

# Subquestions and Quantificational Variability Effects

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## 1. Quantificational Variability: the proposal

As first observed in Berman (1991), (1a-c) have a Quantificational Variability (henceforth, QV) reading, where the adverb (*for the most part, partly, with few exceptions*, etc.) quantifies over what seems to be, in some sense, an answer to the interrogative complement of the main verb:

- (1) a. For the most part, John knows who cheated.  
"For most x that cheated, John knows that x cheated"
- b. John partly remembers who cheated.
- c. With few exceptions, John found out who cheated.

The proposal that we defend in this paper is that in a QV structure, the adverb quantifies over semantic questions (i.e., Hamblin-intensions – functions from possible worlds to sets of possible answers; Hamblin (1973)). Accordingly, the semantic interpretation of (1a) is (2):

- (2) MOST-Q<sub><s, <<s, t>, t>></sub>[Q is a relevant subquestion of 'who cheated'] [John knows Q]

The key notion in (2) is "subquestion". Intuitively, we take a subquestion to be a part of a question. So according to (2), to know for the most part who cheated is to know the answers to most of the relevant question-parts of the question 'who cheated'. The assumptions underlying (2) are:

- a. The interrogative complement of *know* is optionally scoped out of the nuclear scope. Since *know* semantically selects a question, the trace of the complement of *know* is a variable over questions.

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- b. The adverb's restriction contains the clause "Q is a relevant subquestion of the complement of *know*".
- c. 'who cheated' is the Hamblin-intension  $\lambda w \lambda p \exists x [p = \text{that } x \text{ cheated}]$ . For example, in some world  $w$ , the extension of 'who cheated' is {that Sue cheated, that Fred cheated, that Bill...}.
- d. To know a question Q is to know the complete true answer to Q.
- e. A question Q is a subquestion of a question Q' iff  $\exists p_{\langle s,t \rangle} \exists w [p \in Q'(w) \ \& \ Q = \lambda w' \lambda q [q = p \vee q = \text{not } p]]$ . For example, 'did Sue cheat' is a subquestion of 'who cheated' (this simplified definition will be revised in Section 5).
- f. The relevance of Q is determined partly by the presuppositions of the nuclear scope (which may be accommodated into the restriction), and partly by other factors. In (2), "Q is relevant" amounts to "Q has a true answer" (i.e.,  $\exists p [p$  is a true member of the actual extension of Q]), because "John knows Q" presupposes that Q has a true answer. If the main verb is non-factive, "Q is relevant" may amount to something else.

The crucial assumption of this analysis is that *know* semantically selects a question, and therefore the adverb quantifies over questions. To appreciate the merits of the current proposal, it is useful to evaluate it against previous analyses, which assume that in the structure underlying (1a), *know* semantically selects a proposition.

The most well known analyses of QV are Berman (1991) and Lahiri (1991, 2000, in press). According to Berman, in a QV structure, the main verb in the nuclear scope selects a proposition, and the adverb quantifies over individuals. (1a) receives the following interpretation:

(3) MOST- $x_e[x \text{ cheated}][\text{John knows that } x \text{ cheated}]$

The assumptions underlying (3) are the following:

- a. *Wh*-phrases are indefinites in the sense of Heim (1982). They contribute a variable that may get bound by a quantifier. Accordingly, the nuclear scope in (3) is "John knows that  $x$  cheated", and ' $x$ ' is bound by MOST.
- b. The presuppositions of the nuclear scope are accommodated into the adverb's restriction. Since "John knows that  $x$  cheated" presupposes that  $x$  cheated, the restriction in (3) contains the clause " $x$  cheated".

Lahiri follows Berman in assuming that *know* semantically selects a proposition, but unlike Berman, he argues that in a QV structure the adverb quantifies over possible answer-parts (i.e., propositions). Accordingly, (1a) receives the following interpretation:

- (4) MOST- $p_{\langle s,t \rangle}$ [ $p$  is a relevant possible answer-part to ‘who cheated’][John knows  $p$ ]

The assumptions underlying (4) are the following:

- a. The interrogative complement of *know* is scoped out of the nuclear scope because *know* (semantically) selects a proposition. The trace of the raised question is of type  $\langle s,t \rangle$ .
- b. The restriction contains the clause: “ $p$  is a relevant possible answer-part to the complement of *know*.”
- c. A possible answer-part is a member of the Hamblin-extension of ‘who cheated’ (e.g., {that Sue cheated, that Bill cheated, ...}).
- d. Relevance is determined partly by the presuppositions of the nuclear scope and partly by other factors. In (4), “ $p$  is relevant” means “ $p$  is true”, since “John knows  $p$ ” presupposes that  $p$  is true.

