# There is Something about *Might*

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**Abstract.** In this paper we present an alternative interpretation of
statements of epistemic possibility, which does not induce a consistency
test on a common ground, as in (Veltman 1996), but which tests whether
the possibility is supported by some update of the common ground, as
in (Veltman 1984). The information space relative to which such claims
are evaluated are taken to consist in the possible developements of a dis-
course in action. It is shown that this notion of *Might* not only behaves
better logically and pragmatically speaking, but that it also allows for
non-trivial attitude reports and questions about epistemic possibilities.
These epistemic modal statements can also be understood to guide or
focus the inquisitive actions of the discourse participants.

## 1 Epistemic Modalities

Epistemic modal operators like *Might* and *Must* in English, and semantically
related verbs, adverbs and markers, express a kind of possibility or necessity
relative to some body of knowledge, evidence, or other constraints. A sentence
formalized as $Might(\phi)$ (or: $\Diamond\phi$) is used to express that $\phi$ is not excluded relative
to some source of evidence. In the standard semantic approach (Kratzer 1977)
such a body of knowledge or evidence is conceived of as a set of possibilities
(situations, worlds, . . . ), relative to which $\Diamond\phi$ is true iff $\phi$ is true with respect to
some possibilities in $K$.

In the literature, this basic interpretation of the modalities has been chal-
lenged and modified in two respects. Firstly, epistemic modals are seen to be in-
herently contextual, or indexical. The relevant body of knowledge against which
to evaluate epistemic modals has to be found relative to the discourse situation
in which these modal sentences are uttered. Secondly, the relevant bodies of
information have been argued to be those of the interlocutors in an actually un-
folding discourse. Building on Stalnaker's idea of establishing common grounds,
an utterance of $\Diamond\phi$ has been taken to express consistency of $\phi$ with the current
information state of the interlocutors in a discourse. This idea has been formally
developed in (Veltman 1996) and subsequent work.

Notoriously, such a consistency interpretation of $\Diamond\phi$ can be deemed rather
vacuous. While Veltman's update semantics is motivated in part by (Stalnaker
1978)'s idea that assertions, or utterances, are put to use to substantially con-
tribute to a common ground for the participants in a discourse, the epistemic

test associated with $\diamondsuit\phi$ appears to do nothing of the kind. In response to a claim that it might be the case that $\phi$, one can simply agree that it is consistent with the common ground that $\phi$, or just disagree that it is not. Upon the interpretation proposed, there is no other option available. Worse, assuming, as one would ideally do, that the common ground contains common knowledge, and that participants have the gift of introspection, a use of $\diamondsuit\phi$ is utterly pointless, and would at best remedy possibly misconceptions of the common ground—while the remedies or required revisions typically remain beyond the scope of current systems of update or inquisitive semantics.

It has been suggested every here and there that epistemic modal statements additionally serve to "raise" possibilities, that they are used to bring us to "attend to" or "focus on" possibilities. (Hulstijn 1997; Groenendijk 2007; Yalcin 2008; Roussarie 2009; Brumwell 2009; Groenendijk & Roelofsen 2009). However, it has sofar remained unclear what exactly it means to raise a possibility, or for there to be one. As before, in response to a claim that $\diamondsuit\phi$, one might agree that, "Yes, there is the possibility that $\phi$." or that "No, there is not." but this will not all by itself serve to make $\diamondsuit\phi$ any less pointless. Surely, $\diamondsuit\phi$ can be taken to effectuate something like the presence or actuality of the possibility that $\phi$ in the common ground. The question then, however, becomes what these actually present possibilities are? One may ask, what is the difference between a state of information with, or the same one without the possibility that $\phi$. So far I have seen no answer but that the first does not, and the second does support that $\diamondsuit\phi$. Not very informative yet. Nevertheless, it seems hardly anybody would deny that such possibility statements serve a non-trivial purpose. For instance, because they have substance. In this paper I will polemically argue for this point by associating them with ordinary truth-conditions. As will come clear once we go along, nothing really hinges on the issue on whether to call these truth-conditions, or acceptability-conditions, or whatever conditions of your ilk.

