Schaffer on Knowing-*Wh*

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In a recent paper, Jonathan Schaffer presents an argument against the received view that knowledge-*wh* ascriptions can be analyzed in terms of knowledge-*that* ascriptions, a view that Schaffer calls the reductive view of knowledge-*wh*. On the reductive view of knowledge-*wh*, to know Q in a context w, where Q is an embedded question, is to know the true answer to Q in w. The reductive analysis makes the prediction that if two questions Q and Q' have the same answer P in a given context, then knowing Q and knowing Q' should come out semantically equivalent: thus, convergent questions are predicted to yield equivalent ascriptions when embedded under *know*. Schaffer objects to that prediction, by pointing out that in a context in which Bush is on TV, I can easily know whether Bush or Janet Jackson is on TV (because distinguishing between the two is easy), and yet fail to know whether Bush or Will Ferrell is on TV (because Ferrell is such a good impersonator of Bush). Thus, although the two questions "is Bush or Janet Jackson on TV?" and "is Bush or Will Ferrell on TV?" have the same actual answer (namely "Bush is on TV"), they do not yield equivalent knowledge claims. On the basis of this and related examples, Schaffer proposes to abandon the reductive analysis, and at the same time to defend the opposite view that knowledge-*that* claims themselves are relative to questions.

According to Schaffer, the reductive analysis stems from two main sources: the first is the assumption that *knowing-that* constructions are more primitive than other constructions involving *know*; the second is the idea that *know* denotes a binary relation between an agent and a proposition. Accordingly, Schaffer ends up challenging both assumptions. In linguistic circles, on the other hand, the reductive analysis of knowing-*wh* in terms of knowing-*that* is also the dominant view, but primarily because the meaning of (unembedded as well as embedded) questions is itself conceived reductively in terms of the meaning of their answers. On Karttunen's semantics for questions, for instance, a question Q in a context w denotes the set of all true propositional answers to Q in w. On Groenendijk and Stokhof's account, a question Q denotes a function which to each world w associates the true and exhaustive propositional answer to the question Q in w. Although the two theories differ, as we will see in greater detail, in both of them the reductive analysis of knowing-*wh* in terms of knowing-*that* is itself parasitic on the reductive analysis of the meaning of questions in terms of their propositional answers, together with the principle of compositionality. Thus, if we let $[\![\text{Q}]\!]$ stand for the meaning or intension of Q, and $[\![\text{Q}]\!](w)$ denote the value of Q in w, namely the true propositional answer to Q in w, it can be checked that both Karttunen's semantics and Groenendijk and Stokhof's semantics satisfy the prediction that convergent questions yield equivalent knowledge-*wh* claims, namely the following schema holds in both frameworks:[1]

[1] $[\![\text{Q}]\!](w)$ denotes a proposition in Groenendijk and Stokhof's semantics, and a set of propositions in Karttunen's semantics. In Groenendijk and Stokhof's theory, (CV) follows from the assumption that SKQ is true in w iff $K_w \subseteq [\![\text{Q}]\!](w)$, where K_w is S's belief state (see (18) below). In Karttunen's semantics, it follows from the assumption that SKQ is true in w iff $K_w \subseteq \cap([\![\text{Q}]\!](w))$, namely if S knows the conjunction of all true answers to Q (assuming here what Heim

$$\text{(CV)} \qquad \frac{[\![\ Q\ ]\!](w) = [\![\ Q'\ ]\!](w)}{[\![\ S \text{ knows } Q\ ]\!](w) = [\![\ S \text{ knows } Q'\ ]\!](w)}$$

One aim in this paper is to challenge Schaffer's analysis of his own counterexample to (CV), and to defend the reductive analysis of knowing-*wh* to knowing-*that*. Schaffer's proposed counterexample to (CV) involves two alternative questions of the form "whether A or B" vs "whether A or C". In the first part of the paper, we propose a closer analysis of the meaning of alternative questions, and argue that Schaffer's example is not conclusive against (CV): we examine several ways of understanding Schaffer's proposal, and show that on nearly all of them, (CV) either remains sound, or holds vacuously. In the second part of the paper, we examine elements in favour of Schaffer's view, namely of the idea that these contrasts exemplify a form of context-dependency required in the analysis of knowing-*wh*. While we agree with Schaffer's contextualist view, on the present account this context-dependency is revealing of an ambiguity in what "knowing the answer" means in the first place. In particular, there may be two ways of understanding "knowing whether A or B": before the question is asked explicitly, and after it has been asked explicitly. The second sense, however, is weaker than the first, since it rests on some form of presupposition accommodation. We present a dynamic implementation of Schaffer's contextualist view in the technical appendix.

1 Polar questions and alternative questions

Under Karttunen's semantics, to know-*wh* is to know the true propositions that answer Q. For example to know who called is to know of the people who actually called that they called. Groenendijk and Stokhof (1984) observed that our intuitions are in fact stronger than that. Knowing who called further requires to know of the people who didn't call that they didn't call.[2] Compare the following entailments:

(1) a. John knows who called. & Mary called. ⇒
  b. John knows that Mary called.

(2) a. John knows who called. & Mary didn't call. ⇒
  b. John knows that Mary didn't call.