The differences between Berman’s proposal and Lahiri’s are well known (as is Lahiri’s criticism of Berman’s proposal), and we do not discuss them here. What is of interest to us is the assumption that these two proposals share, namely, that *know* (and all other verbs that belong to the same class) semantically selects a proposition. Both Berman and Lahiri therefore predict that only proposition-taking predicates (i.e., the *know*-class: *know*, *agree on*, *be certain*, etc.) give rise to QV readings. Predicates that are exclusively question-taking (i.e., the *wonder*-class: *wonder*, *inquire*, *ask*, etc.) do not give rise to QV readings. This prediction seems to be borne out by the unacceptability of the following example:

- (5) ##For the most part, John wonders who cheated.

By contrast, the current proposal predicts that only question-taking predicates give rise to QV readings. More specifically, we argue that members of the *know*-class trigger QV effects because they have a question-taking meaning alongside their proposition-taking meaning. The meaning that participates in a QV structure is the question-taking meaning. As for verbs that have only a question-taking meaning, we argue that they too, trigger QV effects.

In the next section we show that question-taking predicates indeed trigger QV effects. In sections 3-5 we provide additional support for our claim. The unacceptability of (5) is addressed in Section 6.

## 2. QV effects with verbs that are exclusively question-taking

There are two question-taking verbs that easily give rise to QV readings: *depend on* and “generic” *decide*. Starting with *depend on*,

consider (6), which can be roughly paraphrased as: “for most candidates x, whether x will be admitted depends (exclusively) on this committee”:

- (6) Which candidates will be admitted depends, for the most part, (exclusively) on this committee.

We argue that the QV interpretation of (6) is the following:

- (7) MOST-Q[Q is a relevant subquestion of ‘which candidates will be admitted’][Q depends on this committee]

where the set of relevant subquestions is: {will Sue be admitted? will Sally be admitted?, will Fred be admitted?,...}. Since *depend on* doesn’t take proposition complements, it is hard to see how either Berman or Lahiri would account for the QV reading of (6).

Notice that (6) has another, non-QV, paraphrase (cf. Lahiri (in press)):

- (8) This committee has an important role in determining which candidates will be admitted.

But this paraphrase is irrelevant to the current discussion, because here the adverb quantifies over degrees of dependency, and not over parts of the complement. Notice also, that the reading in (8) is available only when *exclusively* in (6) is not present. When *exclusively* is present, the QV paraphrase is the only one available.

Turning to “generic” *decide*, consider the following example, which has the following rough paraphrase: “for most candidates x, the admissions committee decides whether x will be admitted”:

- (9) For the most part, the admissions committee decides which candidates will be admitted.

We argue that this QV reading comes from the following representation:

- (10) MOST-Q[Q is a relevant subquestion of ‘which candidates will be admitted’][the admissions committee decides Q]

“Generic” *decide*, which appears in the generic tense and is question-taking, should not be confused with “episodic” *decide*, which appears in the episodic tense and is proposition-taking. The difference between the two is illustrated by the following contrast:

- (11) a. This committee decided that Frank will be admitted.

- b. #This committee decides that Frank will be admitted.

The oddity of (11b) comes from the fact that when *decide* takes a proposition complement, it usually appears in the episodic tense. Note that there is no paraphrase of (9) where the complement is a proposition. Thus, neither (12a) nor (12b) are good paraphrases of (9):

- (12) a. For most candidates who will be admitted, this committee decides that they will be admitted.  
b. For most candidates, this committee decides that they will be admitted.

It is again hard to see how Berman or Lahiri, according to whom the complement of the main verb in the nuclear scope is a proposition, could explain why “generic” *decide* gives rise to QV effects.

Having established that there are question-taking verbs which (a) give rise to QV effects, and (b) do not have a proposition-taking meaning, we now provide further evidence in support of the claim that QV effects arise as a result of the adverb quantifying over questions.