The main idea pursued in this paper is that the epistemic *Might*-operator can be made more sense of if we revive an original interpretation of $\diamondsuit$ as an ordinary modal operator defined over a space, not of simple possibilities, but of information states, as proposed in the so-called data semantics from (Veltman 1984; Landman 1986). Roughly, $\diamondsuit\phi$ is taken to state $\phi$ holds in an update of the current information state. Like the $\diamondsuit$-operator from modal logic, which deems $\diamondsuit\phi$ true in a situation (world, ...) iff there is an accessible situation (world, ...) in which $\phi$ is true, epistemic *Might* ($\diamondsuit\phi$ would be rendered true if there is an update, or extension, of the current information state in which $\phi$ holds. As we will see below, this interpretation is practically sufficiently close to the interpretation of $\diamondsuit\phi$ as a consistency test on information states; however, it also allows us to make more substantial sense of statements of epistemic possibility.

Veltman and Landman have originally focused on the logical aspects of their modal operators and related conditional sentences, but they have remained by and large silent about the set up of the space of information states in which the modal operators get defined. There, it has been relatively classically assumed to be a fixed space, with a set of information states assumed given, together with

a primitive and fixed extension or update relation. With all the work that has been done on the formal semantics and pragmatics of discourse, however, such spaces of information states and their updates have been and can be investigated and formalized in lots of further detail in the meantime. In this paper I want to show that indeed a neat formulation of $\Diamond\phi$ can be given, drawing from the data semantics insights on *Might*, fleshing it out relative to a notion of a common ground, which is indexically linked to an actually occurring discourse. The space of updates or extensions of the relevant information states can be taken to consist in the future developments of the common ground in a discourse in action. And $\Diamond\phi$ can be taken to state the speaker's opinion that $\phi$ holds in a possible, maybe partial, resolution of the discourse.

## 2  Optimal Inquisitive Discourse

In order to implement the above ideas one can in principle take any classical or non-classical framework of interpretation, which deals with the raising and resolving of issues in discourse, like that of (Ginzburg 1995; Roberts 1996; Hulstijn 1997; Groenendijk 2007; Groenendijk & Roelofsen 2009), to name a few. For the present purposes it seems appropriate to build on my own (Dekker 2004; Dekker 2007), since the framework proposed there is framed in classical semantic and pragmatic terms, and arguably consistent with the others.

In (Dekker 2004; Dekker 2007) a notion of an optimal inquisitive discourse is defined that relates a set of agents whose epistemic states carry information and are troubled by questions. Let me first clarify what I mean with questions. There are questions which people have and questions people pose. Questions people have is what they wonder about, out of curiosity, but normally in relation to the Big Question, "What to do?" Questions people pose may and may not be questions people have, but normally they are, and they serve to make questions they have into issues which they share with others.

An appropriate way to model states with information and questions is given in (Groenendijk 2007) (originally from 1999) in which states are modeled by a symmetric and transitive relation on a set of possibilities. The idea is that possibilities that stand in that relation are considered possible ways the actual world or situation might be, and that the difference between connected possibilities is considered immaterial. Formally, a possibility $i$ is considered to be a way the world might be in state $\sigma$, iff there is an $i'$, typically $i$ itself, such that $\langle i, i' \rangle \in \sigma$. In such a case we say $i \in D(\sigma)$, with $D(\sigma)$ representing the data in $\sigma$. If $\langle i, j \rangle \in \sigma$, it is considered no question whether the actual world is like $i$ or $j$. However, if $i, j \in D(\sigma)$, and $\langle i, j \rangle \notin \sigma$, then the difference between the two does count. In that case the information state models the issue whether the actual world is an $i$- or a $j$-kind world. The relevant 'kinds' here are very much defined by the given information state. Like I said, states are modeled by means of a symmetric and transitive relation $\sigma$, so they induce an partition of a subset of the whole

set of possibilities, viz., of the data set $D(\sigma)$ of $\sigma$.[1] The real question modeled is then, in which block of connected possibilities the actual world resides—not which particular possibility it is in such a block.

