his discussion does not entirely address the problem: he suggests that even though question predicates do not have declarative complements, it is *prima facie* surprising that e.g. 'The principal mostly wonders which students cheat on the exam' has no reading wherein 'for most students x such that x cheated on the final exam, the principal stands in the wondering relation to the proposition that x is a student and x cheated on the final exam'. Given that 'wonder' and other question predicates are inapplicable to propositional denoting expressions in general, this would make the proposed paraphrase ill-formed.

\(^5\) This example was suggested to me by Elisabet Engdahl.
(21)a. Who comes here in the morning depends to some extent on how many terminals are free.
   b. That is, there is a partial dependency of the resolution of the question who comes here to the resolution of the question how many terminals are free.

With 'wonder', it is somewhat less easy to get such readings: wondering involves, roughly, a desire to get an unresolved question resolved. Partial wonderment would thus appear to involve either a partial desire or a partially resolved question or both:

(22)a. I was really perplexed by his attack. Of course, your explanation of his behaviour seems reasonable, but I still wonder to some extent at least why anyone would adopt such an attitude. (That is, I still have a partial desire for an explanation that could resolve that issue.)
   b. To some extent I do wonder if there's any point in pursuing this project anymore. (That is, to a certain extent I realize why we should pursue the project, but I also have doubts.)

With 'ask', given its reportive function, some work is required to construct convincing examples of non-cases readings:

(23)a. I'm not sure if there is any point in my raising this question, how you deal with these ECP counterexamples, since the previous speaker was to a large extent asking this same question.
   b. I hope you realize that what he's doing is to some extent asking you how much you'll pay up.

The conclusion these data point to is that adverbs of extent can trigger qv readings for question predicates. The basic criterion for availability of such a reading seems to be: to what extent can the argument of the predicate be "partially consumed". Partial knowledge or recollection are more easily conceivable than partial wonderment or asking.

6.4. QV Readings for Non-interrogative Complements

We will now see that qv readings also arise with non-interrogative complements of these same predicates. (24a,b) contrast sharply with (25a,b): the former demonstrate that adverbs of extent can modify both the (semi) factivity of an embedded declarative as well as the resolvedness of an embedded interrogative. In other words, in both cases what has been established is a weaker fact than the one potentially described by the
complement. On the other hand, with a full factive like ‘amaze’, both the factivity and the resolutivity are maintained.

(24)a. The scientist has to some extent established which person committed the crime. (The scientist has established a fact that goes some way towards resolving the question of which person committed the crime.)

b. The scientist has to some extent established that unpasteurised milk causes botulism in rats. (The scientist has established a fact that goes some way towards proving the claim that unpasteurised milk causes botulism in rats.)

(25)a. It to some extent amazed/disgusted Jill who chose to show up to the party. (Jill was somewhat amazed/disgusted by a fact that resolves the question of who chose to show up to the party.)

b. It to some extent amazed/disgusted Jill that unpasteurised milk causes botulism in rats. (Jill was somewhat amazed/disgusted by the fact that (proves the claim that) unpasteurised milk causes botulism in rats.)

I correlate the split with whether a similar split arises with fact nominals:

(26)a. This fact to some extent amazes Jill.

b. Jill has to some extent managed to establish [this fact]. (What Jill has actually established is a “weaker” fact than fact₁.)

More generally, my claim is that partial answer/evidence readings arise for precisely those predicates which manifest a “weaker” fact reading in (27a):

(27)a. Bill to some extent knows/discovered/revealed [this fact].

(b What Bill actually knows/discovered/revealed is a “weaker” fact than fact₁.)

b. Bill to some extent knows/discovered/revealed who showed up.

(What Bill knows/discovered/revealed is a fact from which one can partially conclude a fact resolving the question who showed up.)

c. Bill to some extent knows/discovered/revealed that Mary showed up.

(What Bill knows/discovered/revealed is information from which one can partially conclude that Mary showed up.)
These data, combined with the data presented in the previous section, suggest two sources for qv readings. The first: such readings result from V modification. In particular, this would pave the way for an account for resolutivity/factivity projection properties, which are uniform for a given predicate. Thus, 'be-amazed' or 'disgust' are holes both for factivity and resolutivity when extent-modified, whereas 'establish' or 'reveal' filter them away. In the following section, where I explore the need for an account that captures resolutivity and factivity in terms of coercion, the possibility of a unified treatment will emerge: the basic idea will be that declaratives/interrogatives embedded by factives/resolutives describe facts. Partial answer/evidence readings will then be analysed in terms of attitude verb modification:

\[(28) \quad \langle V\text{-to-Q-extent, } A, \sigma \rangle \leftrightarrow \langle V, \tau \rangle, \text{ where } \tau \rightarrow^{Q\text{-extent}} \sigma\]

Given this, the possibility for an account of a related reading, one in which the asserter to Q-extent commits herself to a statement emerges directly (cf. footnote 2):

\[(29)a.\quad \text{To some extent/for the most part, (I'm willing to say that) this book is convincing.}\]
\[b.\quad \text{To some extent/for the most part, (I'm willing to say that) Jill knows who was there.}\]
\[c.\quad \text{To some extent/for the most part, (I'm willing to say that) Jill knows that Mary was there.}\]
\[d.\quad \langle \text{ASSERT}\text{-to-Q-extent, } A, (s!\sigma) \rangle \leftrightarrow \langle \text{ASSERT} (s!\tau) \rangle, \text{ where } \tau \rightarrow^{Q\text{-extent}} \sigma\]

7. Ontology

7.1. Introduction

The strategy I have developed so far can be labelled Karttunenian, as far as one important aspect goes: predicates embedding interrogatives have been treated uniformly as denoting relations whose complement denotes a ques-

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6. The predicates 'give an X idea' or 'have an X idea' where X varies over 'some' 'reasonable' or 'very good' are perhaps prototypical examples of such a process of modification.
7. Obviously one cannot subsume all verb-modification readings to be instances of the "hedging" reading: this would not account for multiply embedded qv readings as in (i).
   (i) Jill told me that Bill knows to some extent who came.
   Nor would it account for the fact that presupposition projection is constant for a given predicate.
tion. The fact that certain of these predicates can also embed declaratives and fact-denoting NP's whose content is systematically related to the question denoted by the interrogative complement has been captured by means of certain constraints, see Section 4.1.

Karttunen's strategy was, to a large extent, unprecedented and also abandoned by many subsequent works, all of which adopted a propositionally reductive strategy of some sort to deal with the resolutives. Thus, the approach developed by Hintikka reduces interrogative meaning to declarative meaning. Groenendijk and Stokhof, by contrast, do not eschew positing the existence of relations that take a question as their argument, which in their system is the intension of an interrogative sentence. Relations of this kind include 'wonder' and 'ask'. However, relations such as those denoted by interrogative complement embedding 'know' and 'tell' etc. are not treated as relations that take questions, rather the argument in this case is taken to be a proposition, which in their system is the extension of an interrogative sentence.

Here I will argue that a careful consideration of the entities that interrogative and declarative predicates are applicable to, as demonstrated by a series of inference patterns that test whether an argument role is purely referential (in Quine's sense) in question/proposition entities, demonstrates that neither strategy is tenable. The evidence I present indicates that resolutive interrogative complements denote neither questions nor propositions but rather a family of entities which include the class of facts. Conversely, it also turns out that precisely those declarative embedding predicates whose arguments are required to be propositions, by just about anyone's criteria for what constitutes a proposition, namely being a bearer of truth or falsity, are inapplicable to interrogative content.

These considerations will inter alia motivate the need for an ontology that distinguishes facts and (true) propositions. One such ontology is that provided by situation theory, certain of whose features prove theoretically useful, certain others of which perhaps less so. Given that interrogatives do, of course, have a question-denoting use, and declaratives a proposition-denoting use, the strategy I will pursue will be based on the notion of coercion. Roughly, I will assume that an interrogative I can be coerced to describe a fact, one that in that context resolves the question denoted by I, whereas a declarative d can be coerced to describe a fact, one which proves the truth of the proposition denoted by d.

---

8 Here and elsewhere I use 'denote' as shorthand for 'its content on a particular use is'; in particular, no associations whatever should be made between this usage and ones that pertain to the Fregean distinction between sense and denotation.
Finally, I will show how the revised semantics for resolutive/factive predicates can be exploited to provide a unified account of adverbial modification effects discussed above.

The account offered here bears a number of obvious debts, in particular to Austin (1950, 1954) and to Vendler (1967, 1972): Austin (1954), while defending the theory of truth presented in Austin 1950, argues at some length against conflating facts with true propositions. This is a position that Vendler (1967) motivates further, whereas Vendler (1972) assembles a variety of evidence that partitions the declarative complement predicates into two main categories. He uses this data to argue for a pervasive ambiguity among these complements, between fact-embedding and proposition-embedding predicates.