### 3. Multiple embeddings in the nuclear scope

For many speakers, the answer in (13) has a QV reading, roughly paraphrased as: “for most relevant people, John is certain Mary knows whether they cheated”:

- (13) A: Is anybody here certain that Mary knows who cheated?  
B: Well... John, for the most part, is.

This reading, we argue, corresponds to the following interpretation:

- (14) MOST-Q[Q is a subquestion of ‘who cheated’ and John believes that Q has a true answer and that it’s possible Mary knows Q][John is certain Mary knows Q]

The restriction in (14) contains the clause “John believes Q has a true answer”. This is the result of accommodating the presupposition of the nuclear scope into the restriction. We follow Karttunen (1973) and Heim (1992), and assume that the following principle applies to presuppositions of complement clauses:

- (15) Where V is a propositional attitude verb, “x V p” presupposes that x believes the presuppositions of p.

Since “Mary knows Q” presupposes that Q has a true answer, “John is certain Mary knows Q” presupposes (among its other presuppositions, cf. Lahiri (1991, in press)) that John believes that Q has a true answer.

Here is what Berman and Lahiri’s theories predict to be the respective readings of (13). Since they assume that *know* is proposition-taking, for Berman one of the presuppositions accommodated into the restriction is “John believes that x cheated” (presupposed by “John is certain Mary knows x cheated”), and for Lahiri, “John believes p” (presupposed by “John is certain Mary knows p”) is accommodated:

- (16) a. Berman: MOST-x[John believes that x cheated and that it’s possible Mary knows x cheated][John is certain Mary knows x cheated]  
b. Lahiri: MOST-p[p ∈ {Jim cheated, Sue cheated,...} & John believes p and that it’s possible Mary knows p][John is certain Mary knows p]

Those speakers who accept the QV-answer in (13) may judge it true even in scenarios where John himself has no beliefs regarding who cheated. This is predicted by the current analysis, and is obviously a problem for Berman and Lahiri. Thus, the assumption that the embedding verb in a QV structure is proposition-embedding, combined with Presupposition Accommodation, leads to truth conditions that are too strong. When we shift to quantification over subquestions the problem does not arise. As for speakers who reject (13), it is possible that those speakers obey some locality constraint which restricts the raising of the embedded question.

So far we have focussed on showing that quantification over semantic questions is an essential ingredient of the theory of QV. We will now assume this, and shift the discussion to the notion of “relevant subquestion” in an attempt to make it more precise.

#### 4. V-if readings vs. V-that readings

Consider the two different paraphrases below for the sentence in (17):

- (17) For the most part, John knows who cheated.  
a. For most people who cheated, John knows that they cheated.  
b. For most people, John knows whether they cheated.

The Berman/Lahiri theory predicts only (17a) to be available. As it turns out, however, for many speakers QV sentences such as (17) are ambiguous between (17a), a V-that reading, and (17b), a V-if reading (and even

Berman and Lahiri report that not all their consultants confirmed their predictions). Both readings should be accounted for by (18):

(18) MOST-Q[Q is a subquestion of 'who cheated'] [John knows Q]

Suppose our individuals are Sue, Sally, Frank, Bill, Fred, and Lynn, and our actual cheating individuals are Sue, Sally, and Frank. In order to account for the two readings, we want to be able to quantify over two different sets of relevant subquestions, as follows:

(19) Relevant subquestions for the *know-that* reading:

{did Sue cheat?, did Sally cheat?, did Frank cheat?}

Relevant subquestions for the *know-if* reading:

{did Sue cheat?, did Sally cheat?, did Frank cheat?, did Bill cheat?, did Fred cheat?, did Lynn cheat?}

In order to derive these sets, we replace the vague notion "relevant subquestion" with a more formal notion of "division of a question into subquestions". Thus, we propose (20) as the semantic representation of (17), where  $\text{Part}(\text{'who cheated'})(w)$  is a division of 'who cheated' in  $w$ :

(20) MOST-Q[ $Q \in \text{Part}(\text{'who cheated'})(w)$ ] [John knows<sub>w</sub> Q]

