SOME REMARKS ON QUANTIFICATIONAL VARIABILITY AND QUESTION-EMBEDDING PREDICATES

YAEL SHARVIT

University of Connecticut*


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In his book, Questions and Answers in Embedded Contexts, Utpal Lahiri investigates the syntax and semantics of matrix and embedded interrogatives, paying special attention to a phenomenon called Quantificational Variability (henceforth, QV). The existence of QV leads Lahiri to the conclusion that interrogatives are plural predicates, much like plural NPs (i.e. NPs that appear with a morphological plurality marker, such as boys). Rather than comment on Lahiri’s book in general terms, in this short review I comment on the following two specific claims made in the book: the claim that QV of the kind that involves interrogative clauses comes in two forms (this is discussed in section 1); and the claim that the interrogative-embedding verb surprise is non-distributive with respect to its interrogative argument (this is discussed in sections 1 and 2). While I find Lahiri’s claims convincing and his arguments compelling, I discuss (based on research reported in Sharvit and Beck (2001), Beck and Sharvit (2002), and Sharvit (2002)) some possible modifications of the theory that are meant to account for some interesting facts that Lahiri (I think) cannot account for, but are also meant to preserve the basic insights and spirit of Lahiri’s theory.

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1. QV

1.1. The Phenomenon

Stephen Berman (in Berman (1991)) was the first to observe the correlation between the effects of adverbial quantification in sentences with indefinite singular noun phrases (discussed, among others, by Lewis (1975) and Heim (1982); illustrated in (1)), and sentences with embedded interrogatives (illustrated in (2)):

(1) a. A lion usually roars.
   b. An old house is sometimes hard to maintain.

(2) a. For the most part, John knows who cheated.
   b. John remembers, in part, what he got for his birthday.

In Heim's analysis, indefinites do not have quantificational force of their own. Rather, they are restricted variables that get bound by whatever quantifier is there to bind them. The indefinites in (1) are variables that get bound by the adverbials (usually in (1a), sometimes in (1b)). Inspired by Heim's analysis, Berman proposes that an interrogative such as Who cheated is also a restricted indefinite of some sort, that is to say, it is interpreted as the "open" proposition 'that x cheated,' which contains a variable that may be bound by whatever quantifier is there to bind it. In (2), these quantifiers are for the most part ((2a)) and in part ((2b)). He also assumes, that verbs such as know and remember take propositions as complements. Following Heim's analysis of sentences such as those in (1), Berman attributes to both (1) and (2) a tripartite LF structure. As a result (1a, b) and (2a, b) are analyzed as in (1'a, b) and (2'a, b) respectively:

(1') a. Most-x [x is a lion][x roars]
   Interpretation: MOST({x:x is a lion}, {x:x roars})
   b. Some-x [x is an old house][x is hard to maintain]
   Interpretation: SOME({x:x is an old house}, {x:x is hard to maintain})

(2') a. Most-x [x cheated][John knows that x cheated]
   Interpretation: MOST({x:x cheated}, {x:John knows that x cheated})
   b. In part-x [John got x for his birthday][John remembers that he got x for his birthday]
   Interpretation: SOME({x:John got x for this birthday}, {x:John remembers that he got x for his birthday})
In (1'), the adverb's domain is restricted by the predicate part of the indefinite; in (2')—it seems to be restricted by the presuppositions of *know/remember*, which get "accommodated" into the adverb's restrictive clause (for example, one cannot know that x cheated unless x really cheated). In (1'), the adverb's nuclear scope is supplied by the VP; in (2') it seems to be supplied by the main clause, where the embedded interrogative has the form of an "open" proposition ('that x cheated' in (2'a), 'that he got x for his birthday' in (2'b)). Berman refers to both these effects as Quantificational Variability Effects (or QVE). The meanings assumed for MOST and SOME are the standard meanings, as follows:

(3) MOST(A, B) <=> there are more x's in A \( \cap \) B than there are x's in A \( \cap \) B\(^{-}\) (where B\(^{-}\) is the complement of B relative to the relevant domain)

(4) SOME(A, B) <=> there is at least one x in A \( \cap \) B

Berman further assumes that when an interrogative such as *Who cheated* appears in the complement position of a verb such as *wonder* (which does not take declarative complements), it is preceded by a silent Question-morpheme, which binds the free variable and turns its complement into a semantic question ('which x is such that x cheated'). Otherwise, these sentences would be uninterpretable, since *wonder*-type verbs take semantic questions, and crucially not propositions, as their complements.

Lahiri argues, contra Berman, that the QVE in (1) and those in (2) are different phenomena. So different, that we cannot take (2'a) and (2'b) to be the actual semantic representations of (2a) and (2b). Rather, we should treat them as inferences drawn from the "correct" representations (to be discussed below). Lahiri points out several problems in connection with Berman's proposal (that is to say, the view that (1) and (2) exhibit the same phenomenon, and therefore deserve the same analysis). Here I mention only some of these problems. First, although there is some similarity between the QV in sentences with singular indefinites (those in (1)) and the QV in sentences with embedded interrogatives (those in (2)), there are also important differences between them. These differences have to do with the kind of adverbs involved.

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1 The meanings assumed for other adverbs (such as ALL) are, likewise, standard.
The adverbs in (1) are adverbs of frequency (i.e. *seldom*, *usually*, *always*, *often*, *generally*, *frequently*, *rarely*, *sometimes*, etc.), and the adverbs in (2) are adverbs of quantity (i.e. *for the most part*, *partly*, *in part*, *largely*, *to a great extent*, *to some extent*, *with few exceptions*, etc.). As Lahiri shows (and as also discussed in part by Berman), frequency adverbs do not strongly support QV in sentences with embedded questions. To see this, consider the following cases:

(5)  
  a. *John usually knows what Bill did yesterday at 3am.*
  b. John usually knows what Bill does on Sundays.
  c. John usually knows who does well on the exam.

The adverb *usually* seems to combine well with habitual sentences, but not so well with episodic sentences (this explains why the episodic (5a) is not good). As for (5b) and (5c), they are both good, but they do not have the interpretations we would expect them to have under Berman’s analysis:

(6)  
  a. MOST({x:Bill does x on Sundays}, {x:John knows that Bill does x on Sundays})
  b. MOST({x:x does well on the exam}, {x:John knows that x does well on the exam})

Rather, they seem to have the following interpretations, where x is not a variable over “normal” individuals, but rather a variable over times or occasions:

(7)  
  a. MOST({x:x is a Sunday}, {x:John knows what Bill does in x})
  b. MOST({x:there is an exam in x}, {x:John knows who does well in the exam in x})

The following examples, with *rarely*, illustrate the same point:

(8)  
  a. *John rarely knows what Bill did yesterday at 3pm.*
  b. John rarely knows what Bill does on Sundays.
  c. John rarely knows who does well on the exam.