7.2. Purely Referential Question Predicates

An important presupposition of mine below will be the following criterion. Assume we have a predicate expression \( P \) which takes as its surface arguments a class of expressions \( E \), the referents of which can be described, say, as \( ®q \). Take as given \( e \in E \), a context \( c \) where \( P \) denotes \( D(P) \), and \( e \) denotes \( D(e) \). Then, a necessary and sufficient condition for positing that \( D(e) \) is in the extension of \( D(P) \), and more generally that the referents of \( E \) should be posited as members of the positive or negative extension of \( D(P) \), is that the occurrence of \( e \) in \( ®Pe® \) is purely referential in the sense due to Quine.\(^9\) Two tests for this are substitutivity and existential generalisation:

\[
\begin{align*}
\text{(30)} & \quad ®Pe® \\
\text{e is } & \quad \Gamma \\
\hline
\text{substitutivity} \\
\text{(31)} & \quad ®Pe® \\
\text{there exists a } & \quad q \text{ such that } Pq® \\
\text{existential generalisation}
\end{align*}
\]

\(^9\) See e.g. Quine (1961, pp. 139–145) for discussion. The notation \( ®a_1a_2...a_n® \), due to Quine, is used to refer to the string whose first character is \( a_1 \), second character is \( a_2 \) and so on, whose last character is \( a_n \). I use it in this section whenever I wish to refer unambiguously to the surface realisation of an expression without entering into debate of whether the syntactic structure underlyingly contains null constituents, e.g. null complementisers or null NP's such as 'the fact' in factive complements (cf. Kiparsky and Kiparsky 1970, Munsat 1986).
Table 1. Resolutive and question predicates

<table>
<thead>
<tr>
<th>RESOLUTIVES (RI)</th>
<th>QI</th>
</tr>
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<tbody>
<tr>
<td>discover</td>
<td>report</td>
</tr>
<tr>
<td>show</td>
<td>tell</td>
</tr>
<tr>
<td>forget</td>
<td>announce</td>
</tr>
<tr>
<td>reveal</td>
<td>state</td>
</tr>
<tr>
<td>remember</td>
<td>guess</td>
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<td>know</td>
<td>predict</td>
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<tr>
<td>determine</td>
<td></td>
</tr>
</tbody>
</table>

Both tests are not entirely unproblematic. Existential generalisation becomes more and more controversial the further one strays from the domain of concrete entities. Substitutivity, especially in attitude contexts, depends on maintaining a single perspective. Nonetheless, these caveats notwithstanding, I believe that the contrasts these tests bring out in the following sections will be sharp enough to enable us to draw some reasonably firm conclusions.

By these criteria, for instance, ‘eat’ has the denotata of such expressions as ‘the pie’ in its positive and negative extensions which consist of ‘concrete objects’ (assuming for the moment such a class can be characterized somehow.):

(32)a. Jill ate the pie. The pie is the thing Bill baked yesterday. Hence, Jill ate the thing Bill baked yesterday.

b. Bill ate a pie. Hence, there is some concrete object that Bill ate.

I start with evidence that shows the existence of predicates that are purely referential with a class of NP’s that denote “question individuals”, and also predicates which fail these tests. I refer to the former as question interrogative predicates (QI), to the latter as resolutive interrogative predicates (RI). Table 1 provides a sample list of predicates from both categories.

Various common-noun phrases denote entities of which one can predicate unresolvedness, openness and so forth:

(33)a. The question/issue remains unresolved.

b. The question/issue is still an open one.

Interrogative but not declarative sentences can be used to designate such entities:
RESOLVING QUESTIONS, II

(34)a. The question/issue is who left/whether Bill is happy/the cause of Bill's happiness.
   b. #The question/issue is that Bill is happy.

QI predicates are purely referential in question-entities, whereas resolutive predicates fail such tests:¹⁰

- Substitutivity:

(35)a. Jill asked/reflected over an interesting question. The question was who left yesterday. Hence: Jill asked/reflected over who left yesterday.
   b. Bill investigated/discussed that issue. The issue was whether Jill would arrive. Hence: Bill investigated/discussed whether Jill would arrive.
   c. Jill discovered/revealed an interesting question. The question was who left yesterday. It does not follow that: Jill discovered/revealed who left yesterday. (It does follow that Jill reported/was aware of what the question is.)
   d. Bill reported/was aware of the issue. The issue was whether Jill would arrive. It does not follow that: Bill reported/was aware of whether Jill would arrive. (It does follow that Bill reported/was aware of what the issue is.)

- Existential generalisation:

(36)a. Jill asked/reflected over who left yesterday. Hence, there is a question/issue that Jill asked/reflected over yesterday. Which question? The question was who left yesterday.
   b. Bill investigated/discussed whether Jill would arrive. Hence there is a question/issue that Bill investigated/discussed. Which question? The issue was whether Jill would arrive.
   c. Jill discovered/knows who left yesterday. It does not follow that: there is a question/issue that Jill discovered/knows.

This data illustrates that resolutive predicates do not embed question

¹⁰ 'Wonder' does not subcategorize for NP arguments, hence it is inapplicable to these particular tests. 'Wonder about' is applicable to and passes these tests and is, apparently, reasonably synonymous to 'wonder'. In fact, 'V about' passes these tests for resolutive predicates as well. However, as for instance Boër (1978) notes, in such cases 'V about' manifests significantly distinct behaviour from 'V'. For instance, 'Bill managed to make a guess about who showed up to the party' does not imply that Bill's guess was correct, in contrast to 'Bill managed to guess who showed up to the party'. These facts follows directly once we assume that it is 'about', a predicate that is purely referential in question entities, that is predicating of the questions in these cases.
denoting expressions purely referentially. Note that this is not influenced by syntactic form since the same facts apply to so-called 'concealed questions':

(37)a. Jill asked/reflect over/discovered an interesting question. The question was the source of Bill's wealth. Hence: Jill asked/reflect over the source of Bill's wealth. It does not follow that: Jill discovered the source of Bill's wealth.  
b. Jill asked/reflect over/discovered the source of Bill's wealth. Hence, there is a question/issue that Jill asked/reflect over yesterday. Which question? The source of Bill's wealth. It does not follow that: there is a question/issue that Jill discovered.

In fact, the only reading which resolutive predicates can obtain with question nominals is, as we have noted in (35c,d), a concealed question paraphrasable as 'V what the question/issue is', just as with other entities such as times or names which are clearly not potential arguments of the predicates.

Such data, then, constitute a serious problem for the Karttunean strategy for embedded interrogatives. Let us ignore some, as it were, tactical problems related to the strictly typed Montogovian system in which Karttunen's system is formulated: due to this, it is not straightforward to extend the system to offer a semantics for question nominal uses.11 Nonetheless, within a different setting, one of two approaches can be expected. Either assume the existence of a single relation underlying the interrogative and the NP complement verbs, or at the very worst, use an equivalence of the following kind to relate interrogative, VQ and question nominal relations, VNP:

(38) \( \forall Q(\text{question}(q) \rightarrow [V_{NP}(x, q) \leftrightarrow V_Q(x, q)]) \)

However, both approaches fly in the face of the data we observed above. The conclusion that this points to: resolutive predicates do not have questions in their extension.

7.3. Purely Referential Proposition Predicates

A set of data similar in many respects to the one we observed in the previous section with respect to questions can be produced with respect

11 See Chierchia (1982) for a post-Montagovian system adequate for such a job.
Table 2. Resolutive and propositional predicates

<table>
<thead>
<tr>
<th>TF</th>
<th>FACTIVES</th>
</tr>
</thead>
<tbody>
<tr>
<td>claim</td>
<td>discover</td>
</tr>
<tr>
<td>allege</td>
<td>find out</td>
</tr>
<tr>
<td>assert</td>
<td>forget</td>
</tr>
<tr>
<td>believe</td>
<td>reveal</td>
</tr>
<tr>
<td>assume</td>
<td>remember</td>
</tr>
<tr>
<td>accept</td>
<td>know</td>
</tr>
<tr>
<td>deny</td>
<td>regret</td>
</tr>
</tbody>
</table>

to propositions. Various common-noun phrases denote entities of which one can predicate truth or falsity:

(39) theory, claim, report, forecast, allegation, prediction, charges, hypothesis, conjecture.

Declarative but not interrogative sentences can be used to designate such entities:

(40)a. The theory/claim/belief is that Bill is happy.
  b. ≠ The theory/claim/belief is who left/whether Bill is happy/the cause of Bill’s happiness.