Karttunen's analysis captures (1) but fails to validate (2). To capture (2) Groenendijk and Stokhof assume that to know Q is to know the true *exhaustive* answer to Q, rather than the true answer. Suppose only Mary and John called:

(3) Who called?
  a. true answer: John and Mary called.
  b. true exhaustive answer: John and Mary called and nobody else called.

Following Groenendijk and Stokhof we call *weakly exhaustive* an analysis that defines question denotation and knowledge-*wh* in terms of the notion of their true answer, and so validates (1), and

1994 calls the "simplified Karttunen's analysis").

[2] Assuming that the domain of individuals itself is known. The strongly exhaustive behavior of *know* is standardly contrasted with that of other predicates, like *surprise*, which show only weak exhaustivity. Thus, one can say: "it surprised John who called, but it did not surprise him who did not call", if for instance Ann and Bob called, Carol and Don did not, and John expected only Ann to call, and the others not to. By contrast, for John to know who called, John must know that Ann and Bob called; but that is not enough, for presumably one would not say "John knows who called" if he is uncertain about Carol and Ted: John must also know that Carol and Ted did not call.

strongly exhaustive one that defines question denotation and knowledge-*wh* in terms of the notion of their true exhaustive answer and therefore validates (2).

(4) a. Weakly exhaustive theory: S knows Q iff S knows that P where P is the true answer to Q
b. Strongly exhaustive theory: S knows Q iff S knows that P where P is the true exhaustive answer to Q

It is easy to see that both theories are reductive and do satisfy (CV). Only the weakly exhaustive theory, however, satisfies the following argument that according to Schaffer's follows from (CV):

(A) a. S knows $?(\phi \vee \psi_1)$
b. ϕ
c. S knows $?(\phi \vee \psi_2)$

To see why, we need to take a closer look at disjunctive questions. First of all, notice that disjunctive questions like *Is Bush or Janet Jackson on television?* are ambiguous between a polar reading (expected answer: *yes/no*) and an alternative reading (expected answers: *Bush/Jackson*). A number of languages (e.g. Mandarin Chinese, Finnish and Basque) use different disjunctive markers for these two readings (Haspelmath 2000). In English, intonation seems to play a disambiguating role (Romero and Han 2003). In alternative questions, the alternatives are stressed:

(5) Is BUSH or JACKSON on television? a. (?) Yes/No. b. Bush/ Jackson.

The contrastive *either... or...*, on the other hand, can only express polar reading.

(6) Is either Bush or Jackson on television? a. Yes/No. b. (?) Bush/ Jackson.

Let us assume now that only Bush is on television. Consider Schaffer's two examples.

(7) a. Is Bush or Janet Jackson on television?
b. Is Bush or Will Ferrell on television?

On the polar reading, Schaffer's two questions are not convergent, and the premise of (CV) fails to be instantiated:[3]

(8) a. Is Bush or Janet Jackson on television? (on polar reading)
b. True (exhaustive) answer: Either Bush or Janet Jackson is on television.

(9) a. Is Bush or Will Ferrell on television? (on polar reading)
b. True (exhaustive) answer: Either Bush or Will Ferrell is on television.

The proposition: *Bush is on TV* entails both answers, but strictly speaking is not *the* answer to either of the questions. You do not need to know that Bush is on television to know whether either Bush or someone else is on television. As expected, argument (A) does not go through in this case:

(10) a. S knows whether either Bush or Janet Jackson is on television.
b. Bush is on television.
c. S knows whether either Bush or Will Ferrell is on television.

[3]For polar questions, the notions of the true and exhaustive answer collapse. True answers to polar questions are always exhaustive (Groenendijk and Stokhof).

Suppose S wrongly believes that Janet Jackson is on television. Then S believes the disjunctive proposition that Bush or Janet Jackson is on television, but need not believe the disjunctive proposition that Bush or Will Ferrell is on television.

Let us turn to the alternative reading, which is obviously the reading intended by Schaffer in his argument.[4]

(11) a. Is Bush or Janet Jackson on television?
b. True answer: Bush is on television.
c. True exhaustive answer: Bush is on television and Janet Jackson is not.

(12) a. Is Bush or Will Ferrell on television?
b. True answer: Bush is on television.
c. True exhaustive answer: Bush is on television and Will Ferrell is not.

It is easy to see that only if we assume a weak exhaustive analysis of knowledge-*wh* argument (A) would go through. On the strongly exhaustive analysis indeed, for (13)-c to be true S has to know that Will Ferrell is not on television.

(13) a. S knows whether Bush or Janet Jackson is on television.
b. Bush is on television.
c. S knows whether Bush or Will Ferrel is on television.

However, S may know that Bush is on television and Janet Jackson is not, and still be uncertain as to whether Ferrell is or is not on television. More generally, we see that (11)-a and (12)-a do not converge to the same true exhaustive answer, and under that interpretation the main premise of (CV) simply fails to be instantiated.

In summary, we see that both on the polar reading and on the alternative reading, Schaffer's disjunctive questions fail to be convergent if one assumes the strongly exhaustive analysis of questions. Either way, we get no counterexample to (CV), and likewise (A) does not go through. On the other hand, (CV) is indeed instantiated, and the problematic schema (A) does go through if one assumes the weakly exhaustive analysis of alternative questions. But this, arguably, is not an argument against the reductive analysis of knowing-*wh*. Rather, it may be held against precisely this weak interpretation of alternative questions and embedded questions more generally under the scope of *know*.