But adverbs of quantity do go well with episodic sentences, and the sentences do have the expected interpretations, where x is a variable over “normal” individuals:

(9)  
  a. For the most part, John knows who passed the exam.
     MOST({x:x passed the exam}, {x:John knows that x passed the exam})
     SOME({x:Bill bought x}, {x:John knows that Bill
It is true that some adverbs (e.g. *mostly*) have both meanings, in which case the sentences may be ambiguous between a frequency reading and a quantity reading. But still, since not all adverbs are ambiguous, it is important to acknowledge that often the sentences are unambiguous, and exhibit one kind of QV but not the other.

In addition, adverbs of quantity do not combine well with sentences with singular indefinites, but adverbs of frequency do.

(10) a. *A man, for the most part, has many enemies. (p. 50)
    b. Men, for the most part, have many enemies.
    c. A man usually has many enemies. (p. 50)

Thus, it seems that the QV of the kind triggered by adverbs of quantity (in sentences with embedded questions) requires a different analysis. More specifically, it seems that adverbs of quantity, unlike adverbs of frequency, operate on plural predicates. If interrogative clauses are taken to denote such predicates (much like NPs that are morphologically marked as plural), these correspondences can be captured. In section 1.2.2 we will see that according to Lahiri interrogatives denote pluralities of possible answers.

Another problem Lahiri points out for Berman’s proposal is that it works only when the embedding predicate is distributive with respect to its interrogative argument (e.g. *know, remember, find out*), that is to say, when it supports inferences of the following kind:

    b. Bill and Fred are those who cheated.
    ==> c. John knows that Bill cheated and he knows that Fred cheated.

For John to qualify as knowing who cheated he has to know, for each single individual who cheated, that s/he indeed cheated. This is predicted under Berman’s analysis of (11a). In the absence of an overt adverb of quantification, an implicit universal acts as the binder of the individual variable ‘x’:

(12) ALL({x:x cheated}, {x:John knows that x cheated})

But not all interrogative-embedding predicates are distributive in the sense just described. The following examples illustrate this point:

(13) a. It surprised Bill who cheated.
    b. It surprises Bill who loves whom.

(13a) can be true in a situation where Fred and Mary are those who cheated, and Bill is surprised by the fact that Fred and Mary cheated,
but he is not surprised by the fact that Fred cheated, nor is he surprised by the fact that Mary cheated. That is to say, he expected Fred and Mary not to cheat, which doesn't necessarily mean that he expected Fred not to cheat, nor does it mean that he expected Mary not to cheat. It is the combination of Fred and Mary cheating that surprised Bill. But this is not what we predict when we apply a Berman-style analysis:

(14) \text{ALL}\{(x:x \text{ cheated}), (x:it \text{ surprised Bill that } x \text{ cheated})\}

We wrongly predict a distributive reading.

The same point can be made for (13b). Suppose Fred loves Mary and John loves Jane (and these are the only lover-lovee pairs). Bill is surprised by that, but he is not surprised individually by Fred loving Mary or by John loving Jane. (13b) is true in this situation, but this is not what a straightforward Berman-style analysis predicts, as shown below:

(15) \text{ALL}\{(x,y): x \text{ loves } y\}, (x,y):it \text{ surprises Bill that } x \text{ loves } y\}

For Lahiri, then, the semantic representation Berman attributes to sentences with embedded questions is often a good inference drawn from the "correct" representation (i.e. whenever the embedding predicate is distributive), but since it isn't always a good inference, it cannot be taken as the actual analysis. Lahiri considers several possible solutions to this problem, within Berman's approach, but concludes that they are all problematic. The problems are avoided, he says, if the interrogative denotes a set of propositions, rather than a set of individuals. We will look at Lahiri's proposal in more detail below.

1.2. Three Possible Analyses

Assuming that Lahiri is right, and that Berman's analysis of QVE with embedded interrogatives cannot be maintained, it is important to note that whatever alternative analysis one proposes, it must answer the following two questions with respect to QVE in sentences such as (2): (a) Must the embedding verb belong to the know-class (which includes verbs such as know, remember, tell, amaze; these verbs can take interrogatives or declaratives as complements) for QVE to arise?; and (b) Must the complement of the embedding verb be an interrogative clause, or can it also be a declarative clause?

The following sentences illustrate why the answers to (a) and (b) are not obvious: the embedding verb wonder (which belongs to the class that includes ask, inquire, and investigate; these verbs can take only
interrogatives as complements) seems to support QVE in (16), and the embedding verb *amaze* (followed by a declarative clause) seems to support QVE in (17):

(16) To some extent, we wondered who cheated.
(17) To some extent, it amazes me that Bill loves Mary.

In view of (16) and (17), there are various possible answers that one might give to questions (a) and (b) posed above. One might take the position that the phenomenon we see in (2) is the same one we see in (16) and (17), and therefore, the answer to the questions in (a) and (b) above is that any clause-taking verb exhibits QVE, with any type of clause (as long as the verb may embed that type of clause to begin with, and as long as the adverb is not a frequency adverb). This seems to be the position taken in Ginzburg (1995). One can also take the position (advocated by Lahiri, who follows Berman in this respect) that the QVE we see in (2) are very different from the QVE we see in (16) and in (17), and therefore the questions in (a) and (b) are answered as follows: one type of QVE (QVE1—where quantification is over parts of a question) arise only with *know*-type verbs, and only when they embed an interrogative clause; another type of QVE (QVE2—where quantification is over degrees) arise with other verbs/other types of clauses.

A third possible approach to these facts is the one advocated in Sharvit and Beck (2001) and Beck and Sharvit (2002), who agree with Lahiri that there are two distinct kinds of “clausal” QVE, but argue that QVE1 may arise with verbs of the *know*-class as well as verbs of the *wonder*-class. Like Lahiri, Beck and Sharvit claim that QVE1 are restricted to embedded interrogatives and cannot arise with embedded declaratives (which can only support QVE2).

To understand the theoretical significance of each of these approaches, we will now go through them briefly, pointing out some of their motivations and predictions.

1.2.1. Ginzburg’s Analysis

According to Ginzburg, all instances of QVE with embedded clauses (those that Lahiri calls QVE1 as well as those that he calls QVE2) arise as a result of the adverb binding a degree variable in the main verb. Ginzburg’s approach can be seen as follows. Because of cases such as (16) and (17), we need to say that adverbs may bind a degree variable in the main verb anyway. The verbs *wonder* and *amaze* are
clearly gradable verbs, as the following examples indicate, where these verbs are modified by the degree-modifiers *a lot* and *a little*:

(18) a. We wondered a lot who cheated.
    b. It amazed me a little that Fred wants to marry Sue.

(16) and (17), then, receive the following interpretations, where the adverb binds the degree argument of the main verb:

(19) For some relevant degree d, we d-wondered (i.e. wondered to degree d) who cheated.

(20) For some relevant degree d, it d-amazes me (i.e. amazes me to degree d) that Bill loves Mary.

If, says Ginzburg, we can show that (2a, b) are just a special instance of the same phenomenon, then we don’t have to posit complicated mechanisms that would yield, what superficially seems to be a different QVE reading. So for him, in (2a) too, the adverb binds a degree variable in the main verb. The resulting interpretation is roughly the following:

(21) For some “above the middle” degree d of relevant knowledge, John d-knows (i.e. knows to degree d) the fact that Bill, Jane, and Fred cheated (assuming that Bill, Jane and Fred cheated is the full answer to *Who cheated*).