On the one hand, there exists a class of predicates which pass purely referentiality tests for such nominals, whereas there exists a class of predicates, primarily factives, which fail these tests. I refer to the former class as TF (for truth/falsity) predicates. Table 2 provides a sample list of predicates from both categories.

- Substitutivity:

(41)a. The Fed’s forecast was that gold reserves will be depleted by the year 2000.
  b. Bill believes/accepts the Fed’s forecast. Hence, Bill believes/accepts that gold reserves will be depleted by the year 2000.
  c. Bill discovered/was aware of the Fed’s forecast. It does not follow that: Bill discovered/was aware that gold reserves will be depleted by the year 2000. (It does follow that Bill discovered/was aware of what the Fed’s forecast is.)

- Existential generalisation:

(42)a. Bill believes that gold reserves will be depleted by the year 2000. Hence, there is a claim/hypothesis/prediction that Bill believes.
b. Bill discovered/knows that gold reserves will be depleted by the year 2000. *It does not follow* that there is a claim/hypothesis that Bill discovered/knows.

I believe that the contrasts in (41) are fairly uncontroversial; (42), on the other hand, is an obvious target for dissent even by those tolerant of a reasonable dose of ontological pluralism. Nonetheless, even for those who accept only (41), it reveals a clear contrast exemplified in (43):

(43)a. Jill believes that hypothesis.

b. Jill discovered that hypothesis.

Whereas in (43a) the fact that ‘hypothesis’ is an entity that has propositional content is crucial for the felicity of the predication, in (43b), to the extent that it is felicitous at all, this fact is completely orthogonal; whereas in (43a) once we know what the hypothesis concerns, we learn something about what Jill believes, we learn no such thing about what Jill has discovered in (43b). (43b) means something like ‘Some saliently demonstrated hypothesis lay around undetected; at some point Jill did manage to detect it, however’. The very same reading would arise if we would substitute ‘that continent’ for ‘that hypothesis’. This is very strange behaviour indeed if discover takes propositions or propositional entities as its arguments.

In fact, this data constitutes the tip of an empirical iceberg that motivates discarding the label *propositional attitudes* as a catchall term for the ‘that-clause’ embedders, given the presupposition carried by that label that all such predicates take propositions as their arguments. There are many explanatory benefits for reserving this term and the presupposition it embodies to TF predicates and, moreover, for assuming both that:

- **Non-prop-int**: interrogatives do not have a propositional denotation.
  and, that
- **Non-prop-decl**: declaratives do have a non-propositional denotation.

Let us take these assumptions in turn. Consider the following fact: TF predicates but not other declarative embedding predicates obey the following inference pattern, noticed by Vendler:12

\[
\begin{align*}
\text{TF-predicate} & \quad \text{T-Pred} \\
(44) & \quad \text{if } \text{the } N' \text{ is true} \\
\end{align*}
\]

12 Vendler (1972, chapter 5).
Bill believes/accepts Mary’s theory/the Fed’s forecast/the recently published report.

Hence, Bill believes/accepts that Mary’s theory/the Fed’s forecast/the recently published report is true.

Jill discovered/revealed Bill’s hypothesis/claim/conjecture.

It does not follow that: Jill discovered/revealed that Bill’s hypothesis/claim/conjecture is true.

T-pred characterizes TF predicates as imposing an appropriateness condition on their arguments, namely that they be truth/falsity predicable. T-pred coupled with Non-prop-int allows for an ontology in which the following fact about TF predicates can be captured. TF predicates are inapplicable to interrogative content:

(47)a. ≠ Bill believes/hopes who came yesterday.

b. ≠ Basil supposes/assumes which pitcher will do what tomorrow.

c. ≠ Bill claimed/argued who came yesterday.

Notice that these facts remain unchanged if one adds as an assumption that the requisite belief, desire, claim etc. is true:

Bill knows who left: Jerry, Mike and Mirella. So, ≠ he believes/assumes who left.

Similar facts hold for concealed questions:

These facts are stable, apparently, across a wide range of languages, including English, Hebrew, Japanese (Yo Matsumoto p.c.), and Turkish (Guven Guzeldere p.c.).

In certain environments believe does have a factive, “emotive” use where it comes to mean something like ‘be reconciled with’:

(i) She can’t BELIEVE that line-call.

This use enables believe to predicate of wh-questions:

(ii) You won’t BELIEVE who showed up last night.

or NP’s:

(iii) You won’t BELIEVE that fact.

Note that this use seems to require stressing the verb. Moreover, as David Milward has pointed out to me, unambiguously propositional negation does not license such predications:

(iv) ≠ It is not the case that you will believe who showed up last night.

This suggests that it is modification at the level of the verb that is involved here. Hence, whatever the precise nature of the phenomenon, we need not suspect that, via some process of presupposition projection, the “normal” sense of believe is applicable to questions or facts.
(49) ≠ Jack believed/doubted/assumed Bill’s weight/my phone number.

Now if interrogatives never denote propositions, whereas TF predicates require precisely such entities as their arguments, then, as long as we have a "well motivated" ontology for what interrogatives do denote, the inapplicability facts above fall out immediately. Moreover, TF predicates are inapplicable to other construction-types which can be argued to denote facts, for instance POSS-gerunds:  

(50)a. ≠ Bill believed/alleged/assumed/doubted/claimed Jill’s having discovered a new ontological distinction.

b. ≠ Bill believed/alleged/assumed/doubted/claimed Jill’s finding the treasure much before anyone else did.

Such an account of (47), (49) is neither more nor less explanatory, as far as I can tell, than an explanation of the infelicity of (51) based on a common sense ontology which distinguishes abstract from concrete entities, and assumes ‘eat’ imposes the appropriateness condition on its eatee argument that it be concrete:

(51) ≠ Bill ate the square root of 3.

Can we evade these semantic conclusions by means of some pragmatic explanation? I believe not. Stalnaker (1974, 1978) and Lewis (1979) have persuasively argued for the utility of a notion of presupposition as conversationally accepted information. However, assuming such a notion of presupposition means that serious problems will be encountered by any attempt to invoke presuppositions whose function is the enforcing of 'epistemic weakness' or 'conversational controversiality' to the arguments of TF predicates. In other words, it is problematic to assume that the inapplicability of TF predicates to the veridical entities made available by resolved questions, fact nominals, POSS-gerunds etc. derives from a prohibition of the following kind: do not fill the cognitive argument of a TF predicate with material present in the conversational record.  

Data such as the following would appear to fly in the face of such a prohibition:

---

15 See Vendler (1967) and Bennett (1988, chapters 1, 2) for such arguments.
16 Boër (1978) seems to advocate such a solution: ‘[I]t is the inherent factivity of ‘who’ clauses which makes them bad company for most non-factive verbs of propositional attitude. Usually, the pragmatic point of using a non-factive verb of propositional attitude is to leave open the question of truth value of the proposition which is the object of that attitude, and this point is frustrated by the semantics of ‘who’ clauses . . . ’ (Boër 1978, p. 333).
(52)a. Bill is usually so wrong-headed, but for once he actually believes something we all accept without batting an eyelid, namely that the sun will rise tomorrow.

b. Now that she's been shown the evidence, and let me assure you it conclusively establishes his guilt, Jill won't deny that Bill could have committed the crime.

(53)a. For a long time there had been allegations that Dave was seeing a certain actress. It's turned out that the allegations are well founded. Thus, even though we all know they're true, John, staunchly loyal, doesn't accept the allegations.

b. Bill's claim was that Mary was ill. I discovered that, in fact, Mary was ill. After that, everyone accepted the claim.

Any adjusting of the condition to hold not of the conversational record, but of the agent whose mental state is reported, is confounded by examples such as the following:

(54) Jill believes that John was on MDA last night, in fact she knows it.
(55) Bill knows that, but he doesn't believe it. ('believe' can only be understood here in the sense of 'be reconciled with'.)

Thus, building into 'believe' or other TF predicates a requirement that its complement is not known will result in contradiction.

7.4. Purely Referential Fact-embedders

Let us turn to the second assumption appealed to above, namely that declaratives also have a non-propositional denotation. Following argumentation of a similar kind to the one employed in the previous subsection to resolutive predicates and questions, it seems that such an assumption is required in order to explain why factives fail the purely referentiality tests above with TF nominals.