What we have shown therefore is that whether or not two questions converge to the same answer depends on the background theory of questions one is working with. As a result, the schema of convergent knowledge cannot be held directly against the reductive analysis of knowing-*wh*. This, however, only shows that under one analysis of questions, Schaffer's argument does not go through. But this does not show that his argument would not go through under any reasonable analysis of the meaning of questions. In the next section, we propose to reconstruct Schaffer's own intuition, by examining directly our intuitions about the truth and falsity of knowledge ascriptions in his examples.

[4] This is suggested by Schaffer's use of clefting, when he writes "the question of whether *it is Bush or Janet Jackson* [who is on TV] is a relatively easy question" (italics and addition ours). Note that there is no agreement in the literature on how alternative questions should be analyzed (cf. Groenendijk 2007). In what follows, exhaustive answers to alternative questions are calculated as in Groenendijk and Stokhof (1984). Heim's (1994) algorithm to derive exhaustive answers from Karttunen's true answers gives us the same result.

2 A closer look at Schaffer's examples

By asking an alternative question, one generally presupposes that one and at most one of the two disjuncts is true.[5] For instance, when asking (11)-a, one typically presupposes that exactly one of Bush or Jackson is on television. This, however, does not imply that there could not be more than one person on television. In a context in which Bush is on TV and Janet Jackson is not, the true exhaustive answer "Bush is on TV and Janet Jackson is not on TV" to (11)-a does not exclude that Ferrell or someone else too might be on TV (along with Bush). For the kind of scenario that Schaffer describes, however, the participants to the conversation presumably share the extra knowledge that *exactly one person is on TV*. If we add this pragmatic presupposition into the picture, then the two questions (11)-a and (12)-b, on their alternative reading, will indeed converge to the same proposition:

(14) Bush and noone else is on television.

Interestingly, an answer of that kind counts as a strongly exhaustive answer to the question "who is on television?". Thus, if you know that Bush and noone else is on television, then you know who is on TV. In Groenendijk and Stokhof's framework, the question "who is on TV?" determines a partition of the set of possible worlds, where each cell in the partition represents a strongly exhaustive answer to the question. Assuming that the domain of individuals consists of only George W. Bush, Will Ferrell, and Janet Jackson, for instance, then the question "who is on TV?" would be represented as in Figure 1, where B^* denotes the set of worlds in which Bush and no one else is on TV, J^* the set of worlds in which Jackson and no one else is on TV, and F^* the set of worlds in which Ferrell and no one else is on TV (and likewise $(BF)^*$ the set of worlds where Bush and Ferrell and no one else is on TV, and so on).[6]

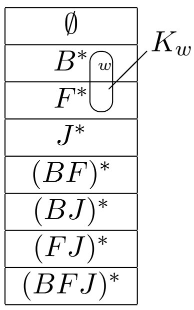

Figure 1: Who is on TV?

By hypothesis, the actual world w is contained in B^*. If it is part of the common ground that exactly one person is on TV, then all possibilities outside B^*, F^* and J^* are excluded when the dialogue starts. Schaffer does not specify in which order the questions are asked. This matters of

[5]It is controversial, however, whether this presupposition should be part of the denotation of alternative questions, and more generally, whether this is simply a pragmatic inference, or a semantic presupposition. For arguments in favour of the former view, see for instance Groenendijk and Stokhof (1984:92), who write: "it is better to regard these phenomena as (pragmatic) *implicatures* and not as presuppositions in the strict semantic sense". For an opposite view, see Higginbotham (1991: 8), who writes "alternative questions carry the presupposition that at most one (but not at least one) alternative is true". We maintain, in the semantics presented in the Appendix, that the answer to an alternative question of the form "whether A or B" could be "both" or "neither".

[6]The symbol * is used to mark the "and no one else". We abbreviate $[\![\, \mathrm{P} \,]\!]$ into P: e.g. B denotes the proposition that Bush (and possibly someone else) is on TV, and B^* the proposition that Bush and no one else is on TV (ie $B\overline{F}\,\overline{J}$).

course, since questions, like assertions, can change the context. In particular, they can change the range of alternatives the attitude holder is aware of, and likewise the range of alternatives considered relevant by the ascriber. For simplicity, we consider the situation statically first, and assume that the background of possibilities for the agent's state of knowledge can be represented as in Figure 1, taking into account the three possibilities F^*, B^* and J^* all at once.

Let K_w denote the set of worlds compatible with the beliefs of the agent (call him S) who is asked the question at w. We assume the standard truth conditions for knowing-*that*, namely:

(15) "S knows that P" is true in w iff $K_w \subseteq P$

One way of representing the scenario Schaffer has in mind is to suppose that $K_w \subseteq B^* \cup F^*$, but $K_w \nsubseteq B^*$ and $K_w \nsubseteq F^*$. That is, S thinks that one of Bush or Ferrell is on TV, but doesn't know which. Consequently, S knows that the person on TV is not Janet Jackson, since her belief set excludes any Janet world.