According to Ginzburg, when the embedding verb is factive (e.g. *know*), the embedded interrogative somehow receives a “fact”-interpretation. Thus, to fully know who cheated is to know the fact that Bill, Jane and Fred cheated, if they indeed cheated. To mostly know this fact, is to know most of the relevant aspects of this fact. In some contexts, this would amount to knowing about most cheaters that they in fact cheated. Thus, according to Ginzburg, the reading that Lahiri calls QVE1 (associated with (2a)) is just one of the many possible inferences one can draw from the reading informally represented in (21).

How does Ginzburg’s proposal fare with respect to problems Lahiri notes for Berman? The proposal certainly distinguishes between (1) and (2) (the adverb quantifies over times or occasions in the former; over degrees in the latter). As for the distributivity problem, the following is the predicted analysis of *It surprised John who cheated*, along the lines of Ginzburg (in a situation where Bill, Fred, and Jane cheated):

(22) For the highest degree of relevant surprise d, the fact that Bill, Fred, and Jane cheated d-surprised John.

We might wonder how the “height” of the degree is determined in
the absence of an overt adverb of quantification. But assuming that this problem can be solved, it seems that Ginzburg's analysis doesn't face the problem that Berman's analysis faces: being d-surprised by the combination of the cheaters doesn't entail being surprised by the individual cheatings.

1.2.2. Lahiri's Analysis

According to Lahiri, QVE1 is in principle distinct from QVE2. QVE2 indeed arises when the adverb binds a degree variable in the main verb. Therefore, Lahiri would not object to the interpretations given in (19) and (20) for (16) and (17) respectively. QVE1, however, is something completely different. Here, Lahiri claims, the adverb quantifies over parts of what the embedded interrogative denotes. For him, these "parts" are possible answers. Thus, as a first approximation, he proposes the following analysis for (2a) (where 'atomic,' in this context, is an answer of the form 'that Mary cheated,' and non-atomic—'that Mary and Fred cheated'):

\[(23) \text{MOST}([p: p \text{ is a relevant atomic part of 'who cheated'?}], [p: John knows p])\]

If we take the meaning of MOST to be the following, we get the right result:

\[(24) \text{MOST}(A, B) \iff \text{there are more p's in } A \cap B \text{ than there are p's in } A \cap B^- \text{ (where } B^- \text{ is the complement of } B \text{ relative to the domain of propositions)}\]

Following the Hamblin-Karttunen tradition (Hamblin (1971), Karttunen (1977)), Lahiri assumes that an interrogative denotes a set of propositions (possible answers). Simplifying Lahiri's analysis somewhat, let us assume that the denotation of 'who cheated?' is not the set {'that Mary cheated', 'that Sally cheated', 'that Fred cheated', ...} (as

2 More accurately, an interrogative denotes a function from worlds to functions from propositions to truth values ([[]]]) is the interpretation function):

\[[\text{who cheated}]] = [\lambda w \in D_s . [\lambda p \in D_{w < s} . \text{there is an } x \in D_c \text{ such that } p = [\lambda w' \in D_s . x \text{ cheated in } w']]]

\[[\text{which students cheated}]] = [\lambda w \in D_s . [\lambda p \in D_{w < s} . \text{there is an } x \in D_c \text{ such that } x \text{ is a student (or a plurality of students) in } w \text{ and } p = [\lambda w' \in D_s . x \text{ cheated in } w']]]

\[[\text{did Mary cheat}]] = [\lambda w \in D_s . [\lambda p \in D_{w < s} . \text{Mary cheated in } w'] \text{ or } p = [\lambda w' \in D_s . \text{Mary didn't cheat in } w']]\]
Hamblin would have it). Rather, it is the set {‘that Mary cheated’, ‘that Sally cheated’, ‘that Fred cheated’, ‘that Mary and Sally cheated’, ‘that Sally and Fred cheated’, ‘that Mary and Fred cheated’, ‘that Mary, Sally, and Fred cheated’, ...}, such that every combination of individuals, singularity or plurality, is “represented” in the set of possible answers of the form ‘that x cheated’. Let us call this set a question. Any member of the question is a “part” of the question. The set of its atomic parts is {‘that Mary cheated’, ‘that Sally cheated’, ‘that Fred cheated’, ...}. The complement of this set is the set of its non-atomic parts. Since in (2a) the embedding verb is factive, the relevant atomic parts of ‘who cheated?’ are the true ones (as one cannot know p unless p is true). The result is that (23) is actually (25):

\[
(25) \text{MOST} \{p: \text{p is a true atomic part of ‘who cheated?’}, \{p: \text{John knows p}\}\}
\]

But this cannot be the whole story. As noted above, one of the problems Lahiri points out in connection with Berman’s analysis is that it doesn’t work well when the embedding predicate is non-distributive with respect to its question-complement. The same wrong prediction is made here, when a default implicit adverb of quantification is inserted:

\[
(26) \begin{align*}
& \text{a. It surprised Bill who cheated.} \\
& \text{b. ALL} \{p: p \text{ is a true atomic part of ‘who cheated?’}, \{p: p \text{ surprised Bill}\}\}
\end{align*}
\]

To solve this problem, Lahiri suggests that the relevant quantification in QVE1 is amount quantification (along the lines of Higginbotham’s (1994) analysis of mass terms). To this end, we need to define a universal quantifier suitable for amount quantification over sets of propositions. Thus, the actual analysis of (26a) proposed by Lahiri is this:

\[
(27) \text{ALL}^+ \{p: p \text{ is a true member of ‘who cheated?’}, \{p: p \text{ surprised Bill}\}\}
\]

This time the answers quantified over need not be atomic. The semantics assumed for ALL+ is roughly this (see Lahiri for the precise definition, as well as the definitions of the other adverbials under their amount quantification guise):

\[
(28) \text{ALL}^+(A,B) \iff \text{the most informative member of } A \text{ is the most informative member of } A \cap B.
\]

Consider (27) in a situation where Sally and Fred are the cheaters, and Bill is surprised by the “cheating combination” Sally-Fred, but not by the individual cheatings. The most informative member of \{p: p is a true member of ‘who cheated?’\} (namely, A) is ‘that Sally and Fred
cheated’. A intersected with \{p:p surprised Bill\} (namely, B) is \{'that Sally and Fred cheated’\} (whose sole member is the most informative one). To be surprised by p is to expect the negation of p (in our case, to expect ‘it is not the case that Sally and Fred cheated’, which doesn’t entail the expectation that Sally didn’t cheat or the expectation that Fred didn’t cheat). It follows, then, that \textit{It surprised Bill who cheated} is judged true in this situation. If we replace surprise with know, we will predict that Bill knows that Fred and Sally cheated, but by the distributive semantics of know, it will follow that he knows that Fred cheated and that he knows that Sally cheated (to know p entails to believe p, which in turn entails believing whatever is entailed by p).