The notion of an optimal inquisitive discourse in (Dekker 2004; Dekker 2007) is based on the simple assumption that agents involved in a communication aim to get their questions resolved in a reliable and respectable manner. In, indeed, the very simple cases, they have to do with the questions they have and with the information which is there, the joint information of the interlocuting participants. By the end of the day, the interlocutors want to get their questions resolved, so that they know what to do. Having no other information available than the information one has oneself, and what the others may provide, and, if necessary, the information from an oracle, the information which is exchanged and ends up in the common ground is ideally supported by the joint information of the interlocutors. Formally, a discourse situation involves a number of agents $a_1, \ldots, a_n \in A$, each with their own (private) information and (private) questions, modeled by information states $\sigma_1, \ldots, \sigma_n$, respectively. We also assume an oracle $\mathcal{O} = \sigma_0$ to model the possibility of solicited and unsolicited information.

**Definition 1 (Optimal Inquiry)** *An inquisitive discourse $\Phi$ among a set of agents $a_1, \ldots, a_n \in A$ with information states $\sigma_1, \ldots, \sigma_n$, together with an oracle $\mathcal{O} = \sigma_0$, is optimal iff:*

$-\ \forall i (1 \leq i \leq n)\text{:}\ D(\llbracket \Phi \rrbracket) \cap D(\sigma_i) \models \sigma_i$ *(relation)*

$(s \models \sigma,\ s\ answers\ \sigma,\ iff\ s^2 \subseteq \sigma)$

$D(\bigcap_{0 \leq i \leq n}(\sigma_i)) \subseteq D(\llbracket \Phi \rrbracket)$ *(quality)*

$\Phi$ *is minimal and well-behaved* *(quantity and manner)*

Assuming $\llbracket \Phi \rrbracket$, the interpretation of the discourse $\Phi$, to convey information and raise issues, it can be rendered as an information state in its own right. The first requirement says that $\Phi$ answers the questions of any participant.[2] In the second requirement $\bigcap_{0 \leq i \leq n}(\sigma_i)$ presents the joint information and questions of the participants. The data provided by $\Phi$ are required to be supported by the joint information of the participants. The minimality requirement obviously relates to Grice's maxim of quantity and is motivated by the insight that the Big Question is never "What is the world exactly like?", but, rather, "What to do?" with limited resources of information, reasoning, and time. A Gricean manner maxim is motivated by the observation that the exchange of information inherently involves engaging in a social practice.

The above definition indicates the way in which a discourse might ideally proceed. The participants each ask the questions they have, and the others give the required answers. Of course, it may be the case that the participants fail

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[1] We denote this as $Q(\sigma)$, defined by $p \in Q(\sigma)$ iff $\exists i \in p\text{:}\ \forall j (j \in p \leftrightarrow \langle i, j \rangle \in \sigma)$. Notice that, if we would drop transitivity, in order to cope with conditional questions, we would need to use a pseudopartition on the dataset of $\sigma$, defined by $p \in Q(\sigma)$ iff $\forall j (j \in p \leftrightarrow \forall i \in p\text{:}\ \langle i, j \rangle \in \sigma)$.

[2] This is the 'ideal' situation. If not all questions *can* be answered, we might say that an optimal discourse is one in which those are answered than can be answered.

the answer, so that one may try to consult the oracle, but this one may fail the answer as well. The main goals can be achieved differently, though. The required information may be there in a discourse situation, but distributed over the agents, or interlocutors. Thus, an optimal inquiry might run as follows then.

(1)  *A*: Will Bernd be at the reception?
(2)  *B*: I don't know. He will be if he finished his grading.
(3)  *C*: Oh, but he just finished his grading.