It is clear in what sense S does not know whether Bush or Ferrell is on television, since S's belief set entails neither B^* nor F^*, but overlaps both. But in what sense can it be said that S knows whether it is Bush or Janet Jackson? Schaffer's idea here is that if S were to choose between the two incompatible answers "Bush is on TV", and "Janet Jackson is on TV", then S would choose the first. In other words, if S can ignore the possibility that it might be Ferrell, then her belief state would be contained entirely in B^*. On a first approximation, this suggests the following truth-conditions for knowing-*whether* with alternative questions:

(16) "S knows whether A or B" is true in w iff $K_w \cap (A \cup B) \subseteq A$ or $K_w \cap (A \cup B) \subseteq B$

These truth-conditions are faithful to Schaffer's contextualist idea. In particular, (16) entails that S knows whether it is Bush or Janet Jackson who is on TV, since $K_w \cap (B \cup J) \subseteq B$. But S does not know whether it is Bush or Ferrell who is on TV, since $K_w \cap (B \cup F) \nsubseteq B$ and $K_w \cap (B \cup F) \nsubseteq F$.

This analysis can be made compositional if we suppose, as Schaffer does, that for an alternative question Q of the form "whether A or B", the meaning of Q is defined directly as the set of potential answers $\{A, B\}$.[7] Let $[\![\text{Q}]\!](w)$ denote which of those alternatives is true in w. Then (16) can be rephrased as:

(17) "S knows Q" is true in w iff $K_w \cap (\cup [\![\text{Q}]\!]) \subseteq [\![\text{Q}]\!](w)$

By contrast, the truth-conditions given initially in (4) for knowing-*wh* were of the form:

(18) "S knows Q" is true in w iff $K_w \subseteq [\![\text{Q}]\!](w)$

The difference is that in (17) the ascription of knowledge is context-dependent, and more precisely, it is dependent on the question itself. Moreover, the truth-conditions of (17) no longer validate (CV), since precisely from $[\![\text{Q}]\!](w)$= $[\![\text{Q'}]\!](w')$, it needn't follow that $\cup [\![\text{Q}]\!] = \cup [\![\text{Q'}]\!]$.

The general pattern underlying (17) is of the form:

(19) "S knows Q" is true in w with respect to X iff $K_w \cap X \subseteq [\![\text{Q}]\!](w)$

In agreement with Schaffer, the parameter X represents a contextual restriction of the background of possibilities relevant for the answer. In (17) this restriction is derived directly from the semantics of the alternative question (and therefore the restriction does not appear on the left hand side of the

[7] See Schaffer 2005, fn. 9. This way of defining the meaning of a question, as the set of possible answers, is closer to Hamblin's 1973 than to either Karttunen's or Groenendijk and Stokhof's.

equivalence). This may be too drastic, however, since other factors beside the embedded question can influence the set X of relevant alternatives. Suppose, for example, that S is wondering whether it is Bush or Ferrell on TV, and someone asks him whether it is Bush or Janet Jackson. It is not obvious that S will answer: "it is Bush". Most probably, she will answer: "at any rate, it is not Janet Jackson". With respect to the question "who is on TV?", the answer "it is not Janet Jackson" is what Groenendijk and Stokhof call a *partial answer*, since it does not select one cell in the partition induced by the question. But knowing that Janet Jackson is not on TV is not sufficient in general to know who is on TV. Intuitively, therefore, we wouldn't say that S knows whether it is Bush or Janet Jackson in this situation. The analysis in (17), on the other hand, makes the opposite prediction for the scenario we are considering. Relative to $X = \cup [\![\mathrm{Q}]\!] = B \cup J$, it holds that $K_w \cap X \subseteq B$, namely S is predicted to answer "it is Bush", irrespective of the other alternatives she may consider outside those raised by the question. To match our intuition for such a case, therefore, we need a larger set of relevant alternatives, one that includes F. Assuming $X = B \cup J \cup F$, then it is no longer true that $K_w \cap X \subseteq B$.

For an analysis like (17) to work, one would have to suppose that the subject S, when asked an alternative question of the form "is it A or B?", systematically accommodates the presupposition that one and only one of the two alternatives is true.[8] But this may not always be the case. Suppose, to use Dretske's notorious example, that a skeptic first asks: "is it a zebra or a horse?". I answer: "a zebra". He pursues: "but is it a zebra, or a cleverly painted mule?". I answer: "I don't know". Then the skeptic reiterates: "so is it a zebra, or a horse?". Here, the best answer can only be: "not a horse" (assuming I remain confident about this), for in that state the skeptic undercuts the invitation to consider that exactly one of the two answers is true. This suggests that (17) should be revised in a way that integrates the dynamics of questions and the order in which they introduce alternatives.

In the Appendix, we present a dynamic system with context-sensitive truth conditions for knowledge attributions along the lines of (19), which is aimed to capture precisely this phenomenon. The truth-conditions we obtain differ from (17) in three respects. First, the contextual restriction for knowing-*wh* is not simply a function of the embedded question; rather, it is a function of the issues under discussion, in agreement with Schaffer's own account, namely of the alternatives judged relevant by the ascriber, even though the embedded question remains an input to the issues under discussion. Secondly, this contextual restriction is defined in an incremental way, relative to the previous issues under discussion in the conversation, in order to model the dynamics of conversation. Finally, while the meaning of embedded questions remains defined in terms of the partition induced by the question, partitions are derived from a more encompassing notion of question denotation, which also associates to each question a set of *topics*. In the case of alternative and constituent questions, the set of topics raised by the question corresponds to the Hamblin denotation of the question, namely to the set of possible (rather than true) answers to the question.