The idea is that a division of a question  $Q$  into subquestions in  $w$  is a set of subquestions of  $Q$  whose answers in  $w$  together provide the complete answer to  $Q$  in  $w$ . In order to provide a precise definition of the term, we introduce two notions of Answerhood. Heim (1994), building on the widely discussed notions of strong and weak exhaustivity (e.g., Groenendijk & Stokhof (1984)), defines the following two notions of Answerhood:

(21) a.  $\text{Ans-wk}(Q)(w) = \cap \{p: Q(w)(p) \ \& \ w \in p\}$   
(weakly exhaustive)

b.  $\text{Ans-strg}(Q)(w) = \{w': \text{Ans-wk}(Q)(w') = \text{Ans-wk}(Q)(w)\}$   
(strongly exhaustive)

$\text{Ans-wk}$ , the weakly exhaustive answer, is the intersection of the true propositions in the Hamblin-extension. According to the scenario discussed above,  $\text{Ans-wk}(\text{'who cheated'})(w)$  – where 'w' is the actual world – is the proposition  $\{w': \text{Sue, Sally, and Frank cheated in } w'\}$ .  $\text{Ans-strg}$ , the strongly exhaustive answer, is the set of worlds where the weakly exhaustive answer is the weakly exhaustive answer in the world of evaluation. According to the scenario discussed above,  $\text{Ans-strg}(\text{'who cheated'})(w)$  is the proposition

{w': Sue, Sally, and Frank cheated in w'; Bill, Fred, and Lynn didn't cheat in w'}.

Equipped with these two notions of Answerhood, we can now define "division of a question" (this definition will be revised in section 5):

(22) A set of question-intensions S is a division of a question-intension Q into subquestions in a world w, iff (i)-(ii) hold:

(i) Each member of S is a subquestion of Q (as defined in Section 1);

(ii) Either a.  $\text{Ans-wk}(Q)(w) = \bigcap \{ \text{Ans-wk}(Q')(w) : Q' \in S \}$ ,  
or b.  $\text{Ans-strg}(Q)(w) = \bigcap \{ \text{Ans-wk}(Q')(w) : Q' \in S \}$ .

We assume that the context provides a particular set of questions as the division of the original question into subquestions. In our semantic representations,  $\text{Part}(Q)(w)$  stands for this set. Given that clause (ii) in (22) gives us two options,  $\text{Part}(\text{'who cheated'})(w)$  in (20) may have one of two values – one corresponding to the *know-that* reading of (17), and one corresponding to its *know-if* reading:

(23)  $\text{Part}_{\text{know-that}}(\text{'who cheated'})(w) = \{ \text{did Sue cheat, did Sally cheat, did Frank cheat} \}$   
 $\text{Part}_{\text{know-if}}(\text{'who cheated'})(w) = \{ \text{did Sue cheat, did Sally cheat, did Frank cheat, did Bill cheat, did Fred cheat, did Lynn cheat} \}$

Each member of  $\text{Part}_{\text{know-that}}(\text{'who cheated'})(w)$  is a subquestion of 'who cheated'. Moreover,  $\text{Ans-wk}(\text{'who cheated'})(w)$  equals the intersection of the weakly exhaustive answers to the members of  $\text{Part}_{\text{know-that}}(\text{'who cheated'})(w)$ . That is to say,  $\bigcap \{ \text{that Sue cheated, that Sally cheated, that Frank cheated} \} = \{ w' : \text{Sue, Sally, and Frank cheated in } w' \}$ .

Each member of  $\text{Part}_{\text{know-if}}(\text{'who cheated'})(w)$  is a subquestion of 'who cheated'.  $\text{Ans-strg}(\text{'who cheated'})(w)$  is the intersection of the weakly exhaustive answers to the members of  $\text{Part}_{\text{know-if}}(\text{'who cheated'})(w)$ . That is to say,  $\bigcap \{ \text{that Sue cheated, that Sally cheated, that Frank cheated, that Bill didn't cheat, that Fred didn't cheat, that Sam didn't cheat} \} = \{ w' : \text{Sue, Sally, and Frank cheated in } w'; \text{ Bill, Fred, and Lynn didn't cheat in } w' \}$ .