Let us now look at the analysis of \textit{It surprises Bill who loves who}.

\begin{equation}
\text{(29) ALL}^+\{(p:p \text{ is a true member of} \ ‘\text{who love who}?’)\}, \{p:p \text{ sur-
prises Bill}\})
\end{equation}

Suppose John loves Mary and Fred loves Sally (and these are the only lover-lovee pairs). Bill is surprised by this “loving combination,” but not by its parts. The most informative member of A in this case is ‘that John loves Mary and Fred loves Sally’. Intersecting A and B yields \{'that John loves Mary and Fred loves Sally’\}. Once again, this is the desired result.

The semantics of MOST$^+$ is roughly this (see Lahiri for the precise definition):

\begin{equation}
\text{(30) MOST}^+(A,B) \iff \text{the most informative member of} \ A \cap B \\
\text{has more atomic parts than the most informative member of} \\
(A - (A \cap B)).
\end{equation}

I leave it to the reader to check that the right predictions are made with respect to sentences such as \textit{For the most part, John knows who cheated} and \textit{For the most part, John knows who loves who}.

Could amount quantification save Berman’s proposal? Lahiri discusses this option in some detail. For this to work, we would need to define a new universal quantifier suitable for amount quantification over sets of individuals. Let us call this quantifier ALL$^{++}$; with the following definition (once again, I am simplifying Lahiri’s presentation considerably):

\begin{equation}
\text{(31) ALL}^{++}(A, B) \iff \text{MAX}(A) = \text{MAX}(A \cap B).
\end{equation}

This definition relies on the notion MAX. Let us assume that MAX(A) is the plural individual formed by adding all the elements of A. For example, MAX(a,b,c) = a+b+c. Consider now \textit{John knows who cheated}, under this analysis:
(32) \( \text{ALL}^{++}({\{x : x \text{ cheated}\}, \{x : \text{John knows that } x \text{ cheated}\}}) \)

This gives us the right results for this particular example, as the reader can easily verify. Notice, however, that the analysis doesn’t give the desired solution for the distributivity problem. To see this, consider \( \text{It surprises Bill who loves who} \), in the situation described above. The predicted interpretation would be this:

(33) \( \text{ALL}^{++}({\{<x,y> : x \text{ loves } y\}, \{<x,y> : \text{it surprises Bill that } x \text{ loves } y\}}) \)

In the situation described above, \( A = \{\text{<John, Mary>, <Fred, Sally>}\} \). But what is \( A \cap B \)? Since it didn’t surprise Bill that John loves Mary, nor did it surprise him that Fred loves Sally, \( A \cap B \) turns out to be the empty set. The reader is referred to Lahiri for a detailed discussion of this problem, and additional attempts to save Berman’s proposal under amount quantification. Lahiri’s general conclusion is that amount quantification cannot save Berman’s proposal.

Notice that although Lahiri’s theory differs from Berman’s with respect to the predictions made regarding non-distributive predicates, it shares one important prediction with it: the prediction that only verbs of the \textit{know}-class—that is to say, verbs that take propositions—support QVE1. In Berman’s theory, this is because \textit{know}-type verbs must take propositions as their complements, and \textit{wonder}-type verbs must take semantic questions (and any free variable in them is bound by a Question-morpheme, so there is nothing for an adverb to bind). In Lahiri’s theory, this is because \textit{know}-type verbs can take proposition complements (though they do not have to), but \textit{wonder}-type verbs cannot, and quantity adverbs can bind variables over propositions, but not variables over questions.

There is, however, one prediction that seems to be made more straightforwardly in Berman’s analysis. In Berman’s analysis we do not expect QVE1 to arise when the embedded clause is a declarative.

(34) For the most part, John knows that Fred, Sue, and Bill cheated.

(cannot mean that John knows about most cheaters that they cheated.)

Since the embedded clause doesn’t contain a free individual-variable (not even in the guise of a singular indefinite), the adverb either has nothing to bind or it binds some argument of the verb. In any event, the QVE1-reading doesn’t arise. However, in Lahiri’s story one might expect the following analysis to be possible:
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(35) \textsc{Most}\{\{p:p \text{ is a relevant atomic part of 'that Fred, Sue, and Bill cheated'}\}, \{p: John knows p\}\}

If propositions such as 'that Fred, Sue, and Bill cheated' can be thought of as pluralities, we certainly expect this interpretation, but it is not available. It is quite clear that for Lahiri, the relevant "part of" relation in QVE1 involves the "being an answer to" relation (and therefore, only interrogatives support QVE1). But still, declaratives can be thought of as denoting pluralities, and it is not entirely clear why they do not support QVE1, with an appropriate notion of "part of."

1.2.3. Beck and Sharvit's Analysis

Beck and Sharvit agree with Lahiri that QVE1 and QVE2 are two distinct phenomena, and one cannot be reduced to the other. So, like Lahiri, they agree that QVE2—namely, having the adverb bind a degree variable in the main verb—is possible whenever the main verb takes a degree argument. Also, like Lahiri, they agree that adverbs of quantity are the relevant ones for QVE1, and that they quantify over "parts" of the embedded question.

However, unlike Lahiri, Beck and Sharvit argue that QVE1 result, not from the adverb quantifying over answers to the question-complement of the main verb, but rather over relevant subquestions of the question-complement. Informally, a subquestion of a question Q is a question whose true answer gives a (possibly incomplete) true answer to Q. For example, 'did Mary cheat?' is a subquestion of 'who cheated?', because assuming that Mary cheated, the answer to Did Mary cheat (which is Mary cheated) provides an incomplete answer to Who cheated (whose full answer is, say, Mary, Sally, and Fred cheated, in the situation we are talking about). Accordingly, the interpretation of (2a) is as follows, where the "classic" semantics for MOST—the one in (3)—is assumed, except that the two arguments of MOST are sets of questions, rather than sets of individuals (Beck and Sharvit assume that to know a question Q is to believe its most informative true answer):

(36) \textsc{Most}\{\{Q:Q \in \textsc{Part}('who cheated?')\}, \{Q: John knows Q\}\}

\textsc{Part}('who cheated?') is a free variable over sets of relevant subquestions of 'who cheated?', whose value is fixed by the context (see Beck and Sharvit for the precise definition). Since know is factive (or, in its question-taking guise, veridical), \textsc{Part}('who cheated?') has to consist of subquestions of 'who cheated?' that together comprise the full true answer to Who cheated. Here are two possible values for \textsc{Part} (these
are not the only possible values, of course), in a situation where Mary, Sally, and Fred cheated.