The system allows us to implement Schaffer's contextualist idea, but in a sense we predict more context-sensitivity than Schaffer suggests. In particular, Schaffer seems to consider that even if the alternatives consist of Bush, Ferrell and Janet Jackson, "virtually anyone (with decent vision and minimal cultural background) can know whether it is Bush or Janet Jackson". In our approach, assuming that S's belief set is as in Figure 1, this is so only if the alternatives are restricted to Bush and Jackson, or otherwise if knowing-*wh* is given the weak sense of knowing a partial answer to the question.

[8] A similar objection was made to Schaffer by J. Stanley and another participant at the Aberdeen Conference on Linguistics and Epistemology, 2007.

3 Knowing the Answer

The analysis sketched in the previous section and developed in the Appendix is one way of formalizing Schaffer's contextualist intuition. We therefore agree with Schaffer that the truth-value of knowing-*wh* ascriptions will vary depending on the background of possibilities that are considered relevant. However, we remain skeptical on the idea that this should provide an argument against the so-called reductive analysis of knowing-*wh*, or even against the soundness of the schema of convergent knowledge.

As regards the latter, the reason is that if the background context X is kept constant in (19), then convergent questions still yield equivalent knowledge claims, and as explained in general X is not simply a function of the question asked. For instance, relative to $X = B \cup F \cup J$, not only does S fail to know whether Bush or Ferrell is on TV, but we have seen that S does not really know whether Bush or Jackson is on TV either. Conversely, if one can indeed say "S knows whether it is Bush or Janet Jackson" and then "but S does not know whether it is Bush or Ferrell", then this is due precisely to the fact that the background context X differs in the two cases.

As regards the reductive view of knowing-*wh*, Schaffer denies it by writing: "there is more to knowledge-*wh* than knowing the proposition that just so happens to be the answer". We do not quite agree with this view. For one thing, even a context-dependent analysis of knowing-*wh* like (17) is expressed in terms of knowing-*that*. More importantly, we take Schaffer's example to be revealing rather of a form of ambiguity in what "knowing the answer" means in the first place. There may be two senses of "knowing the answer to the question whether A or B": "knowing whether A or B" *before* the question is asked explicitly by someone else, and "knowing whether A or B" *after* the question has been asked explicitly by someone else. A related point was made earlier by J. Hawthorne, who writes that "the very asking of a question may provide one with new evidence regarding the subject matter".[9] However, Schaffer dismisses it by considering that we can make knowing-*wh* ascriptions *in absentia*, namely "of subjects who are miles away". We agree with him, but in our opinion, knowledge ascriptions may differ depending on whether the ascriber imagines: "if I asked him whether A or B, how would he answer?", or: "what does he presently think about whether A or B?".

Consider a pupil, on the way to her history exam, trying to remember whether Napoleon I was born in 1768 or 1769. She cannot remember whether Napoleon was born in 1768 or 1769. Then comes the exam; one of the questions is: "was Napoleon born in 1769, or in 1869?". S answers that Napoleon was born in 1769, because she knows for sure that Napoleon was born before 1800. By doing so, however, S makes the reasonable assumption that the question asked contains the correct answer. In other words, S accommodates the information contained in the question in order to restrict the range of possibilities. Before the question was asked, however, can one say:

(20) S knows whether Napoleon was born in 1769 or in 1868

This is not clear. For once again, S's knowledge that Napoleon was not born in 1869 is not sufficient to settle the issue. After the question was asked and S correctly answers "1769", however, it seems one can indeed say:

(21) S knows the answer to the question whether Napoleon was born in 1769 or 1869.

If so, the contrast suggests that "knowing whether" and "knowing the answer to the question whether" are not necessarily synonymous, or more precisely, that "knowing whether", just like "knowing the answer", is potentially ambiguous.

[9] Hawthorne (2004: 78), quoted by Schaffer (2005), fn. 22.

The example points toward another interesting phenomenon. Before the question was asked, it seems also infelicitous to say:

(22) S does not know whether Napoleon was born in 1769 or in 1869

For in this context, "S does not know whether A or B" seems to presuppose "S wonders whether A or B".[10] But wondering whether A or B implies that one considers both A and B as possible. In our scenario, S wonders whether Napoleon was born in 1768 or 1769, but does not wonder whether he was born in 1869, because she already rules out that possibility. This presuppositional behavior accounts for others of Schaffer's examples. Thus, Schaffer notes that the two sentences:

(23) a. I forgot whether I left my keys on the table, or by the phone.
b. I forgot whether I left my keys on the table, or in the fridge.

are clearly inequivalent in a context in which I remember I did not leave my keys in the fridge, but don't remember whether I left them on the table or by the phone, even if the two embedded questions have the same answer (I left my keys on the table). According to Schaffer, (23-a) is true and (23-b) is *false* in that situation. On our view, (23-b) is *odd* or *inappropriate* rather than false, since in order for (23-b) to receive a truth value, the presupposition that I wonder whether I left my keys in the fridge ought to be satisfied. We perfectly agree, therefore, about the inequivalence, but disagree on the nature of the inequivalence. On our account, the intuition of inequivalence is easily explained if one adopts GS's view of *wonder* as selecting the intension of a question: thus, the two questions "whether I left my keys on the table or by the phone" and "whether I left my keys on the table or in the fridge" clearly have distinct intensions. Those, however, affect the presuppositional content of *forget whether*, rather than its assertive content.