At this point, one might wonder whether the *know-that* reading can be obtained via quantification over propositions. In other words, we should ask whether the theory of QV should allow the adverb to quantify either over propositions or over questions, and that quantification over the former yields V-that readings, whereas quantification over the latter, using the *Ans-strg* version of *Part*, yields V-if readings. Our answer is that such an account might work for verbs such as *know*, which have a question-taking meaning and a proposition-taking meaning, but not for verbs such as

“generic” *decide*, which lack a proposition-taking meaning. Consider (24) (Irene Heim, p.c.):

(24) On Tuesday we mostly decide who will be admitted, and on Thursday we mostly decide who won't be admitted.

The QV reading of (24) makes sense only if *mostly* quantifies over distinct sets in the two conjuncts. This is guaranteed if the *Ans-wk* version of *Part* is used. For example,  $\text{Part}(\text{'who will be admitted'})_w$  here is obtained by applying (22(ia)) (i.e., where we collect all subquestions whose weakly exhaustive answers yield the weakly exhaustive answer to 'who will be admitted'). If we choose the other option (namely, if we collect all subquestions whose weakly exhaustive answers jointly yield the strongly exhaustive answer to 'who will be admitted'), we will quantify over identical sets in the two conjuncts of (24).

As a second step towards refining the notion “relevant subquestion” we now consider cases where the subquestions quantified over do not correspond to members of the Hamblin-extension of the original question.

## 5. Flexible subquestions

### 5.1. Unexpected QV readings

Williams (2000) observes that the following sentence has two QV readings – one of them expected, the other less expected:

(25) John mostly knows which books these professors recommended.

A possible scenario where (25) can be uttered felicitously is one where, for example, Prof. Smith recommended book A, Prof. Jones – book B, and Prof. Green – books C,D,E. Suppose this is true in the actual world.

The weakly exhaustive answer to 'which books these professors recommended' is the cumulative 'that Profs. Smith, Jones, and Green recommended books A+B+C+D+E'. It doesn't say who recommended what, but rather that these professors, between them, recommended these books. The expected reading of (25) is thus the following:

(26) For most  $y$ ,  $y$  a book recommended by one of {Prof. Smith, Prof. Jones, Prof. Green}, John knows that  $y$  is a book recommended by one of {Prof. Smith, Prof. Jones, Prof. Green}.

The reader can verify that this reading is easily obtained in a Lahiri-style analysis. The less expected reading of (25) is the following:

- (27) For most  $x$ ,  $x$  is one of {Prof. Smith, Prof. Jones, Prof. Green}, John knows which books  $x$  recommended.

Deriving this reading Lahiri-style is not a trivial matter (the reader is referred to Lahiri (in press) and to Williams (2000) for discussion). In the current framework, both the expected and unexpected readings should be derivable from the following representation:

- (28) MOST-Q[ $Q \in \text{Part}(\text{'which books did these professors recommend'})_w$ ][John knows<sub>w</sub> Q]

To get the reading in (26), we need  $\text{Part}(\text{'which books did these professors recommend'})_w$  to be {did one of these professors recommend Book A?, did one of these professors recommend Book B?,...}. To get the reading in (27), we need  $\text{Part}(\text{'which books did these professors recommend'})_w$  to be {which book(s) did Prof. Smith recommend?, which book(s) did Prof. Jones recommend?, which book(s) did Prof. Green recommend?}. It is clear that the definition of "subquestion" that we have been using will not give us these two sets, so let us adopt the following definition, which gives us more flexibility in carving out the parts of the raised question:

- (29) A question-intension  $Q'$  is a subquestion of a question-intension  $Q$  iff:  
 $\exists w \exists p [\text{Ans-strg}(Q')(w) \subseteq p \ \& \ p \text{ is a partial answer to } Q]$

The notion of "partial answer" that we assume is taken from Groenendijk & Stokhof (1984). A proposition  $p$  is a partial answer to a question  $Q$  if  $p$  eliminates some uncertainty regarding the strongly exhaustive answer to  $Q$ . Or, in other words, if in some world  $w^*$  the strongly exhaustive answer to  $Q$  is incompatible with  $p$ :

- (30) A proposition  $p$  is a partial answer to a question  $Q$  iff:  
 $\exists w^* [\text{Ans-strg}(Q)(w^*) \cap p = \emptyset]$