(37) PART1: {‘did Mary cheat?’, ‘did Sally cheat?’, ‘did Fred cheat?’}

PART2: {‘did Mary and Sally cheat?’, ‘did Fred cheat?’}

PART1 consists of (what we will call) atomic subquestions; PART2 has two members: one atomic (‘did Fred cheat?’) and one non-atomic (‘did Mary and Sally cheat?’). If the context supplies PART1, (36) is effectively interpreted as (38), provided that Mary, Sally, and Fred are the ones who cheated:

(38) MOST({Q:Q ∈ {‘did Mary cheat?’, ‘did Sally cheat?’, ‘did Fred cheat?’}}, {Q: John knows Q})

So, effectively, this interpretation gives rise to an inference that can be formulated as in (2’)(a) (see Beck and Sharvit for discussion of cases in which PART2 is relevant).

Since for Beck and Sharvit the crucial “part of” relation in QVE1 is the “subquestion” relation, they predict QVE1 to arise only when the complement of the verb is a semantic question (i.e. a set of propositions). As is the case with Lahiri’s theory, one might still wonder why the relevant “part of” relation has to be that, and why declaratives do not support QVE1. This seems to be a weakness that is shared by both theories. However, unlike Lahiri, Beck and Sharvit predict that QVE1 is possible when the main verb is interrogative-taking. The embedding verb need not be declarative-taking and interrogative-taking, as Lahiri would have it: complements of verbs belonging to the wonder-class also have subquestions, and as such, say Beck and Sharvit, they support QVE1. And indeed, to support their analysis, they point out the following well-formed example with depend, which is exclusively question-taking:

(39) Which candidates will be admitted depends, for the most part, on the committee’s decision.

This example receives the following analysis:

(40) MOST({Q:Q∈{‘will Sally be admitted?’ , ‘will Fred be admitted?’,...}}, {Q:Q depends on the committee’s decision})

But notice that depend is one of those verbs that Ginzburg uses in support of his proposal that QVE is the result of degree modification. Beck and Sharvit point out that indeed, (39) is ambiguous between a genuine QVE1 reading, and a reading that talks about degrees of dependency (QVE2). But the following sentence, with exclusively, is unam-
biguous, and has only the QVE1 reading:

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

Here, *for the most part* doesn’t relate to the degree of dependency that exists between the question and the committee. That is to say, (41) unlike (39), cannot be true in a situation where the admittance of less than half of the candidates depends on the committee.

Despite the contrast between (39) and (41), we still need more general tests to distinguish between these two proposals, and more general tests to assess all three (Ginzburg’s, Lahiri’s, Beck and Sharvit’s). We discuss such tests in the following section. Before doing so, I would like to draw the readers’ attention to one important point.

As the attentive readers may have noticed, Beck and Sharvit’s analysis may not have a straightforward answer to the distributivity problem associated with verbs such as *surprise*. Here is what they predict:

(42) a. It surprised Bill who cheated.

b. $\text{ALL}({Q: Q \in \text{PART}('who cheated?')}, {Q: Q \text{ surprised Bill}})$

Since PART does not have to consist of atomic questions (such as ‘did Fred cheat?’), at least one predicted reading is non-distributive. For example, if PART is the singleton set ‘did Mary, Sally, and Fred cheat?’, then we predict Bill to be surprised by the answer to that question, which is: ‘that Mary, Sally, and Fred cheated’ (assuming that to be surprised by Q means to expect the negation of the most informative answer to Q). But Beck and Sharvit still predict there to be distributive readings (depending on the values assigned to PART). We come back to this issue in Section 2.

Beck and Sharvit’s analysis, as stated in the previous paragraph, faces an additional problem. As is well known, *surprise* doesn’t take Yes/No questions at all, as indicated by the ungrammaticality of the following example:

(43) *It surprised Bill whether Sue cheated.

Yet in (42b), *surprise* takes a variable over Yes/No questions.$^3$ This problem can be avoided if we allow, as Beck and Sharvit do, subques-

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$^3$ Why *surprise* doesn’t take Yes/No questions is, of course, a problem for any theory that doesn’t distinguish Yes/No questions from WH-questions on the basis of semantic type. But assuming that the verb *surprise* “knows” how to distinguish between the two, Beck and Sharvit’s theory has to address this.
tions to be WH-questions. Assuming that all the individuals who cheated are American students, (42b) could be re-written as follows:

\[(44) \text{ALL}\{\{Q:Q \in \{\text{"which American students cheated?"}\}\}, \{Q:Q \text{ surprised Bill}\}\}\]

This analysis crucially depends on the flexibility in the interpretation of PART and “subquestion,” which allows us: (a) to have non-atomic sub-questions in PART; and (b) to have WH-questions as subquestions. This flexibility, especially with respect to PART, makes the context an important factor in determining the interpretation. And in fact, as Beck and Sharvit note, this context-dependency is reminiscent of the context-dependency of the interpretation of plural NPs. They further note that the inspiration for the idea of PART comes from Schwarzschild’s (1996) use of Covers in the semantics of sentences with plural NPs. The reader is referred to Beck and Sharvit's work for additional empirical motivation for such flexibility in determining the value of PART.

1.3. Assessing the Proposals

Lahiri, in arguing against Ginzburg’s approach, reviews (in Chapter 5) a number of empirical tests that are meant to show that QVE1 and QVE2 are indeed distinct, and that QVE1 arise only under the circumstances that his theory allows. Let us, then, go through some of these tests and see (a) how Lahiri uses them to compare his theory with Ginzburg’s; and (b) how we may use them to compare Beck and Sharvit’s theory with Lahiri’s and Ginzburg’s.

1.3.1. Know-class Predicates are not Always Gradable

The verb tell seems to belong to the know-class—it takes interrogative complements and declarative complements, and it gives rise to QVE1 (for simplicity, I use a Berman-style paraphrase):

\[(45) \text{a. John told me who came to the party, for the most part.} \quad (p. 234)\]

\[\text{b. MOST}\{\{x:x \text{ came to the party}\}, \{x:John \text{ told me that } x \text{ came to the party}\}\}\]

However, that tell is not gradable (and therefore does not have a degree variable that an adverbial can bind) can be seen from the following examples, where the appearance of the degree-modifying adverb to some extent is odd:

\[(46) ??\text{John to some extent told me that Jill came to the party yesterday.}\]
Lahiri points out that this is unexpected on Ginzburg’s account, because presumably (45a) for him is the result of for the most part binding a degree variable of tell. But the sentences in (46) show that tell doesn’t have a degree variable. Lahiri points out that report, announce, and state are like tell in this respect, as the following contrast shows:

(47) a. Jill reported, to some extent, which students were at the party.
b. Jill reported to some extent that Mary likes Bill.

Since Beck and Sharvit agree with Lahiri that QVE1 is not the result of degree modification of the main verb, these facts also support their view.

1.3.2. Modification of Interrogative Complements vs. Modification of Interrogative-taking Predicates

Recall that in evaluating Berman’s proposal, Lahiri drew our attention to the distinction between adverbs of frequency and adverbs of quantity. In connection with Ginzburg’s proposal, Lahiri draws our attention to a further distinction. Among the adverbs that are not frequency adverbs, there is a distinction between adverbs that modify embedded interrogatives and adverbs that modify interrogative-taking predicates. Adverbs such as mostly, for the most part, partly, in part, and completely tend to modify embedded interrogatives, and adverbs such as to some extent, to a large extent, fully, and only tend to modify interrogative-taking predicates. It is often hard to tell them apart, because there is considerable overlap between the two classes (for example, mostly and for the most part can often do both jobs). Nevertheless, the classes are distinct, and it is this distinctness that teases apart QVE1 and QVE2. The contrast between the two classes shows up in pairs such as these:

(48) a. We wondered, to some extent, why anyone would adopt such an attitude.
b. We wondered, in part, why anyone would adopt such an attitude.