More generally, the understanding of embedded questions will differ depending on the embedding verb and its presuppositional behavior. There is, in this respect, a clear contrast between "know whether" and "can tell whether", or more clearly, "could tell whether". Let us compare for instance:

(24) a. S knows whether Napoleon was born in 1769 or in 1869.
b. S could tell whether Napoleon was born in 1769 or in 1869.

Our intuition is that (24-b) is more appropriate than (24-a) for the kind of scenario that Schaffer considers, since it refers more clearly to the fact that S is facing or might be facing an explicit question. More precisely, "S could tell whether A or B" seems to mean: "supposing A or B were actually the case, S could tell which of them is", thereby justifying the restriction of the alternatives to A and B.[11] We do agree, however, that "know" can be used to mean "can tell", and likewise "would know" can be used to mean "could tell". Nevertheless, this sense of "know" is compatible with weaker standards of knowledge. To be sure, let us compare:

(25) a. (?) S does not know for sure whether Napoleon was born in 1768 or in 1769, but he knows whether Napoleon was born in 1769 or in 1869.
b. S does not know for sure whether Napoleon was born in 1768 or in 1769, but he could tell whether Napoleon was born in 1769 or in 1869.

[10] Remember that this is before anyone other than S asks the question. In this context, "wonder" is stronger than "being asked", since it means "asking oneself".

[11] Thus, in the Bush-Ferrell scenario, for instance, it seems one can even say: "S could tell whether it is Ferrell or Janet Jackson", meaning that if it had to be only one of them, S could still rule out Janet Jackson and choose Ferrell.

Pierre can tell whether A or B if he knows and can provide the partial answer "not A", even if he does not know about B for sure. Thus, "can tell whether A or B" seems more adequate than "know whether" to mean "make the correct choice between A and B". By contrast, for Pierre to know whether A or B, Pierre may well have to know whether A *and* to know whether B. Knowing whether, we argue, is ambiguous between these two senses of knowing the answer: knowing a partial answer to the question, and being able to infer the actual answer from that partial answer on the one hand, versus knowing the true exhaustive answer directly on the other hand, independently of the information brought up by the questioner. The latter, of course, is more demanding than the former.[12] As Schaffer writes, "a student might well know the answer when the options are easy". This, however, is "knowledge in the eye of the ascriber". Suppose the student answers "1769" to the question whether Napoleon was born in 1769 or 1869. By the professor's standards, the student knows the answer. But does S know that she knows the answer? This seems less obvious, because S may still doubt whether Napoleon was born in 1769, and fear the professor might have devised a "snare question". For S to know that she knows the answer, S would have to know that Napoleon was born in 1769 prior to the question being asked, without having to trust the questioner on the correctness of the alternatives.

4 Conclusion

Schaffer's examples make a new case for the context-sensitivity of knowledge ascriptions. While we agree on the contextualist conclusion Schaffer draws from his examples, we nevertheless disagree with him on several points of detail, and more substantially, on the extent given to the contextualist analysis. In the first section of this paper, we have argued that the schema of convergent knowledge does not provide a straightforward argument against the reductive analysis of knowledge-*wh* to knowledge-*that*, in particular if one adopts the partition theory of questions. In the last part, we have moreover argued that some of the inequivalences observed by Schaffer should be traced to the presuppositions associated with the use of *whether*-complements, rather than to the assertive content they contribute under the scope of attitude verbs. More fundamentally, on our account Schaffer's examples are revealing of a form of ambiguity in what "knowing the answer" means, roughly between knowing the true exhaustive answer prior the question is asked, and being able to tell the answer if the question were asked explicitly (relying on knowledge of the partial answer). Like Schaffer, however, we do agree that the meaning of questions is dependent both on the domain of quantification and on the alternatives that are considered relevant. But this is not sufficient to conclude, as Schaffer does, that knowledge-*that*, no more than knowledge-*wh*, systematically "includes a question". On the present view, "know" continues to denote a binary relation between an agent and a proposition, even when the context is more richly articulated.

References

[1] Dretske, F. (1970), "Epistemic Operators", *The Journal of Philosophy*, Vol. 67, No. 24 (Dec. 24, 1970), 1007-1023.

[2] Groenendijk, J. (2007), *The Dynamics of Inquiry*. Paper presented at the Symposium on: Philosophical Consequences of Dynamic Logic April 21, 2007, Central APA Meeting, Chicago

[12] In some cases, "knowing the answer" may simply mean "being able to give the correct answer", whatever method has been used, even if S has simply *guessed* the correct answer. However, "S could tell whether A or B" seems to imply that S has a reliable method to tell the correct answer.

[3] Groenendijk, J. and Stokhof M. (1984), *Studies in the Semantics of Questions and the Pragmatics of Answers*. PhD dissertation, University of Amsterdam.

[4] Hamblin, C.L. (1973), "Questions in Montague English", *Foundations of Language*, 10, 41-53.

[5] Haspelmath, M. (2000), "Coordination". To appear in: T. Shopen (ed.) *Language typology and syntactic description*. 2nd ed. Cambridge: Cambridge University Press.

[6] Hawthorne, J. (2004), *Knowledge and Lotteries*, Oxford University Press.

[7] Heim, I. (1994), "Interrogative Semantics and Karttunen's Semantics for *Know*", in R. Buchalla and A. Mittwoch (eds) *Proceedings of IATL 1*, 128-144. Akademon, Jerusalem.