With this definition of subquestion, all members of {did one of these professors recommend Book A?, did one of these professors recommend Book B?,...}, and all members of {which book(s) did Prof. Smith recommend?, which book(s) did Prof. Jones recommend?, which book(s) did Prof. Green recommend?} are subquestions of 'which books did these professors recommend'. Let us show that 'which book(s) did Prof. Smith recommend' is indeed a subquestion of 'which books did these professors recommend?'. This is so, because there is a proposition  $p$ , e.g., 'that Prof. Smith recommended Book A', such that (a) in some world  $w'$ ,  $p$  is entailed by the strongly exhaustive answer to 'which book(s) did Prof. Smith

recommend' (the actual world is such a world); and (b) p is a partial answer to 'which books did these professors recommend?'. Why? Because in some world  $w^*$  the strongly exhaustive answer to 'which books did these professors recommend' is incompatible with 'that Prof. Smith recommended Book A' (in fact, any world where nobody recommended Book A is such a world). The reader can verify that 'did one of these professors recommend Book A?' is a subquestion of 'which books did these professors recommend?'.<sup>1</sup>

Notice that no member of {which books did Prof. Smith recommend?, which books did Prof. Jones recommend?,...} corresponds to a member of the Hamblin-extension of 'which books did these professors recommend'. So the intersection of the answers to members of this set does not necessarily yield the answer to 'which books did these professors recommend?'. Rather, it implies it. Therefore, the change in the definition of "subquestion" requires some adjustments in the definition of "division of a question into subquestions":

- (31) A set of question-intensions  $S$  is a division of a question-intension  $Q$  into subquestions in a world  $w$  iff (i)-(ii) hold:
- (i) Each member of  $S$  is a subquestion of  $Q$ ;
  - (ii) Either a.  $\bigcap\{\text{Ans-wk}(Q')(w):Q'\in S\} \subseteq \text{Ans-wk}(Q)(w)$ , and there is no set  $S'$ ,  $S'\subset S$ , such that  $\bigcap\{\text{Ans-wk}(Q')(w):Q'\in S'\} \subseteq \text{Ans-wk}(Q)(w)$ ,  
 or b.  $\bigcap\{\text{Ans-wk}(Q')(w):Q'\in S\} \subseteq \text{Ans-strg}(Q)(w)$ , and there is no set  $S'$ ,  $S'\subset S$ , such that  $\bigcap\{\text{Ans-wk}(Q')(w):Q'\in S'\} \subseteq \text{Ans-strg}(Q)(w)$ .

For the reading in (27), Part('which books did these professors recommend')(w) is the set {which book(s) did Prof. Smith recommend?, which book(s) did Prof. Jones recommend?,...}. Why? Because (a) each member of this set is a subquestion of 'which books did these professors recommend?'; (b) the intersection of the weakly exhaustive answers to these questions entails 'that professors Smith, Jones and Green recommended Books A+B+C+D+E' – the weakly exhaustive answer to 'which books did these professors recommend?'; and (c) no proper subset of this set has the property described in (b).<sup>1,2</sup>

1. The non-overlap conditions in (31ii) ensure, among other things, that we don't get questions with overlapping answers in the same set.

2. (25) also has the following QV reading (we thank Barry Schein for pointing out this possibility):

(i) For all  $y$ ,  $y$  one of these professors, John knows most of the answer to 'which books did  $y$  recommend'.

In sum, the new definition of “subquestion” affords greater flexibility in constraining the domain over which the adverb quantifies, and thus correctly predicts that this domain need not be composed of questions that correspond to the Hamblin-extension of the question that is raised out of the nuclear scope. More than one choice of *Part* is possible, and the value itself is determined by the context.

### 5.2. Presupposition Accommodation

According to what we have said so far, we expect the restriction of (32), with non-factive *certain*, to consist of (a) the presuppositions of the nuclear scope (via Presupposition Accommodation), and (b) the requirement that the question quantified over by the adverb be a member of the relevant *Part*(‘who cheated’). The resulting interpretation is given in (33):

(32) For the most part, Mary is certain who cheated.