Of course, we can only adopt such an assumption if we have a viable alternative. And I believe such an alternative exists: my claim is that the requisite semantic category is one that includes the class of facts. Both the factives as well as the non-factive resolutive predicates show purely referential behaviour with fact nominals:

Certain common-noun phrases, like those in (56), denote entities which refer to or describe facts, events, or other states of affairs that obtain:
truth-about, outcome, result, important fact about, earthquake, King's coronation

We note first that truth or falsity cannot be predicated of the entities referred to or described by such expressions:

(57) #The truth about that event/the outcome of the competition/this fact/that earthquake is true/false.

• Substitutivity:

(58)a. Jill is aware of/reported/revealed that fact. That fact is that Bill has been working hard to destroy the company. Hence, Jill is aware/reported/revealed that Bill has been working hard to destroy the company.

b. Jill guessed/could have predicted/discovered these basic truths about Bill. One of these is that Bill never finishes writing up. Hence, Jill guessed/could have predicted/discovered that Bill never finishes writing up.

c. Jill regrets/remembers well a particularly gruesome outcome of Bill's pronouncement. That particularly gruesome outcome of Bill's pronouncement was that everyone was required to sign the pledge. Hence, Jill regrets/remembers well that everyone was required to sign the pledge.

• Existential generalisation: (for declaratives: valid only for factives)

(59)a. Jill discovered/revealed that Bill has been working hard to destroy the company. Hence, there is some fact that Jill discovered/revealed.

b. Jill discovered/told us who Bill has chosen for the job. Hence, there is some fact that Jill discovered/told us.

This data provides us with a way out from the impasse one might think we had reached having concluded that both interrogatives and declaratives need not denote questions and propositions. The explanation common to both phenomena, I suggest, is that such expressions can be coerced, coerced to denote facts. I follow a variety of recent work surveyed in Pustejovsky (1993) that appeals to a notion of coercion described as follows:

Type coercion: a semantic operation that converts an argument to the type which is expected by a function, where it would otherwise result in a type error. (Pustejovsky 1993, p. 83)
Pustejovsky provides a system in which the reading paraphrasable as (60b) can be provided for a sentence such as (60a):

(60)a. John began a novel.

b. John began reading a novel. (Pustejovsky's example (43))

In the system described by Pustejovsky, each expression is (potentially) assigned an argument structure, an event structure defining the event type of the expression and a qualia structure. In (60a) the verb 'begin' expects a second argument of type event, one of whose participants is the filler of its first argument. The NP 'the novel' does not satisfy this type, so the verb coerces the NP into an event denotation, in this case an event structure of sort \( \text{READ}(\text{event}:e, \text{agent}:x, \text{Novel}:y) \), which the NP has available from its head CN's own qualia structure, in this case 'novel'.

The setting Pustejovsky envisages is a typed \( \lambda \)-calculus. However, in common with e.g. Pollard and Sag (1994),\(^{17}\) one can also envisage such an operation based on appropriateness within a type-free setting such as the one we operate in here. At present I cannot appeal to the existence of a framework that serves to underpin such a view; therefore I will restrict myself to a specification of the coercion in the interrogative/declarative cases that are of concern to us here.

The system that will emerge as a result will involve a 4-way split:

- Factives: take as arguments the coerced factive denotation both for declaratives and for interrogatives.
- Non-factive resolutives: these take the coerced factive interrogative denotation. On the other hand, there is evidence that they can also take propositional arguments, hence no need to assume coercion in the declarative case:

(61)a. Bill has told me that story many times in the past. That story, obviously untrue, was, essentially, that Mary would never agree to Jill's terms. Hence, Bill has told me that Mary would never agree to Jill's terms.

b. Bill predicted, falsely as it turns out, that Mary would never agree to Jill's terms.

- QI: as far as interrogatives go, they take questions as arguments. On the other hand, they are inapplicable to declarative content, presumably since their arguments are required to have "unresolvedness" predicable of them.

\(^{17}\) See their account of complement coercion in control, Section 7.4, p. 308 ff.
(62)a. Xiaokang asked/wondered/investigated/weighed-in-his-mind that Jill likes Bongo drumming.
   b. It is open/unresolved that Jill likes Bongo drumming.

- TF: as far as declaratives go, they take propositions as arguments. They are, as we noted above, inapplicable to interrogative content.

I mention one further ontological constraint that I believe emerges from the data: a necessary condition for an ontology to be adequate for a semantics for factive predicates is that the class of entities that are in the union of the positive and negative extension of (at least one) factive predicates must be a superset of the class of actually holding facts. The reason for this is presupposition projection:

(63)a. Did you, in fact, discover that Javed was a Kylie fan? [Does not entail that Javed was actually a Kylie fan.]
   b. If Martha buys a blue dress and Susan does too, then Martha will regret having bought a dress identical in colour to Susan’s. [Does not entail that Martha did buy a dress of identical colour to Susan’s.] (Based on an example of Soames 1989).

Within a situation theoretic ontology, factuality is a property of a strict subset of the class of SOA’s, since each SOA is posited to have a dual, and only coherent situations\(^{18}\) are assumed to exist. This means that whether predications are felicitous does not become an (entirely) empirical issue. I, therefore, avoid the problem posed by Ramsey (1927) for Russell’s (1918) semantics for factive/perception verbs.\(^{19}\) On the other hand, as it stands, the situation theoretic modelling introduces a certain ‘perspec-

\(^{18}\) Ones that satisfy \(s \models \sigma\) implies \(s \not\models \sigma\).

\(^{19}\) In a number of works (e.g. Russell 1918), Russell propounded a theory which distinguishes the logical form of declarative sentences embedded by ‘believe’ or ‘wish’ from those embedded by ‘perceive’ or ‘know’. Those sentences embedded by ‘believe’ or ‘wish’ would, roughly speaking, contribute an entity consisting of (or individuated by) the denotata of the constituents of the sentences. Thus, in

(i) Othello believed that Desdemona loved Cassio.

The embedded sentence contributes something like a triple consisting of the objects Desdemona, Cassio and the relation love. In contrast, a sentence embedded by ‘perceive’ would contribute a fact, construed in strictly realist terms by Russell as an object on a par with chairs and tables. Thus, in

(ii) Othello perceived that Desdemona wasn’t breathing.

The embedded sentence contributes the fact that Desdemona wasn’t breathing. Were Desdemona to be breathing, the fact that Desdemona wasn’t breathing, would not exist. And herein lies a problem for Russell’s account, as Ramsey points out. Sentences like

(iii) Bill believed he knew that Mary was 6 feet tall.
tival asymmetry' which has no obvious independent motivation: the arguments of factive/resolutive predicates, the SOA's, are always unsituated, whereas the arguments of TF and QI predicates, the propositions and the questions, are always situation dependent (i.e. individuated in terms of a situation and a SOA/abstract: \((s!\sigma), (s?\alpha)\)). One way of eliminating the asymmetry would be to countenance propositions/questions in which the situational constituent is quantified away. In other words, to appeal to a notion akin to Russellian propositions in the sense of Barwise and Etch- emendy (1987). An alternate strategy would be to allow a situation as an implicit argument of factive/resolutive predications. I leave a resolution of these issues to further work and retain here the more orthodox but potentially problematic view.

7.5 Excursus on Hybrid Coordination

The 4-way bifurcation posited above raises one question with respect to coordination, namely the status of hybrid question/proposition entities exemplified by (64):

(64) Jill knows who left and/or that Mary had been disappointed.

Examples such as (64) are among the motivations for Groenendijk and Stokhof’s approach in which the extension of an interrogative is assumed to be of the same semantic type as the intension of a declarative, namely propositional.20

If we assume that both declaratives and interrogatives embedded by a predicate that is both resolutive and factive denote facts, then for such cases, compounding is treatable using the normal SOA-algebra \(\lor\) and \(\land\).

Do we have cases that actually require semantic question-proposition hybrids? There is some data that calls this into question: if the hybrid is to be a proposition, it is surprising that (65b), where this object is predicated by ‘believe’ a predicate of propositions, is bad, whereas if the hybrid

20 See Groenendijk and Stokhof (1989) for detailed discussion of issues pertaining to coordination.
is to be a question, the analogous case with ‘ask’, a predicate of questions, is surprising:\footnote{21}

\[(65)a. \ #Bill asked who left and/or that Mary had been disappointed.\]
\[b. \ #Jill believed who left and/or that Mary had been disappointed.\]

Of course, one could appeal to a syntactic analysis based on subcategorisation to explain these facts: in a framework for coordination along the lines of Sag et al. (1985), where hybrid compounds are allowed in via some kind of “disjunctive” feature only a predicate that subcategorises for both interrogatives and declaratives will also subcategorise for the hybrid.