This is an example where *B* provides unsolicited information, which nevertheless makes the exchange run smooth. More interesting may be a case where it serves to ask a question one doesn't have, as is elaborated in some detail in (Dekker 2004; Dekker 2007). Someone may simply wonder whether or not to attend to the reception, the answer to which may depend on the configuration of lecturers attending it. Instead of spelling out the favorable and unfavorable configurations it may be worthwhile to simply ask which lecturers attend. A few sample answers of lecturers attending and those not attending may already suffice to get the original question answered. So-called conditional questions may also turn out to be very useful, potentially. I may ask "If Carla goes to the reception, will you go there as well?", and a positive reply to this question may sufficiently answer my own question in the sense that I then know I will not be going there. The main point about these examples is that they are reasonable in that they may contribute to establishing an optimal exchange, even though they are not guaranteed to do so. The reason is that, while the global goal is clear, an optimal exchange of information, after all, the agents have to act, and inquire, under uncertainty. It is against this general background that epistemic modality statements can be seen to make sense. By employing $\Diamond\phi$ we claim one points at a possible resolution of the current discourse, and this may serve to point at a possibility which deserves further investigation. This, notwithstanding the fact that, of course, the ensuing investigation may turn out negative after all.

## 3   Epistemic Modality in Discourse

The little discourse (1–3) above might have proceeded differently, for instance, as follows.

(4)  *A*: Will Bernd be at the reception?
(5)  *B*: He might have finished grading.
(6)  *A*: So, what?
(7)  *B*: If he has, he will definitely be there.

Upon this way of proceeding, the interlocutors have an incentive to go and find out whether John has indeed finished grading, that is, a new question has emerged from the possibility statement. Similarly, if I wonder whether or not to go to the reception, and ask who will be there, the assertion that Bernd might be there would elicit a possibility that would directly decide my original question: if Bernd goes I wouldn't hesitate to go as well. Again it incites to investigate or query whether Bernd indeed will come. Finally, if we are looking for the bicycle

keys, with the major issue being where the keys are, we are possibly facing a whole lot of questions, viz., for any possible location $l$ the question whether the keys are at $l$. The statement that they might be in the basement would turn the main question into a more feasible one, viz, whether they are in the basement, and we may find reason to try and find evidence for that possibility, among the interlocutors, by consulting the oracle, or, what may amount to the same thing, go down the basement and look for the keys.

In each of the above cases, of course, there is no guarantee that the stated possibility will turn out true, or supported, and, hence, may help answer our question. Still, it does incite a specific investigative action, which may lead us to do at least something to achieve the required goal. By pointing at a possible resolution of the current discourse situation, one in which $\phi$ holds, this automatically raises the question whether we can reach that state. This, naturally, provides the incentive to go and find out.

Before turning to the definition of the possibility statements themselves, we have to be more specific about possible resolutions of a discourse situation.

**Definition 2 (Resolutions)** *If $D_j$ is a discourse situation after a discourse $\Phi$ established a common ground $\gamma_j \subseteq [\![\Phi]\!]$, then a possible resolution of $D_j$ is a common ground $\gamma_r$ that answers a reaonable update $D_{r-1}$ of $D_j$, with common ground $\gamma_{r-1} \subseteq \gamma_j$ (i.e., $Q(\gamma_r) \subset Q(\sigma_{r-1})$).*

This definition is quite weak indeed, because it allows for very partial resolutions of a discourse situation.[3]

**Definition 3 (Epistemic Possibilities)** *$\Diamond\phi$ is true at $D_j$ iff $\phi$ holds in a possible resolution $\gamma_r$ of $D_j$ (i.e., iff $D(\gamma_r) \subseteq D([\![\phi]\!])$).*

The present definiton of epistemic *Might* directly accounts for a number of typical features of its use. In the first place $\Diamond\phi$ doesn't make sense in situations where $\phi$ is an issue already, or where the issue whether $\phi$ has been resolved. In the second place it is fully indexical. The truth of $\Diamond\phi$ totally depends on the situation in the discourse where it is used, and on the information available there. In the third place it is non-persistent. Once new relevant information enters the common ground, the possibility that $\phi$, once acknowledged, may eventually have to be given up. By the same token, in the fourth, and final, place, the stated possibility or resolution should not be *any* theoretically possible update of the common ground: it should be a reasonably possible update, not one which is loaded with unsolicited details orthogonal to the issues which *are* raised in the common ground. The present definition thus suits some quite common opinions about epistemic *Might*.