(49) a. We investigated to some extent who committed the crime.
b. We partly investigated who committed the crime.
With a few exceptions, John knows who came to the party.

*With a few exceptions, John wondered who came to the party.

Ginzburg's theory cannot account for these contrasts, while under Lahiri's account they follow naturally.

What do these contrasts say about Beck and Sharvit's theory? For one thing, while Lahiri is right that (50b) is non-sensical, it seems that (51), where the main verb is negated, is fine:

(51) With a few exceptions, John didn't even wonder who cheated.

Imagine a situation where John is confronted with serious cheating in his class. For most students, he knows whether or not they cheated. Therefore he doesn't have to wonder about them. The sentence makes perfect sense (and sounds fine) in this situation, and seems to receive the following interpretation:

(52) SOME({Q:Q a relevant subquestion of 'who cheated?'}, {Q:John didn't even wonder (about) Q})

This interpretation is not predicted either by Lahiri or Ginzburg. Lahiri doesn't predict it because in his theory the adverb must bind a variable that stands for an answer. Ginzburg doesn't predict it because, as shown in (50b), with a few exceptions is not a degree-binding adverb.

One would, of course, want to know why negation (and possibly the presence of even) makes such a huge difference and facilitates the QVE1 reading, but the point still remains that the relevant reading of (51) is not one that involves degree-modification, and certainly not one that can arise with quantification over answers.

In addition, recall Beck and Sharvit's claim that depend, when co-occurring with exclusively, has only the QVE1 reading. This claim is confirmed when we try to pair exclusively with an adverb that tends to modify the embedding predicate rather than the embedded interrogative:

(53) ??Which candidates will be admitted, depends to a large extent/to some extent exclusively on this committee.

It therefore seems that indeed, as Lahiri says, QVE2 are genuinely different from QVE1, but contrary to Lahiri's predictions, QVE1 do sometimes arise when the embedding verb belongs to the wonder-class.
1.3.3. Collocational Restrictions

Adverbials that bind degree variables (in wonder-type verbs) show a relatively idiosyncratic behavior, while adverbials that (according to Lahiri) bind answer-variables (in know-type verbs) exhibit a relatively regular behavior. For example, to some extent goes well with wonder-type verbs, but to a large extent goes well with only some of them:

\[(54)\]
\[\begin{array}{l}
\text{a. We wondered to some extent why he didn’t show up last night.} \\
\text{b. We investigated to some extent what he was doing last night.} \\
\text{c. He is to some extent asking how much you’ll pay up.} \\
\text{d. Who comes here in the morning tomorrow depends to some extent on who leaves tonight.}
\end{array}\]

(p. 237)

\[(55)\]
\[\begin{array}{l}
\text{a. We wondered to a large extent why he didn’t show up last night.} \\
\text{b. We investigated to a large extent what he was doing last night.} \\
\text{c. The previous speaker was to a large extent asking how you deal with these counterexamples to the ECP.} \\
\text{d. Who comes here in the morning tomorrow depends to a large extent on who leaves tonight.}
\end{array}\]

(p. 237)

QV with know-class verbs is not as restricted, as the examples cited till now indicate. While this fact does not provide a knock-out argument against Ginzburg’s theory, it does support the view that we have on our hands two kinds of phenomena, as Lahiri, and Beck and Sharvit predict.

To sum up, in this section we looked at some data that support Lahiri’s claim that QV that arises with sentences that contain singular indefinites is very different from QV that arises with embedded interrogatives. Within the latter phenomenon, a further distinction was made by Lahiri, namely, the distinction between QVE1 (quantification over parts of a question), and QVE2 (quantification over degrees). As far as QVE1 goes, there is evidence, pointed out by Beck and Sharvit, that these effects sometimes arise when the embedding verb is exclusively question-taking. This suggests that the relevant “parts” are themselves questions. However, it remains unclear what constrains QVE1 in such environments (as they are not as freely available as one might expect them to be).
In section 2 we come back to the distributivity problem, in connection with surprise. We will see further support for analyzing QVE1 with the kind of flexibility suggested by Beck and Sharvit.

2. Know and Surprise: Are They Both Distributive?

This section challenges Lahiri’s claim that surprise doesn’t support distributive readings. We will look at evidence that supports an analysis of surprise which predicts context-dependent distributivity.

2.1. The Weak, Non-distributive Nature of Surprise

Lahiri’s claim that know is distributive with respect to its question-argument, while surprise is not is supported by the following contrast:

(56) John knows which students left
     <=>
     For every student x who left, John knows that x left

(57) It surprised John which students left
     <=/=>
     For every student x who left, it surprised John that x left

Suppose Mary and Bill are the students who left. In order for John to qualify as knowing which students left, he has to know that Mary left and he has to know that Bill left. But in order for him to qualify as being surprised by which students left, he need not be surprised that Mary left (i.e. he need not have expected the negation of ‘that Mary left’), and he need not be surprised that Bill left (i.e. he need not have expected the negation of ‘that Bill left’). In order to qualify as being surprised by which students left, he has to be surprised by the “combination” of the leavers (i.e. he has to have expected the negation of ‘that Mary and Bill left’). Now, of course there can be a context where John is surprised by the fact that Mary and Bill left, and by the fact that Mary left, and by the fact that Bill left. But this, says Lahiri, is not imposed by the semantics of surprise, and certainly not all contexts where It surprised John which students left is true have to be like that.

While I agree with Lahiri’s basic observation regarding the non-distributive behavior of surprise, I think that we need a theory that predicts, in some cases, distributive readings with surprise. Before showing that surprise sometimes supports distributive readings, we need to discuss another property of this verb, namely, its inherent “weakness.” Many authors, including Lahiri, have observed that know, depending on
The context, can be weak or strong; more accurately, it can be "weakly exhaustive" or "strongly exhaustive." Its weak reading corresponds to (56) above, and is illustrated by the acceptability of the following sentence.

(58) John knows which students left, but he doesn’t know which students didn’t leave.

This weak reading may be obtained, according to Lahiri, in two ways. One way to obtain it is as a QVE effect, with proposition-taking know and an implicit default universal adverb of quantification:

(59) ALL⁺{(p:p is a true answer to ‘which students left?’), {p:John knows_{proposition p}}}

Another way to obtain it is with question-taking know:

(60) ‘John knows_{question-weak} which students left’ is true iff John believes the weak true answer to ‘which students left?’ (where the weak true answer to ‘which students left?’ is the most informative true answer to it).

The strong reading of John knows which students left, on the other hand, corresponds to the truth conditions in (61), and is illustrated by the acceptability of the sentence in (62):

(61) For every student x, John knows whether x left.