The one case that poses some problems and might benefit from proposition/question hybrids concerns resolutives that are not factives, that is, predicates such as ‘tell’ or ‘guess’. In such cases, my account assumes that an interrogative is coerced to denote a fact, but the evidence is that the declarative argument is propositional. It turns out that mixed coordinations in such cases, and with concealed question NP’s or POSS gerunds that can also be argued to denote facts, are quite felicitous:

\[(66)a. \ Jill reported to us who Bill likes and that Mary is ill.\]
\[b. \ Jill reported to us Dave’s current marital status and that Mary is ill.\]
\[c. \ Jill reported to us Dave’s having betrayed Judy and that Mary is ill.\]

One might view this as a \textit{prima facie} counterexample to the current account and its postulated semantic type distinction between states-of-affairs and propositions since, apparently, expressions denoting the two putatively distinct entities can be conjoined. Things are not so simple, however. Notice that truth cannot be predicated of the compound, as we might expect were it to denote a proposition. Thus, the adverb in (67) cannot modify the truth of the embedded clause, it can only serve to indicate that there was some infelicity, for instance in making the report in the given circumstances:

\footnote{21 Conditionals are a somewhat different case since they clearly do form hybrids, of genus question:}

\[(i) \quad \text{Bill asked who would come if Jill left.}\]
\[(ii) \quad \ #\text{Bill believed who would come if Jill left.}\]

These hybrids, nonetheless, can be handled not as question/proposition compounding but simply as SOA/SOA-abstract compounding of the kind discussed in Section 3.3.
(67)a. Jill incorrectly/falsely reported who Bill likes and that Mary is ill.
b. Jill incorrectly/falsely reported to us Dave's current marital status and that Mary is ill.
c. Jill incorrectly/falsely reported to us Dave's having betrayed Judy and that Mary is ill.

Furthermore, the embedded declarative is not forced to be true, as would follow on an account wherein there existed a factive homonym of 'report':

(68) Jill reported who Bill likes and that Mary is ill. As it turns out Mary is not ill.

Thus, the problematic nature of such compounds is independent of the bifurcation postulated here for propositional entities and will not go away by postulating an ambiguity for the embedding predicate. I do not offer a solution to this problem here. One direction worth exploring is, as Lahiri (1991) notes, the approach of Chierchia (1982) where the denotata of 'that'-clauses are treated on a par with the denotata of NP's, viz. as individuals, a view which seems to cohere well with the approach taken here to 'propositional entities'.

7.6. A Coercion-Based Account of Resolutive Interrogative and Factive Declarative Content

The coercion process we require is intended to achieve two effects. On the one hand, it is supposed to enable both an interrogative I and a declarative D to denote facts. On the other hand, the two coercions are required to provide facts with slightly different pedigrees: the interrogative coercion needs to yield a fact that in that context resolves the question denoted by I, whereas the declarative coercion should yield a fact that proves the truth of the proposition denoted by D. In this way, we achieve both the right content-type for resolutives and factives and ensure that the requisite inference patterns are satisfied.

In detail: assume as given a question q. On the basis of the relation RESOLVES developed in Section 4 we can define the following set of SOA's:

(69) \[ f \in \text{RESOLVING-FACTS}[q,ms] \text{ iff RESOLVES}(f,q,ms) \]

Here \( ms \) is a parameter for the mental situation that has to be contextually supplied whenever an attitude predicate embeds a content.
The coercion semantics we are after is intended to get the following effect for a resolutive predicate V:

\[(70) \text{'VS}[+\text{Int}]' \text{ denotes } \lambda x (\text{CONT}(V), x, f, ms) \text{ where}
\]

\[f \in \text{RESOLVING-FACTS}[\text{CONT}(S[+\text{Int}]), ms] \]

Two questions arise: first, how do we know the set \(\text{RESOLVING-FACTS} [\text{CONT}(S[+\text{Int}]), ms]\) is non-empty? Second, if \(\text{RESOLVING-FACTS}[-\text{CONT}(S[+\text{Int}]), ms]\) is non-empty, which \(f\) do we choose? The answer to the first question is clear: the coercion process will be well-defined if and only if the question is resolved. In other words, it is a presupposition of the coercion that the question is resolved. Thus, going along the coercion route, allows for the resolvedness presupposition to emerge without further stipulation.

The second issue is more intricate. We recall the background SOA-algebra: this ensures that for any set of SOA's \(\Sigma\), there exists a join, \(\vee(\Sigma)\), a SOA that represents the weakest information specified by \(\Sigma\). Hence, a tempting option is to take the denotation of a resolutive interrogative complement \(S[+\text{Int}]\) to be simply \(\vee(\text{RESOLVING-FACTS}[\text{CONT}(S[+\text{Int}]), ms])\).

Such a solution would be workable if we could ensure that \(\vee(\text{RESOLVING-FACTS}[\text{CONT}(S[+\text{Int}]), ms])\) is always itself a member of \(\text{RESOLVING-FACTS}[\text{CONT}(S[+\text{Int}]), ms]\). This will not, however, always be the case, primarily because of the sortal condition in the definition of RESOLVES.

In a case where \(\vee(\text{RESOLVING-FACTS}[\text{CONT}(S[+\text{Int}]), ms])\) fails to be a resolving fact, clearly it will not do as the resolutive denotation. However, in such a case, there is no one member of \(\text{RESOLVING-FACTS} [\text{CONT}(S[+\text{Int}]), ms]\) which we can choose as the resolutive denotation without risking error: when we, for instance, attribute to Bill that he knows who came, there will, typically, be a variety of facts that resolve the question 'who came' that Bill does not know. A similar point arises with respect to a negative predication involving a resolutive complement ('Bill does not know who came'), where the wrong reading will arise if...
one particular resolving fact is chosen as the resolutive denotation: the desired reading is that Bill fails to know a single resolving fact, not a particular one.

Given these considerations, I conclude that a resolutive interrogative complement does not behave referentially (i.e. can be taken to involve reference to a (resolving) fact). Rather, it functions like an (indefinite) description for a fact $f$, one where the descriptive condition consists in $f$'s resolving the question denoted by the interrogative complement. This should not perhaps be a particularly surprising outcome: one of the expressive gains provided by nominal quantification is the ability to make statements about arbitrary, non-familiar objects, as in (71a). Analogously, one can argue that resolutive complements provide us with the ability to make statements about the at times arbitrary/non-familiar facts that resolve a given question, as in (71b):

(71)a. Some grain of sand will enter my shoe when I go to the beach tomorrow.

b. Max discovered how to prove the theorem a week ago. Of course since I know no mathematics I couldn't tell you anything about it.

Interrogative coercion, then, needs to achieve the following effect:

(72)a. \[ \text{VP[fin]} \rightarrow \text{H: V[fin], C: S[fin, +INT]} \] (V[fin] is a resolutive predicate)

b. \[ \text{[VP]}(\text{utt - sito,ms}) = \lambda x \exists f(\text{CONT(H)}, \text{subj-role:x, content-role: f, cog-role: ms}); \]

RESTRICTIONS: \[ \text{utt - sito} \in (\text{RESOLVES, f, CONT(C), ms}) \]
conjoined with: \[ \text{RESTR(C) conjoined with RESTR(H)}. \]

One could postulate (72) as a grammar rule, though strictly speaking this does not involve coercion of the interrogative complement: the content has not arisen by composing the embedding predicate with an alternative denotation possessed by the interrogative. This latter effect can be achieved along lines made familiar in Montague's PTQ (Montague 1970): the interrogative is coerced to denote an existential quantifier over facts $f$, restricted so that $f$ resolves the question denoted by the embedded complement relative to $ms$; the embedding predicate is postulated to satisfy a constraint similar to PTQ's MP1 for extensional verbs (the situation theoretic formulation here is based on Cooper 1993):
(73)a. If \( I \) is an interrogative whose content in \( \text{utt} - \text{sito}_0 \) is \((s?\mu)\), \( I \) can be coerced to denote \( \lambda P \exists f[P(f)] \)

**RESTRICTIONS:** \( \text{utt} - \text{sito}_0 \vdash \langle \text{RESOLVES}, f, (s?\mu), \text{ms} \rangle \)

b. If \( V \) is a resolutive predicate and \( P \) a quantifier, then

\[ \langle V, \text{V'er:x}, \text{content-role:} P, \text{cog-role:ms} \rangle \leftrightarrow P(\lambda f(V, \text{V'er:x}, \text{content-role:f, cog-role:ms})) \]

On to the propositional case with factive complements. Here we could adopt two possible courses of action. The first is strongly based on the situation theoretic view of the relation between facts and propositions, namely that if a proposition \( p = (s!\sigma) \) is true, then \( \sigma \) is a fact supported by \( s \). Then the desired effect of the coercion is as specified in (74a), which can be achieved by positing a rule as in (74b):

