# Knowing whether A or B

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## Abstract

*Can we say that $s$ knows whether A or B when $s$ is only able to rule out A, but remains uncertain about B? We discuss a set of examples put forward by J. Schaffer's in favour of a contextualist answer to this problem. We present a context-sensitive and dynamic semantics for knowledge attributions, in which those can depend on the alternatives raised by the embedded question, but also on alternatives raised earlier in the context.*

## 1. Alternative questions in epistemic contexts

The aim of this paper is to discuss the semantics of knowledge attributions of the form "$s$ knows whether A or B", which we may symbolize by $K_s?(A \vee_a B)$, where $?(A \vee_a B)$ denotes an alternative disjunctive question, like "is John in London, or is Mary in London?". More specifically, our aim is to provide a dynamic account of the context-sensitivity of such attributions.

It is standard in linguistic theory to distinguish polar readings and alternative readings of disjunctive questions (see e.g. Haspelmath 2000, Han and Romero 2003). Under the polar reading, a question of the form "is John or Mary in London?" calls for a yes or no answer. The polar reading can be forced in English by asking "is either John or Mary in London?". For the alternative reading, by contrast, the question cannot be answered by yes or no and has to be answered by a sentence like "John is London", or "Mary is not in London", namely by providing information about the truth and falsity of the respective disjuncts.

There is still some debate in the literature about the answerhood conditions of alternative questions, and by way of consequence, about the conditions under which a subject can be said to know whether A or B. In a recent paper (Schaffer 2007), J. Schaffer argues that in a context in which $s$ sees someone on TV, who is actually George Bush, but such that $s$ is not able to discriminate between George Bush and Will Ferrell (because Ferrell is such a good impersonator of Bush), and yet is able to see that it is not Janet Jack-

son, (1-a) below should be judged false, but (1-b) should count as true:

(1)  a.  $s$ knows whether George Bush or Will Ferrell is on TV

  b.  $s$ knows whether George Bush or Janet Jackson is on TV.

The intuition reason for the truth of (1-b), according to Schaffer, is that the question "is Bush or Janet Jackson on TV?" is easier for $s$ to answer than the question "is Bush or Will Ferrel on TV?". In our view, however, ordinary intuitions are less stable: although (1-a) should be incontrovertibly false in the scenario, the status of (1-b) is much less clear. In our opinion, all that $s$ really knows is that *Janet Jackson is not on TV*, which need not be sufficient to fully answer the question "is Bush or Janet Jackson on TV?".

More formally, assuming the partition theory of questions of Groenendijk and Stokhof (1984), an answer of the form "Janet Jackson is not on TV" counts only as a *partial answer* to the question "is Bush or Janet Jackson on TV?". For $s$ to know the complete answer to the question "is Bush or Janet Jackson on TV", $s$ should know more, namely that Bush is on TV and that Janet Jackson is not on TV. The partial answer "Janet Jackson is not on TV" would count as complete if one presupposed that exactly one of the two disjuncts had to be true. In principle, however, there is no more reason to think that "$s$ knows whether Bush or Janet Jackson is on TV" is true than there is to think that "$s$ knows whether Ferrell or Janet Jackson is on TV" is true. In other words, $s$'s ignorance about who exactly *is* on TV seems to override $s$'s partial knowledge about who is *not* on TV.

Despite this, we agree with Schaffer that there is a sense in which, if $s$ is allowed to *ignore* the possibility that Ferrell might be on TV, then $s$ can be said to know whether Bush or Janet Jackson is on TV, simply based on $s$'s knowledge of that partial answer.

## 2. Dynamics of knowledge attributions

To implement this idea, we propose a question semantics for knowledge in which attributions involving questions can

be made sensitive both to the alternatives raised by the question, as well as to alternatives raised earlier in the context. The semantics is dynamic, in so far as the context can be incremented with the considerations of new alternatives, in a way that not simply restricts, but can also increase, the subject's uncertainty.