[8] Higginbotham J. (1991), "Either/Or", in NELS 21: T. Sherer (ed.), 143-155. Amherst, Ma: GLSA.

[9] Karttunen, L. (1977), "Syntax and Semantics of Questions", *Linguistics and Philosophy*, 1, 3-44.

[10] Romero, M. and Han C-H. (2003), "Focus, Ellipsis and the Semantics of Alternative Questions", in *Empirical Issues in Formal Syntax and Semantics 4*. C. Beyssade, O. Bonami, P. Cabredo Hofherr, F. Corblin (eds), Presses Universitaires de Paris-Sorbonne, Paris, 291-307.

[11] Schaffer, J. (2005), "Knowing the Answer", Penultimate Draft, forthcoming in *Philosophy and Phenomenological Research*.

Appendix

In this appendix we present a dynamic semantics for questions and their embedding under "know". The system is one way of formalizing Schaffer's remarks on the dynamics of conversation, but making explicit the importance of the order in which questions are asked.

Question representation Questions are represented by formulas of the form $?p_1, ..., p_n\ \phi$ where ? is a query-operator, $p_1, ..., p_n$ is a possibly empty sequence of propositional variables, and ϕ is a formula of predicate logic with propositional variables. Polar questions result when the query-operator binds no variable (example (26)-a). Alternative questions are represented by formulas like (26)-b which asks which of the propositions ϕ and ψ is true. Formula (26)-c represents constituent questions. It can be paraphrased as 'which of the propositions $\phi(d), \phi(d'), ...$ are true?'.

(26) a. Polar questions: $?\phi$
b. Alternative questions: $?p(p \wedge (p = \phi \vee p = \psi))$
c. Constituent questions: $?p(p \wedge \exists x(p = \phi(x)))$

Question denotation Questions are mapped into sets of pairs $\langle\sigma, w\rangle$ where $\sigma = \alpha_1, ..., \alpha_n$ is a sequence of propositions and w is a possible world. From such sets of pairs, representing the denotation of question Q, we will be able to recover (a) the partition induced by the question and (b) the topics set up by Q. In terms of partitions we will define various notions of answers. Topics will be used to model the contextual restriction at work in Schaffer's examples.

Let $[\![\phi]\!]_{M,g}$ be the proposition expressed by an indicative sentence ϕ:[13]

(27) $[\![\phi]\!]_{M,g} = \{w \mid\ M, w \models_g \phi\}$.

Questions denotations are then defined as follows, where $\vec{p}$ stands for the sequence $p_1, ..., p_n$, and $\vec{\alpha}$ for the sequence $\alpha_1, ..., \alpha_n$.

(28) $[\![?\vec{p}\,\phi]\!]_{M,g} = \{\langle\vec{\alpha}, w\rangle \mid\ w \in [\![\phi]\!]_{M,g[\vec{p}/\vec{\alpha}]}\}$

The denotation of a polar question $?\phi$ is the set of pairs $\langle\lambda, w\rangle$ such that λ is the empty sequence and w satisfies ϕ. The denotation of an alternative question $?p(p \wedge (p = \phi \vee p = \psi))$ is the set of pairs $\langle p, w\rangle$ such that w satisfies p and p is either the proposition expressed by ϕ or the proposition expressed by ψ. And finally the denotation of a constituent question represented as $?p(p \wedge \exists x(p = \phi(x)))$ is the set of pairs $\langle p, w\rangle$ such that w satisfies p and $p = [\![\phi]\!]_{M,g[x/d]}$ for some individual d.

Answers The denotation of a question Q determines an equivalence relation (or, equivalently, a partition) Part(Q) over the set of possible worlds, from which different notions of answers can be defined. For $Q\ = ?\vec{p}\,\phi$, two worlds w and v are in the same cell of Part(Q) iff for each sequence of propositions $\vec{\alpha}$, $\langle\vec{\alpha}, w\rangle$ belongs to the denotation of Q iff $\langle\vec{\alpha}, v\rangle$ does as well.

(29) $\text{Part}_{M,g}(?\vec{p}\,\phi) = \{\langle w, v\rangle \mid \forall\vec{\alpha} : \langle\vec{\alpha}, w\rangle \in [\![?\vec{p}\,\phi]\!]_{M,g} \text{ iff } \langle\vec{\alpha}, v\rangle \in [\![?\vec{p}\,\phi]\!]_{M,g}\}$

Exhaustive answers to Q correspond to cells in Part(Q). The *exhaustive true answer* to Q in w is the cell including w in Part(Q). Finally, *partial answers* (true in w) correspond to non-trivial unions of cells of Part(Q) (including w), namely unions of cells different from Part(Q).

Topics In terms of a question denotation we can also define the topics set up by the question as follows:

(30) $\text{Top}_{M,g}(?\vec{p}\,\phi) = \{\vec{\alpha} \mid \exists w : \langle\vec{\alpha}, w\rangle \in [\![?\vec{p}\,\phi]\!]_{M,g}\}$

Topics are sets of (sequences of) propositions. These topics will be used in what follows to define the contextual restriction on the belief state of the subject of knowledge-*wh*.