(74)a. \( V \ S[+DECL] \) denotes \( \lambda x \langle \text{CONT}(V), x, \sigma, \text{ms} \rangle \) where \( \langle \text{CONT}(S[+DECL]) \rangle = (s!\sigma) \)

b. If \( D \) is a declarative whose content in \( \text{utt} - \text{sito}_0 \) is \((s!\sigma)\), \( D \) can be coerced to denote \( \sigma \)

Alternatively, we can follow a line entirely analogous to the interrogative case: a factive complement functions like an (indefinite) description for a fact \( f \) that proves the proposition denoted by the declarative complement. I choose the second option here, not solely for the sake of uniformity but also because it can be used in a framework where facts and propositions relate to each other in a different way than in situation theory. Once again, the factivity presupposition emerges as a presupposition required for the well-definedness of the coercion process:

(75)a. If \( D \) is a declarative whose content in \( \text{utt} - \text{sito}_0 \) is \((s!\sigma)\), \( D \) can be coerced to denote \( \lambda P \exists f[P(f)] \)

**RESTRICTIONS:** \( \text{utt} - \text{sito}_0 \vdash \langle \text{PROVES}, f, (s!\sigma), \text{ms} \rangle \)

b. If \( V \) is a factive predicate and \( P \) a quantifier, then

\[ \langle V, \text{V'er:x, content-role:} P, \text{cog-role:ms} \rangle \leftrightarrow P(\lambda f(V, \text{V'er:x, content-role:f, cog-role:ms})) \]

(76) provides a simplified derivation for ‘discover who likes what’:

(76)a. \( \text{VP[fin]} \rightarrow H: \text{V[fin]}, C: S[fin,+\text{INT}] \)

b. \([\text{'who likes what'}](\text{utt} - \text{sito}_0, \text{descr - sito}) = \text{(descr-sito}?hv,riLIKE, liker:v, likee: r)) \)

c. \([\text{'discover who likes what'}](\text{utt} - \text{sito}_0, \text{descr - sito}, \text{ms}) = \lambda x \exists f(\text{DISCOVER, subj-role:x, content-role: f, cog-role: ms}) \)

**RESTRICTIONS:**
The rules in (73,75) are stated simply as an operation on contents of interrogatives and declaratives. This is apparently too restricted, since, for instance, it will not capture the fact that concealed question uses have both a question denoting use and a fact denoting use:

(77) Jill investigated/discovered the source of Bill’s wealth.

However, if we reformulate the rules so that they apply to any question-denoting or proposition-denoting expression, they will overgenerate, since, for instance, we do not want a question-denoting NP such as ‘the question’ or a proposition-denoting NP such as ‘the hypothesis’ to coerce in this way, as examples (35) and (41) taught us:

(78)a. Jill discovered a question; The question was who left; *It does not follow* that Jill discovered a fact that resolves the question of who left.

b. Jill discovered a hypothesis; The hypothesis was that Bill left; *It does not follow* that Jill discovered a fact that proves the claim that Bill left.

Resolving the tension between (77) and (78), is unfortunately outside the scope of this paper, not least because it involves providing a treatment of concealed question uses of NP’s. I suggest that the contrast arises for something like the following reason: assume that ‘discover’ expects its argument to be fact-denoting. NP’s can coerce in a variety of ways. 24 One such coercion (‘existential coercion’) is of the type evinced in (77), which can be paraphrased as ‘the fact that x existed’:

(79)a. Jill told me of/reported/is aware of/revealed a certain question. (= Jill told me of/reported/is aware of/revealed the fact that a certain question exists.)

b. Jill told me of/reported/is aware of/revealed a certain book written by Freud. (= Jill told me of/reported/knows/revealed the fact that a certain book written by Freud exists.)

One other possible coercion for an NP, if it is definite, is the concealed

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24 See Pustejovsky (1993) for examples.
question use, where it denotes a question paraphrasable as ‘who/what is the NP’. This in turn can undergo question-to-fact coercion as described in (75). The contrast between (77) and (78) can then be explained as follows: since the NP in (77) is specified as being able to coerce to a fact according to the schema underlying (79), the predication in (77) is successful using that coercion. On the other hand, for an NP such as the one in (78) existential coercion is impossible for some reason, perhaps one that concerns its definiteness. Concealed question coercion is, however, applicable. This outputs a question content. This is still not appropriate for ‘discover’. Hence question-to-fact coercion takes place. Hence, a reading as in (78).

I provide now one application of the coercion analysis: a unified account of the qv reading for interrogative and declarative complements of factive/resolutive predicates.

7.8. QV Readings for Resolutive Interrogatives and Factive Declaratives

Recall that in Section 6.4 I suggested that the partial evidence/answer reading for declaratives and interrogatives is available for a class of predicates, let us call them gradable-fact predicates, which evince similar behaviour with fact nominals:

(80) Jill has to some extent managed to establish this fact. (What Jill has actually established is a “weaker” fact than the fact demonstrated.)

How to obtain such readings? The account proceeds as follows: I treat the adverb of extent as a verb modifier. The modified verb triggers coercion: question-to-fact in the interrogative case, proposition-to-fact in the declarative case, no coercion in the fact nominal case. The meanings involved are as follows:

(81)a. ['to some extent discover who likes what'](utt - sito, descr - sito, ms) =
\[ \lambda x \exists f(DISCOVER-TO-SOME-EXTENT, subj-role:x, content-role:f, cog-role:ms) \]
RESTRICTIONS: utt - sito \(\vdash\) (RESOLVES, f, (descr-sito?Av,r<LIKE, liker:v likee: r)), ms)

b. ['to some extent discover that Bill likes Jill'](utt - sito, descr-sito, ms) =
\[ \lambda x \exists f(DISCOVER-TO-SOME-EXTENT, subj-role:x, content-role:f, cog-role:ms) \]
Restrictions: \( \text{utt} \sim \text{sit}_0 \vdash \langle \text{PROVES}, f, (\text{descr-sit}_0! \langle \text{LIKE}, \text{liker:b likee: j} \rangle), \text{ms} \rangle \)

Finally, I impose the following constraint, assumed to hold for gradable-fact predicates:

\[
\langle \text{V-TO-Q-EXTENT subj-role:x, content-role: f, cog-role: ms} \rightarrow \exists f_1 \langle V, subj-role:x, content-role: f_1, cog-role: ms \rangle, \text{where } f_1 \text{ is a SOA that satisfies the following: } f_1 \Rightarrow_{ms} Q_{-\text{extent}} f. \ (\Rightarrow_{ms} Q_{-\text{extent}} \text{ is a notion of Q-extent information containment as defined in (11).})
\]

In particular, it is straightforward to verify that if \( f_1 \Rightarrow_{ms} Q_{-\text{extent}} f \), where \( f \) resolves a question \( q \), then \( f_1 \) to Q-extent resolves \( q \), in the sense of our definition in Figure 1. Hence, we can capture the requisite truth conditions.

8. Concluding Remarks

I started this paper (‘Resolving Questions, I’) with a somewhat tendentious remark, namely that the semantics of interrogatives had overemphasised answers at the expense of questions. The paper has attempted to illustrate the benefits gained by analysing a question without a priori fixing what its answers are.

More precisely, I have argued that at least four, distinct notions of “answerhood” are required for semantic analysis:

- being information about a question \( q \): needed to characterize the intuitions speakers exhibit in judging whether or not a response coheres with the query that elicited it independently of context particular factors such as specificity or truth.
- being information that fully resolves a question \( q \): needed for the semantics of interrogatives embedded by resolutive predicates, for instance ‘know’, ‘tell’, and ‘discover’.
- being information that partially resolves question \( q \): needed for the semantics of interrogatives embedded by resolutive predicates modified by adverbs of extent such as ‘to some extent’ or ‘for the most part’.
- being information that fulfills the goal(s) associated with the asking of a question \( q \): needed to characterize the intuitions speakers exhibit in judging whether or not a response fulfills the goal(s) associated with the asking of the question.
Of these, only one, the notion of being information about a question, is fixed for a given interrogative once the “usual” indexical parameters (e.g. speaker, location, tense) are fixed. Since the other three notions are subject to much stronger contextual dependence, as has been demonstrated extensively throughout the paper, one cannot hope to offer a semantic analysis of interrogatives in terms of one of these notions of answerhood, as often proposed in past accounts.