## 2.1. Question semantics

Questions in the system 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 $\phi$ is a formula of predicate logic with propositional variables. In the case of alternative questions, a question of the form "is $\phi$ or $\psi$?" (abbreviated $?(\phi \vee_a \psi)$) is represented by a formula of the form $?p(p \wedge (p = \phi \vee p = \psi))$, which asks which of the propositions $\phi$ and $\psi$ is true.

Questions denotations are then defined as follows, where $\vec{p}$ stands for the sequence $p_1, ..., p_n$, and $\vec{\alpha}$ for the sequence $\alpha_1, ..., \alpha_n$: $[\![?\vec{p}\ \phi]\!]_{M,g} = \{\langle \vec{\alpha}, w \rangle \mid w \in [\![\phi]\!]_{M,g[\vec{p}/\vec{\alpha}]}\}$. The denotation of an alternative question $?p(p \wedge (p = \phi \vee p = \psi))$ is thus the set of pairs $\langle p, w \rangle$ such that $w$ satisfies $p$ and $p$ is either the proposition expressed by $\phi$ or the proposition expressed by $\psi$. From the denotation of a question, we can define the *partition* Part$(?\vec{p}\ \phi)$ induced by the question $?\vec{p}\ \phi$ as the set of ordered pairs $\langle w, v \rangle$ such that for all proposition $\vec{\alpha}$, $\langle \vec{\alpha}, w \rangle \in [\![?\vec{p}\ \phi]\!]_{M,g}$ iff $\langle \alpha, v \rangle \in [\![?\vec{p}\ \phi]\!]_{M,g}$. Finally, we define the *topics* raised by a question as the set Top$_{M,g}(?\vec{p}\ \phi) = \{\vec{\alpha} \mid \exists w : \langle \vec{\alpha}, w \rangle \in [\![?\vec{p}\ \phi]\!]_{M,g}\}$. For alternative questions, one can check that Part$(?(\phi \vee_a \psi))=\{\phi \wedge \neg\psi, \neg\phi \wedge \psi, \neg\phi \wedge \neg\psi, \phi \wedge \psi\}$, and Top$(?(\phi \vee_a \psi))=\{\phi, \psi\}$.

## 2.2. Knowledge and context updates

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 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 $Q$:

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

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

Define $\mathcal{K}_s(w)$ to be the knowledge state of $s$ in $w$, namely the set of epistemically accessible worlds to $s$. We then define knowledge as follows:

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

## 3. Schaffer's puzzle

Going back to Schaffer's example, suppose $\mathcal{K}_s(w)$ is a state compatible with Bush being on TV ($B$) and with Ferrell being on TV ($F$), but excluding Janet Jackson being on TV ($J$). The following holds:

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

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

The semantics predicts that when $s$'s knowledge state is restricted to the topics raised by "is Janet Jackson or Bush on TV?", $s$ will know the answer. But if a further issue comes up after this question was asked, namely "is Bush or Ferrell on TV?", then $s$ may no longer be said to know whether Bush or Janet Jackson is on TV, because the context is incremented with a third alternative (namely the possibility that it might be Ferrell).

## 4. Perspectives

The semantics here presented can be used to deal with other scenarios involving, in particular, the consideration of skeptical alternatives, whereby the introduction of a new alternative can impair one's initial confidence in the particular answer to a question. We shall explain the extension of the semantics to other types of questions, and discuss possible connections with the topic of unawareness. A further issue, which we elaborate in the paper, concerns the partialization of the semantics, to deal with presupposition failure. Thus, in a situation in which $s$ holds a partial answer to the question, as in Schaffer's scenario, the negation of (1-b) may be judged inappropriate, hence neither true nor false, rather than true at all. The partiality can be derived from the assumption that $s$'s uncertainty should always be symmetric with respect to the alternatives raised by the question.

## References

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