(62) John doesn’t know which students left, at least not completely, because Bill didn’t leave but John thinks that he did.

In order to obtain this strong reading we need to assume that question-taking know has a strong counterpart. Accordingly, the truth conditions are these:

(63) ‘John knows{question-strong} which students left’ is true iff John believes that the weak true answer to ‘which students left?’

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4 For discussion, see Beck and Rullmann (1999); Lahiri, Chapter 3, section 6.

5 We may define two different meanings of know as follows, using two notions of Answerhood as defined by Heim (1994):

(i) For any Q ∈ D_{<s,<s,t>,t>} and w ∈ D_s, Ans-weak(Q)(w) = [λwʻ ∈ D_s. for all p such that Q(w)(p)=1 and p(w)=1, p(w′)=1]

(ii) For any Q ∈ D_{<s,<s,t>,t>} and w ∈ D_s, Ans-strong(Q)(w) = [λwʻ ∈ D_s. Ans-weak(Q)(w′) = Ans-weak(Q)(w)]

(iii) [[know_{question-weak}]] = [λw ∈ D_s. [λQ ∈ D_{<s,<s,t>,t>} . [λx ∈ D_c . x believes in w Ans-weak(Q)(w); and if {w′ ∈ D_s:Ans-weak(Q)(w)(w′)=1}=D_s, x believes in w Ans-strong(Q)(w)]]

(iv) [[know_{question-strong}]] = [λw ∈ D_s. [λQ ∈ D_{<s,<s,t>,t>} . [λx ∈ D_c . x believes in w Ans-strong(Q)(w)]]]
is its actual weak true answer (for example, if Fred and Susan are the only students who left, then John believes that they left and no one else did).

Heim (1994) presents evidence that suggests that surprise is inherently weak. Suppose Sue, Bill, and Fred are the students, and that Sue and Bill left, and Fred didn’t leave. Now consider the following sentence:

(64) Although Mary expected Sue and Bill to leave, it still surprised her which students left because she also expected Fred, who didn’t leave, to leave.

This sentence is infelicitous in the context described. If surprise had a strong reading, then the combination of Mary and Bill leaving and Fred not leaving could be what Mary didn’t expect (and what surprised her). However, the unacceptability of (64) suggests that surprise is inherently weak.

The infelicity of (64) is explained as follows. If we analyze It surprised Mary which students left as involving QV, we get the following interpretation, which is weak and non-distributive:

(65) ALL+({p:p is a true answer to ‘which students left?’}, {p:p surprised Mary})

And if we analyze it as not involving QV, we need to assume that to be surprised by a question is to expect the negation of its weak true answer (in our case, ‘it isn’t the case that Sue and Bill left’), not the negation of its strong true answer (in our case, ‘it isn’t the case that Sue and Bill left and Fred didn’t leave’). In other words, we have to assume that question-taking surprise, unlike question-taking know, has only a weak interpretation. In both cases, we get a weak non-distributive interpretation.

In the next section, we will discuss some evidence that shows that while surprise is indeed weak, it is sometimes interpreted distributively.

2.2. The Distributive Flavor of Surprise

If surprise were indeed both weak and non-distributive, the contrast between the following two bits of discourse would be mysterious:

(66) Prof. A: It really surprises me which students passed the exam.
    Prof. B: That’s not entirely true. Fred passed, yet you expected him to.

(67) Prof. A: It really surprises me which students passed the
exam.
Prof. B: #That’s not entirely true. Bill failed, yet you expected him to.
If we take seriously the claim that surprise is inherently weak and non-distributive, both (66) and (67) are predicted to be odd, and not just (67). This is because denying the truth of Prof. A’s statement in (66) cannot entail that there is one exam-passer about which Prof. A isn’t surprised. However, if surprise is weak and distributive, we have a natural explanation for the contrast. If Prof. A is not surprised that each individual passer passed, then it isn’t true that which students passed surprises Prof. A. But Prof. A needn’t be surprised by the individual non-passers for the same statement to hold.

Sharvit (2002) discusses examples similar to (66)–(67). The explanation for this kind of contrast offered there relies on the following semantics for surprise:

(68) ‘it surprised x Q’ is True if and only if:
   a. x expected in w the negation of the most informative true proposition in Q; and
   b. x came to believe the most informative true proposition in Q.

According to these truth conditions, for It surprised John who came to be true it is not enough that John have the wrong expectation, he also has to realize his mistake. This semantics could certainly explain the following contrast:

(69) It didn’t really surprise John who came. Indeed, he had the wrong expectations about Mary and Fred, but he never came to realize that Fred indeed came.

(70) It didn’t really surprise John who came. #Indeed, he had the wrong expectations about Mary and Fred, but he never came to realize that Fred didn’t come.

So with the semantics in (68), we predict that the reason for denying the truth of It surprised John who came can be that he never realized the truth for some individual comer.

Sharvit’s analysis is not satisfactory, however. In the contrast (66)–(67), the reason for denying the statement with surprise is Prof. A’s failure to have the wrong expectation regarding some passer, not her failure to realize that that individual passed. In addition, for reasons that I do not go into here, it seems more plausible to say that clause (b) in (68) is a presupposition of surprise, rather than part of what it
asserts. Therefore, we need an explanation for this contrast which comes from clause (a) in (68). For simplicity, I will ignore from now on the presupposition associated with clause (b), and assume that the truth conditions of surprise are given in clause (a). So we need to explain the contrast in (66)–(67) without appealing to clause (b).

It seems that the problem we have on our hands is that we have to make surprise distributive and non-distributive at the same time. Lahiri's claim that one can be surprised by the combination Mary-Bill passing does not entail being surprised individually by their passing suggests that surprise is non-distributive. The facts in (66)–(67) suggest that it is. Notice, though, that the "distributive" flavor of surprise seems to depend highly on the context. The context for (66)–(67) is one where two professors are discussing the outcome of an exam, and since the passing of each individual student probably matters here, surprise is interpreted as weak and distributive. But we can quite easily think of a context where (66) would be as odd as (67)—a context where the general outcome of the exam is what matters. In that case, surprise would be interpreted as weak and non-distributive.

2.3. The Solution

Recall that in the absence of an overt adverb of quantification, we assume a sentence with an embedded interrogative can be interpreted as having an implicit universal quantity adverb. Following Beck and Sharvit, the interpretation of It surprised Prof. A which students passed would then be:

$$(71) \text{ALL}([\{Q:Q \in \text{PART}('\text{which students passed?}')\}], \{Q:Q \text{ surprised Prof. A}\})$$

Recall also that Beck and Sharvit assume that the value of PART is context-dependent. Since the embedding verb is veridical, any PART (whose members are constituent questions) such that the answers to its members together comprise the full true answer to Which students passed is a good candidate. Crucially, PART doesn't have to be a set of atomic subquestions. Here are some possible values for PART with respect to 'which students passed?' (assuming Fred and Sue are the only students who passed, Fred and Sue are the brilliant students who passed, Sue is the American student who passed, and Fred is the French student who passed):

$$\text{PART1} = \{\text{‘which brilliant students passed?’}\}$$
$$\text{PART2} = \{\text{‘which French students passed?’, ‘which American}$$
students passed?’