The alternative I have pursued here is to analyze questions in a manner that resembles the situation theoretic analysis of propositions within an ontology which includes situations, SOA’s, n-ary abstracts. In situation theory, a proposition is constructed as a relational entity \( p = (s!\tau) \), where \( s \) is a situation, \( \tau \) is a SOA. \( p \) is defined to be true iff \( \tau \) is a fact of \( s \) (denoted as: \( s \models \tau \)). A useful notion for certain semantic applications, including the characterisation of factivity, is a notion of provability relativised to an agent’s mental situation \( ms \): this holds between a SOA \( \sigma \) and a proposition \( p = (s!\tau) \) (‘\( \sigma \) proves \( p \)’) iff \( \sigma \) is a fact from which the truth of \( p \) (or equivalently: the facticity of \( \tau \)) can be deduced relative to the notion of consequence provided by \( ms \).

The current proposal involves constructing a question as a relational entity \((s?\mu)\), where \( s \) is a situation and \( \mu = \lambda X_1, \ldots, X_n.\sigma(X_1, \ldots, X_n) (n \geq 0) \) is an n-ary abstract. A question \( q = (s?\mu) \) provides:

1. An “underspecified” informational item, the abstract \( \mu \). The class of informational items, SOA’s, that are about \( q \) can be characterized as a function of \( \mu \).
2. A situation \( s \). Those SOA’s which are facts of \( s \) and informationally subsume a level determined by \( \mu \) constitute the class of SOA’s that potentially resolve \( q \).

Relative to an agent’s mental situation that supplies a goal \( g \) and a notion of consequence, it is possible to determine which of the potentially resolving SOA’s actually resolve \( q \) in that context, which partially resolve \( q \), and which fulfill \( g \).

This approach to explicating what questions are, views them as entities that are distinct from but share certain commonalities with propositions: SOA’s prove propositions and resolve questions. This commonality is exploited in the approach I have taken to interrogative and declarative complementation. On the one hand, I have offered extensive motivation for an ontology that distinguishes propositions, questions, and (factual) SOA’s: I have argued that a question is not an appropriate argument for the relation denoted by a resolutive predicate, whereas a proposition is
not appropriate for a factive predicate. A relation denoted by a QI predicate (e.g. ‘ask’, ‘wonder’, ‘investigate’) is, by contrast, applicable to a question, similarly for a TF predicate (e.g. ‘believe’, ‘claim’, ‘assert’) and a proposition. In fact, TF predicates carry an appropriateness restriction that their argument must be an entity of which truth or falsity is predicable. And yet, where the proposition/question commonality is important is when assigning a semantics to interrogatives/declaratives embedded by resolutive/factive predicates: whenever a resolutive (factive) predicates of an interrogative that denotes a question \( q \) (a declarative that denotes a proposition \( p \)), that complement is coerced to denote a description for a SOA which, unless projection phenomena intervene, resolves the question (proves the proposition).

My approach directly

1. Captures the resolutive (factive) entailments that I suggested resolutive (factive) predicates satisfy (see examples (1)–(4), ‘Resolving Questions, I’).
2. Derives the resolutivity and factivity presuppositions as a condition on the well-definedness of the coercion process.
3. Blocks substitutivity and existential generalisation with question-denoting (proposition-denoting) arguments for resolutive (factive) predicates, while allows them to hold for QI (TF) predicates.
4. Accounts for the uniform behaviour of adverbially modified predicates that are both resolutive and factive with interrogative, declarative and fact-nominal arguments.
5. Offers a simple account for the cross-linguistically valid generalisation that TF predicates are inapplicable to interrogative meaning.

In conclusion, the current theory that starts out from an attempt to increase the “autonomy” for questions from propositions ends up by providing some new insights into the nature of propositional entities and their predicates. A number of open threads remain. Three in particular should be emphasised:

1. Integration of the current work into an update semantics for dialogue. Such an integration would provide a natural setting in which to show how the semantic entities motivated in the previous section, questions, propositions, and facts, both are manipulated in and structure language use. In particular, to explain how such “pragmatically conditioned” presuppositions
as *resolvedness* emerge, but also how the fact that a particular question is *under discussion* influences topic choice and licenses ellipsis. Initial work along these lines is reported in Ginzburg (1994a,b).

2. **The semantic/pragmatic interface with respect to intentionality.** The current work argues that parameters such as an agent's goals are required for semantic analysis and offers an account of how this is to be done for the case when a single, fixed goal is considered. A more general analysis is required that can, for instance, accommodate multiple goals that are allowed to change.

3. **A coercion framework for abstract entity XP's.** I have argued that interrogative and declaratives need, in certain contexts, to be coerced from their 'default' denotation. I have offered a specification for such a coercion account. Further work is needed to provide a general framework in which to embed such an account and offer a treatment for the closely related issue of 'concealed question' and other types of coercion that NP's embedded by propositional entity predicates undergo.

Although the approach I have developed in this paper diverges in certain ways from each of the existing approaches I have mentioned in the paper, it is clear that the current approach synthesises a number of valuable insights present in these works. A brief overview of how a number of these insights are captured in other accounts provides an important perspective on the claims I have made for my own account.

8.1. **Karttunen: An Independent Notion of Question**

Karttunen's (1977) semantics for interrogatives is innovative in its recognition of the need for an independent notion of a question, rather than attempting to reduce interrogative to declarative meaning, as advocated by Hintikka among others. Karttunen proposed an analysis of questions as properties of propositions:

\[(83)a. \quad I = 'who\ walks'\]
\[b. \quad \text{Karttunen denotation of } I \text{ at } w: \lambda p[TRUE(p) \land \exists y(p = WALKS(w)(y))]\]

Karttunen's approach enables the provision of a semantics for interrogative complements embedded by predicates that are not applicable to declaratives (e.g. QI predicates, dependency predicates) without resorting
to lexical decomposition. In addition, the particular property Karttunen associates with each interrogative permits a characterisation of the exhaustive force associated with questions. In particular, this can be exploited to relate the interrogative and declarative complements of resolutive predicates. Karttunen proposes, for instance, the following meaning postulate for 'know', first mentioned in Section 2.1, repeated here as (84):

(84) \(\text{know}(x,Q) \leftrightarrow \forall p (\text{if } Q(p), \text{ then } \text{know}(x,p)) \text{ and if } \neg \exists q Q(q), \text{ then } \text{know}(x, ^\land \neg \exists q Q(q))\) (cf. Karttunen 1977, footnote 11, page 18)

Karttunen's approach faces a number of fundamental problems: first, as discussed in Section 7, the assumption of a uniform semantics for all interrogative complements runs into problems with pure-referentiality inferences with question nominals. Interrogative complements are not embedded in a purely referential way by resolutive predicates. Karttunen's semantics does not lend itself to an account of this.

Second, the notion of exhaustiveness that Karttunen associates with questions is not contextually flexible. Hence, the requisite fluctuation across contexts, which as discussed in Section 2 of 'Resolving Questions, I' is required for the semantics of interrogatives embedded by resolutive predicates, cannot be accommodated.

Third, since Karttunen identifies interrogative meaning with the property of being an exhaustive answer, his semantics is not equipped to offer a characterisation of either the notion of information about a question, nor, consequently, of the notion of information that partially resolves a question. Karttunen did not entertain the need for such a notion, but apparently the weakest informational notion readily definable from a Karttunen question \(Q\) is the notion of being a member of the intension of \(Q\). Informally,

(85) \(p \text{ is About } Q, \text{ where } Q \text{ is the denotation of } I \text{ in } w \text{ iff there exists } w' \text{ such that } Q'(p) \text{ where } Q' \text{ is the denotation of } I \text{ in } w'.\)

This notion still only accommodates polar answers for yes/no questions and instantiated answers for wh-questions.

8.2. Groenendijk and Stokhof: Intensional/Extensional Predicates?

Groenendijk and Stokhof's (1982, 1984a,b, 1989, 1993) semantics for interrogatives contains a number of important insights. I focus here on one: Groenendijk and Stokhof's recognition of the existence of (at least) two kinds of interrogative complements and the need to offer a systematic
connection between the two. Groenendijk and Stokhof follow Karttunen in providing questions as semantic entities distinct from propositions. Indeed, they do not eschew positing the existence of relations that take questions as their arguments. Relations of this kind include ‘wonder’ and ‘ask’, which in their system is the intension of an interrogative sentence. However, relations such as those denoted by interrogative complement embedding ‘know’ or ‘tell’ are not treated as relations that take questions; rather the argument in this case is taken to be a proposition, which in their system is the extension of an interrogative sentence. As mentioned previously in Section 2.1, this enables a systematic connection between the question complement and the propositional complement to be achieved: the extension at \( w \) is a set of worlds, those worlds that determine the extension of the queried property equivalently. The intension of the interrogative is the partition of the set of possible worlds induced by this equivalence relation. This is exemplified in (86)

\[(86)a. \text{ who walks. Assumed paraphrasable as: 'for all } x, \text{ whether } x \text{ walks'.} \]

\[b. \text{ Extension at } i: \lambda j(\lambda x \text{ walk}(x)(j) = \lambda x \text{ walk}(x)(i)) \text{ (All worlds } j \text{ that agree with respect to the extension of 'x walks' at } i.\)]

\[c. \text{ Intension: } \lambda i\lambda j(\lambda x \text{ walk}(x)(j) = \lambda x \text{ walk}(x)(i))\]

Groenendijk and Stokhof’s approach maintains the insights present in Karttunen’s approach, though, as mentioned in Section 2.1 they choose to build in a stronger notion of exhaustiveness; however, in addition, their approach can block the unwanted pure referentiality inferences with resolutive predicates since the complements of these predicates are posited to be proposition-denoting, not question-denoting. An additional bonus is that coordination between interrogatives and declaratives can be semantically meaningful for extensional interrogative complements since in such cases the semantic type of the latter is identical to the intension of a declarative.