(33) MOST-Q[ $Q \in \text{Part}(\text{'who cheated'})_w$ ] & Mary believes<sub>w</sub> Q has a true answer][Mary is certain<sub>w</sub> Q]

This is inappropriate: Mary has to be certain about what she perceives to be the relevant subquestions, not about the actual relevant subquestions. In other words, Q need not be a member of *Part*(‘who cheated’)<sub>w</sub>, but it must be a member of *Part*(‘who cheated’) in Mary’s belief worlds in *w*. The desired interpretation is thus the following:<sup>3</sup>

(34) MOST-Q[ $\forall w' [\text{Bel}(\text{Mary})(w)(w') \rightarrow Q \in \text{Part}(\text{'who cheated'})_{w'}]]$   
[Mary is certain<sub>w</sub> Q]

We therefore revise the schema of the logical form of QV from (35) to (36):

(35) Adv-Q[ $Q \in \text{Part}(Q^*)_w$ ][ $P(w)(Q)$ ]

(36) Adv-Q[ $\forall w' [C(w)(w') \rightarrow Q \in \text{Part}(Q^*)_{w'}]]$ ][ $P(w)(Q)$ ]

*C* is an accessibility relation. Our logical form amounts to the suggestion that there is a hidden modal element in the semantics of QV. The two

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This reading could perhaps arise from an LF with two adverbs, one overt (*for the most part*) and one covert (the universal quantifier):

(ii)  $\forall Q \in \text{Part}(\text{'which books...'})_w$  [MOST-Q'[ $Q' \in \text{Part}^*(Q)_w$ ][John knows Q']]

3. For purposes of illustration, in this subsection we assume that *certain* presupposes that the subject believes the complement has a true answer. In fact, the presuppositions of *certain* (and other non-factive question-embedding predicates) are much more complex.

values for C that we have seen so far are given in (37). The value in (37a) corresponds to (20), and the value in (37b) corresponds to (34):

- (37)a.  $C = \lambda w_1 \lambda w_2 [w_2 = w_1]$   
b.  $C = \lambda w_1 \lambda w_2 [w_2 \in \text{Bel}(\text{Mary})(w_1)]$

The question is how the value of C is determined. Clearly, the semantic properties of the question-embedding predicate play a crucial role. The problem is discussed extensively in Lahiri (1991, in press). We limit ourselves here to considering how the relevant determining properties could be integrated into our theory of QV, and specifically, how the two values for C in (37a,b) can be obtained. (37a) must be tied to the fact that *know* presupposes truth, and (37b) – to the fact that *certain* presupposes belief. Choosing the value in (37a) for (20) amounts to quantifying over subquestions that have true answers (i.e., subquestions compatible with the presuppositions of *know*) and choosing the value in (37b) for (34) amounts to quantifying over subquestions that have true answers according to Mary (i.e., subquestions compatible with the presuppositions of *certain*). In short, the C that is chosen is one that yields a restriction that entails the presuppositions of the nuclear scope. This process is in line with the effects of local accommodation in the sense of Berman (1991), except that here the presuppositions help determine the value of a free variable. Further research would have to investigate what other constraints are imposed on the value of C, the generality of the entire process, and the source of the hidden modal element.

#### 6. Other members of the *wonder*-class

Some members of the *wonder*-class do not usually trigger QV effects, as was illustrated by (5), repeated below:

(38)##For the most part, John wonders who cheated.

While we do not understand the relative unacceptability of (38), we would like to point out that sometimes *wonder* and *ask* do give rise to genuine QV readings. Consider the following example:

- (39)A: Did the police give you-guys a hard time?  
B: No. For the most part, they didn't even ASK who was over 21.

B's answer has the following paraphrase: "for most people x, the police didn't even ask whether x was over 21." Similarly, in the following

example, B's answer can be paraphrased as "for most students x, he is still wondering whether x cheated":

(40) A: Has John decided which of his students can take a make-up test?

B: He has made up his mind only about Susie and Bill. For the most part, he is still wondering which students cheated.

It seems that the focussing element *even* facilitates the QV reading in (39), and similarly, *still* facilitates it in (40). We suspect that this has to do with the topic/focus structure of the relevant sentences, but as of now have no formal analysis of the phenomenon. For current purposes, it suffices to note that all question-taking predicates have the potential to trigger QV effects.

## 7. Conclusion

QV is the result of the adverb quantifying over semantic questions. All question-taking verbs may trigger QV effects. The questions quantified over need not correspond to members of the original Hamblin-extension.

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