Results:

(31) Polar questions ("did John leave?")
  a. Representation: $?\phi$
  b. Partition: $\{\phi, \neg\phi\}$
  c. Topics: $\{\lambda\}$ (the set containing the empty sequence)

(32) Alternative questions ("did John leave, or did Mary leave?")
  a. Representation: $?p(p \wedge (p = \phi \vee p = \psi))$
  b. Partition: $\{\phi \wedge \neg\psi, \neg\phi \wedge \psi, \neg(\phi \vee \psi), \phi \wedge \psi\}$
  c. Topics: $\{\phi, \psi\}$

[13]The satisfaction relation $\models$, assumed in (27), is defined in a standard way. The only clause that deserves to be mentioned is the one for propositional identity:

(i) $M, w \models_g \phi = \psi$ iff $\forall w' : M, w' \models_g \phi$ iff $M, w' \models_g \psi$

(33) Constituent questions ("who left?")

a. Representation: $?p(p \wedge \exists x(p = \phi(x)))$
b. Partition: $\{\forall x \neg\phi(x), \forall x(\phi(x) \leftrightarrow x = d), ..., \forall x \phi(x)\}$
c. Topics: $\{\phi(d), \phi(d'), ...\}$

Dynamics A context C is defined as an ordered pair whose first index s_C is an information state (set of worlds), and whose second index i_C is a sequence of question denotations (as defined above) representing the issues under discussion in C. A context C can be updated either by an assertion P, or by the introduction of a new question Q:

(34) a. $C + P = (s_C \cap [\![P]\!], i_C)$
b. $C + Q = (s_C, i_C + [\![Q]\!])$

Updating C with an assertion P only influence the state-index eliminating those worlds in s_C in which P is false. Updating with a question Q extends the issue parameter by adding to i_C the denotation of Q as last issue under discussion.

Knowledge Let $\text{ANS}_w(Q)$ be the true exhaustive answer to Q in w, and $\text{Top}(C)$ denote the union of the topics introduced by all the issues in C, i.e. for $C = (s_c, [\![Q_1]\!], ..., [\![Q_n]\!])$: $\text{Top}(C) = \bigcup_{i \in n} \text{Top}(Q_i) \setminus \{\langle\rangle\}$. We then define knowledge as follows:

(35) "S knows Q" is true in world w with respect to context C iff
(i) $K_w \cap \text{Top}(C) \subseteq \text{ANS}_w(Q)$, if $\text{Top}(C) \neq \emptyset$;
(ii) $K_w \subseteq \text{ANS}_w(Q)$, otherwise.

Schaffer's example. Let us take s_C to be $\{w_{B^*}\}$, namely the actual world $w = w_{B^*}$ is a world in which only Bush is on TV; $K_w = \{w_{B^*}, w_{F^*}\}$, that is S's belief state is compatible with either only Bush being on TV, and only Ferrell being on TV. When the dialogue starts, i_C is empty. Let us write $?(\phi \vee_a \psi)$ for the longer $?p(p \wedge (p = \phi \vee p = \psi))$. The semantics derives the following predictions:

(36) a. S knows whether it is Bush or Janet Jackson on TV.
b. true in C+$?(B \vee_a J)$, but false in C+$?(B \vee_a J)$+$?(B \vee_a F)$

(37) a. S knows whether it is Bush or Ferrell on TV.
b. false in C+$?(B \vee_a F)$, and likewise false in C+$?(B \vee_a F)$+$?(B \vee_a J)$.

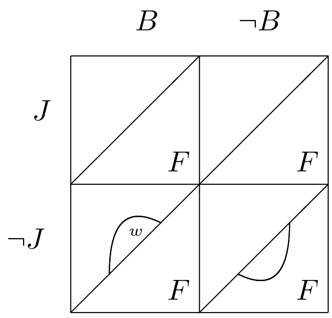

Figure 2: Is it Bush, or is it Janet Jackson?

Figure 2 is another, more adequate way of looking at Figure 1 in order to represent the question "is it Bush, or is it Janet Jackson?". Each cell in the partition induced by $?(B \vee_a J)$ is itself partitioned into F-worlds (below the diagonal) and $\neg F$-worlds (above the diagonal). S's belief state K_w consists of the curved portion containing w above the diagonal in the area $B\neg J\neg F$, together with the curved portion below the diagonal in the area $\neg B\neg JF$.

Suppose S is asked first whether Bush or Janet Jackson is on TV. This updates C with the issue under discussion $?(B \vee_a J)$. Relative to that question, namely to the alternatives $\{B, J\}$, S can give the true exhaustive answer "Bush and not Janet Jackson". Then S is asked whether Bush or Ferrell is on TV. This increments the context with a new issue under discussion, namely $?(B \vee_a F)$, which enlarges the space of relevant alternatives to $\{B, J, F\}$. This time, S's state K_w no longer supports the exhaustive answer "Bush and not Jackson", for it also overlaps with the exhaustive answer "neither Bush nor Jackson". In other words, S's belief state only supports the partial answer "not Jackson".

The notion of partial answer, it may be noted, remains consistent with Schaffer's intuition that the question "is it Bush, or Janet Jackson?" is easier than the question "is it Bush, or Ferrell?", since S can at least provide a partial answer to the first.

The system predicts that "S knows whether Bush or Ferrell is on TV" will come out true if the issue under discussion is simply $?(B \vee_a J)$, namely "is Bush or Janet Jackson on TV?". But this will not happen: for the background issue under discussion should always include the question discussed in the knowledge report.