Groenendijk and Stokhof’s approach does face a number of intrinsic problems. First, although Karttunen’s problem with pure referentiality for question-nominals is avoided, a related problem is not: in Section 7 it was shown that factives do not embed proposition-nominals in a purely referential fashion. Hence, the assumption that the semantic type of the complements of such predicates is propositional is problematic; in particular, it leads to a string of unwanted inferences. Consequently, coercing interrogatives from being question-denoting to being proposition-denoting is dubious.

Second, the predicate ‘true’ is inapplicable to interrogatives. This poses
the following problem for Groenendijk and Stokhof: on their account the extension of an interrogative is a true proposition. In fact, Groenendijk and Stokhof assume that this is the source of the veridicality of interrogatives embedded, e.g. by non-factives such as 'tell' and 'report'. Hence one would expect the predicate 'true' to be an extensional interrogative predicate. This expectation is not met. While this could be attributed to some idiosyncratic property of 'true', we have seen on further examination that this is part of a pervasive generalisation: the class of predicates I have dubbed TF predicates, whose arguments must be truth predicable, are inapplicable to interrogatives. This leaves Groenendijk and Stokhof with subcategorisation as the sole way to explain away this cross-linguistically pervasive pattern of inapplicability.

Third, Groenendijk and Stokhof's approach to exhaustiveness is subject to similar criticisms as Karttunen's, since it is not contextually flexible. Groenendijk and Stokhof do show how to relativize their notion of answerhood to individual epistemic states: what this allows is for a refinement of the partition of the set of possible worlds defined by an interrogative intension.

(87) Assume \( I/Q \) is a partition of the set of possible worlds \( I \) determined by the question \( Q \). An information set \( J \) is a non-empty subset of \( I \). Then, the set of answers compatible with \( J \) is:

\[ \{ X \in Q \mid X \cap J \neq \emptyset \} \]  

(equation (14) in Groenendijk and Stokhof 1984b, p. 151.)

Nonetheless, Groenendijk and Stokhof view such a relativisation as an explanatory tool for the pragmatics of query/response interaction and do not try to build it into the semantics of embedded interrogatives. Moreover, such a relativisation does not help deal with fluctuations of the goal associated with an (embedded) question discussed in Section 2.

Fourth, as discussed in Section 5.3, the notion of 'partial answerhood' readily definable from Groenendijk and Stokhof's semantics is not rich enough to accommodate the notion of 'aboutness'.

Ginzburg (1992) contained a fallacious and (b)rashly stated demonstration of an individuation asymmetry predicted by positing an intensional/extensional split, namely that the complements embedded by the inten-

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25 This is not to say this could not be done, in principle. Martin Stokhof points out to me that '[I]n spelling out the relation expressed by a (certain class of) embedding verbs reference can be made to the pragmatic answers that the question denoted by the interrogative complement allows'. Doing so would require adopting an embedded sentence rule akin to the one provided in the current work ((47), 'Resolving Questions, I') where embedding verbs carry an extra argument corresponding to the reported agent's mental situation.
sional predicates are, in principle, individuated with finer grain than the intensional complements. The fallacy, as pointed out in Groenendijk and Stokhof (1993), lay in the particular set-up in which it was claimed the individuation asymmetry would arise. On a purely formal level it is possible to instantiate the basic set up in a way that does produce the individuation asymmetry, though given the difficulty in assessing what the relevant *linguistic* intuitions are, I certainly cannot dispute Groenendijk and Stokhof’s claim that this problem is not an intrinsic one for their account and need not arise once their framework is formulated in a framework distinct from that of classical intensional logic.

8.3. Lahiri: The QVE as Quantification Over Partial Answers

The data we saw in Section 6 is problematic for approaches that try to pin the qv reading on quantification over the argument role associated with the wh-phrases in the embedded interrogative complement, as Berman’s (1990, 1991) DRT account and Groenendijk and Stokhof’s DMG account do.\(^{26}\)

The intuition underlying Lahiri’s account is quite different, even though for these cases he obtains a Berman–style reading. The intuition is that a partial ordering can be defined on the set of answers to a given question in such a way that adverbs quantify over certain minimal elements of this algebra. This is to be seen simply as one instance of the familiar phenomenon of adverbial modification of mass terms, plurals etc., all of which can be modelled naturally as Boolean structures of some kind. Lahiri assumes a Hamblin/Karttunen semantics for interrogatives. Hence, the set of answers to a wh-interrogative is the set of its instantiations and the minimal parts of the answer are the individual instantiations. Thus, (88a) gets paraphrased as (88b):

\[(88)\text{a. John mostly/partly knows who did well on yesterday’s exam.}\]

\[\text{b. Most/Some atomic factual answers to ‘who did well on the exam’ are atomic factual answers such that John knows them.}\]

Given the relation of answerhood assumed by Lahiri, this is equivalent,

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\(^{26}\) Very roughly, Berman assumes that the embedded wh-interrogative denotes an open sentence and a DRT/FCS approach to adverbs (Lewis 1975, Kamp 1981, Heim 1982). He correlates the existence of a qv reading with the factivity of the embedding predicate. Hence, on his account, the embedded clause gets copied by ‘presupposition accommodation’ into the restrictive clause, which results in the requisite logical form. Groenendijk and Stokhof (1993) manage to achieve a similar effect within Dynamic Montague Grammar using dynamic ‘donkey equivalence’ so that an adverb of quantification modifying an implicational structure can ‘capture’ any existentially quantified variable that appears in the antecedent.
as Lahiri notes, to the reading proposed by Berman, which I have argued above to be incorrect. It is worth pointing out what appears to be a source for this problem, namely the restricted notion of answerhood assumed. Once the range of answerhood is expanded, by allowing in e.g. quantified answers, and the notion of resolvedness is refined to allow goals distinct from the exhaustive answer, then the individual instantiations are no longer the atoms of the answerhood algebra that measure the 'extent' to which an answer is partial. This, for instance, directly blocks the quantificational variability reading from arising. With interrogative complements such an account achieves an effect similar to that achieved by assuming the resolutivity of a predicate can be modified, as occurs in the predicate modifier account I have argued for.

The main problem for Lahiri's account, it would seem, lies in an overly specific diagnosis of the source of qv readings, which leads to an overly specialised solution. Working within a type theory like IL, Lahiri assumes the existence of a semantic type distinction among interrogative complement predicates. Predicates such as 'know' are assumed to take arguments of type \( (s,t) \), whereas predicates such as 'wonder' take arguments of type \( ((s,t),t) \). Thus, when 'know'-type predicates have arguments of type \( ((s,t),t) \) these arguments must raise at LF and be interpreted by a special rule. This rule, which Lahiri dubs interrogative raising (IR), causes the interrogative to raise and adjoin to some sentential constituent, which for concreteness Lahiri assumes is IP. The trace left by this rule is of the type of propositions, \( (s,t) \). The structure formed by IR forms the nuclear scope of an adverbial of quantity (or a default if no overt operator is present.) and is interpreted by a special rule of Int-IP-adjunction. This, in conjunction with presupposition accommodation, yields the requisite quantificational structure.

Lahiri's account as it stands faces two intrinsic problems. On the one hand, it does not offer a source for the qv readings that resolutive predicates manifest with non-interrogative complements such as declaratives and fact-nominals (see Section 6.4, examples (24b), (26b)): in this case there is no type mismatch involving interrogatives and no 'amount of answers' to quantify over. Conversely, the account offers no source for the qv readings exhibited by QI predicates (see Section 6.3): such readings could not arise via IR since, according to Lahiri's assumptions, interrogatives are exactly of the right semantic type for these predicates.

References


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