If the context supplies PART1, (71) will come out true when Prof. A is not surprised by the individual passings (we are still assuming that to be surprised by Q means to expect the negation of the most informative true answer to Q). If, on the other hand, PART2 is supplied by the context, Prof. A will be required to be surprised by each individual passing for (71) to come out true.

Notice that the non-distributive reading also arises if the default universal quantifier is not inserted at all (see (68) above). The resulting interpretation in this case is simply that Prof. A expected the negation of the true (weak) answer to Which students passed (i.e. ‘it is not the case that Fred and Sally passed’). This doesn’t commit the professor to being surprised by the individual passers. It is worth noting that while the option of not inserting a silent universal adverb is available to Lahiri (see (60) above), who assumes that verbs of the know-class can take either propositions or questions, it is not available to Berman, who assumes that interrogatives embedded under verbs of the know class must be interpreted as restricted variables (rather than semantic questions). This is why he needs to invoke a default universal adverb of quantification when such an adverb is missing on the surface.

It is also worth noting that it is certainly possible to express the context-dependent distributivity of surprise within Lahiri’s theory. However, since Lahiri’s theory was shown to have an independent problem (in that it makes wrong predictions with respect to the wonder class; see section 1), the solution we adopt here is Beck and Sharvit’s, which is the following: distributive readings of surprise arise because the domain of the implicit universal adverb may, depending on the context, consist of atomic subquestions.

2.4. An Unsolved Problem

We have compared several theories of QVE1, and while we saw that Lahiri’s theory (which involves quantification over answers) has many advantages, we considered Beck and Sharvit’s theory (which involves quantification over questions) to be a good alternative, given its prediction that QVE1 may arise in cases where the embedding verb is exclusively question-taking. We will now see that Beck and Sharvit’s theory also has an unwelcome prediction, at least as far as surprise goes.

Beck and Sharvit define the notion of PART flexibly enough so as to allow weak and strong QVE1. That is to say, for them, the answers to
the subquestions in PART may either comprise the weak full answer to the question, or its strong answer. By doing that, they predict the following to be ambiguous (for simplicity, I am providing Berman-style paraphrases):

(72) For the most part, John found out which students cheated.
   a. For most students x who cheated, John found out that x cheated.
   b. For most students x, John found out whether x cheated.

The analysis that they suggest is this:

(73) MOST({Q:Q ∈ PART('which students cheated?')}, {Q:John found out Q})
   a. PART1 = {'did Fred cheat?', 'did Susan cheat?', 'did Sally cheat?'}
   b. PART2 = {'did Fred cheat?', 'did Susan cheat?', 'did Sally cheat?', 'did Miranda cheat?', 'did Gwendolyn cheat?', ...}

In a situation where Fred, Susan, and Sally are the only cheaters, the answers to the subquestions in PART1 are all Yes, while the answers to some of the subquestions in PART2 are No. Beck and Sharvit see this as a good prediction, as (72) is sometimes interpreted as “strong”, provided that the context is rich enough to permit this. As Beck and Sharvit explain, this ambiguity cannot be captured in Lahiri’s theory. According to Lahiri, For the most part, John found out which students cheated can only have a weak reading (as the adverb quantifies over true members of the question set only). As we already saw, when there is no overt adverb of quantification, Lahiri predicts that the sentence is three-way ambiguous. For example, (74) is ambiguous between (75) (where know takes a proposition as its complement), (76), where there is no adverb and the weak reading of the question-semantics of know is invoked, and (77), where the strong reading of the question-semantics of know is invoked. (75) and (76) are equivalent:

(74) John knows which students cheated.
(75) ALL+({p:p is a true answer to 'which students cheated?'}, {p:John knows_{proposition} p})
(76) knows_{question-weak} (John, 'which students cheated?')
(77) knows_{question-strong} (John, 'which students cheated?')

So according to Lahiri, a strong reading of know can only arise in the absence of an adverb, whereas according to Beck and Sharvit, both weak and strong readings are always available in principle, whether
there is an adverb, overt or covert, or not (and the context decides which reading is relevant).

If we maintain that *surprise* is always weak (and we have good reasons to do that, as suggested by the discussion above), then Lahiri has a clear advantage over Beck and Sharvit. His theory correctly predicts that interrogatives under *surprise* are always weak, whether there is an adverb present or not. Beck and Sharvit, on the other hand, do not prevent QVE1 with *surprise* being of the "strong" kind. In fact, they predict that a sentence such as *It surprised Prof A which students passed* may have three interpretations: one stemming from an LF without an adverb (corresponding to (78)), one stemming from an LF with an implicit universal adverb and a "weak" PART, and one stemming from an LF with an implicit universal adverb and a "strong" PART (both corresponding to (79)):

(78) ‘which students passed?’ surprised Prof. A
(79) $\text{ALL}(\{Q:Q \in \text{PART}('\text{which students passed?}')\}, \{Q:Q \text{ surprised Prof. A}\})$

This is clearly a wrong prediction, as *It surprised Prof A which students passed* does not have a strong reading.

To solve this problem, one might exploit another idea of Lahiri’s, namely, that the selectional restrictions a verb imposes on its complement can be checked even after the complement has moved. Lahiri uses this idea to explain why the verb *tell*, which is non-factive in its declarative-taking guise but factive (or veridical) in its question-taking guise, behaves factively in QVE1 environments:

(80) John told Bill that Sue cheated
(Sue need not have cheated)
(81) John told Bill which students cheated
(John gave the names of the actual cheaters)
(82) For the most part, John told Bill which students cheated
(John gave names of actual cheaters)

Given Lahiri’s theory, this is unexpected, because in the QVE1 structure *tell* is proposition-taking. But Lahiri claims that there is a co-indexing relation between the complement of *tell* (which is displaced from its original position) and the trace it leaves behind, which preserves the lexical requirements imposed by question-embedding *tell*. Beck and Sharvit could use this idea to explain why *surprise* remains "weak" even in a QVE1 structure. The trace left behind by the complement of *surprise* preserves the lexical restrictions of *surprise*, which require that
the relevant subquestions be members of a “weak” PART. I leave the details of such a proposal for future research.

3. Conclusion

In this review we examined Lahiri’s claim that interrogative clauses denote pluralities, based on speakers’ intuitions regarding the interpretation of sentences that involve QV. While Lahiri’s arguments are compelling, it still remains an open question what kind of plurality is involved. It is quite possible that Lahiri on the one hand and Beck and Sharvit on the other hand are both right, and that QVE1 may be a result of quantification over answers or quantification over semantic questions. If so, the next step should be to find a way to distinguish between these two types of QVE1 on an empirical basis.

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bridge.

Department of Linguistics
University of Connecticut
337 Mansfield Road
Unit 1145
Storrs, CT 06119-1145
USA
e-mail: yael.sharvit@uconn.edu