By way of illustration, consider the following statement.

(8) Bernd might not go to the reception.

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[3] It also needs to be adjusted for some obvious reasons, but in ways which space prohibits detailing here. For one thing, resolutions ought to include the possibility of revision of information, or, rather, exclusion of unreliable information states.

Out of the blue, this would appear to be a vacuous statement, to be rendered false indeed. However, in a context where one addresses Bernd's ex Denise, who wants to go to the reception, but who has plenty of reasons to not see Bernd, it makes sense. Suppose, that we are conversing about the reception and Ann knows that Pete goes to the reception, and Ben is sure that Pete will not go without his new friend Bernd. Denise makes the above statement. In the delicate circumstances, the statement seems true. However, in the same circumstances, delicate as they are, Ann and Ben may conjoin their information, and decide that, oops, Pete is going to the reception with Bernd. If Denise states that Bernd might not go to the reception, they will have to correct her. Notice that the sample statement changes from practically false, to deemed true, to eventually false again.

For a full account of possibility statements, and their use in discourse, we need of course to specify the notion of a reasonably possible update in much more detail. In part this will be framed against the background consisting of the interlocutors' understanding of an optimal inquisitive discourse, as defined above, but it will also have to take into account the actual discourse situation itself, the information the interlocutors have, about the (current stage of the) situation, and about each other's (lack of) information. We leave a specification of these details for the full version of the paper.

Although our understanding of epistemic modality is rather different, logically speaking, from Veltman's consistency *Might*, pragmatically speaking it makes quite similar predictions. For notice that, on the one hand, in run of the mill cases consistency of $\phi$ with the common ground corelates with the theoretical possibility of an update with $\phi$. Moreover, on the second hand, the very fact that the update with $\phi$ is suggested by any use of $\Diamond\phi$ may automatically raise it as an issue in the current discourse, and, hence, as something true in a possible resolution of the ensuing discoruse. Notice, though, that these systematic similarities are purely pragmatic, and, hence, very defeasible.

For, $\Diamond\phi$ can be rejected not just because of inconsistence of $\phi$ with the common ground, but because an update with $\phi$ is ruled out for other reasons. For instance, if $\phi$ is refused as an issue. For instance, philosophically minded persons may at any moment bring up the possibility that there might be cockroach in your coffee, that aliens from space may rule the world tomorrow, or that we are brains in a vat. Upon our understanding of might we need not believe these propositions to be false, in order to, still reject the accompanying statements of epistemic possibility. To accept these statements, it would normally require a reason to even consider the stated possibilities, while one may even also reject the possibility without further argument. Moreover, $\Diamond\phi$ can be true and accepted even if $\phi$ is inconsistent with our current implicit or explicit information. It may open up our eyes, for possibilities thoughtlessly excluded. Possibility statements may in principle announce or require an act of true belief *revision*. So while we may have not been truly believing that the keys are somewhere in the basement, but have been looking for them on the silent assumption that they are there, the announcement that we might have left them in the garage provides the incentive for another potentially very sucessful inquisitive action.

## 4   Questions and Beliefs About Modality

As defined, a possibility statement has truth-conditions, but its truth is very much context-dependent, unstable, and, hence, quite a bit negotiable. Nevertheless, with this little bit of truth-conditions $\Diamond\phi$ may non-trivially figure in attitude reports and questions. As (Gillies & von Fintel 2008; Brumwell 2009; Roussarie 2009) have observed, the following sentences do not just report or question (in)consistencies, but true worries, beliefs and questions:

(9)  Benjamin wonders whether he might go to the reception.

(10)  Sybille believes that he might stay home.

(11)  What do you think. Might Ben go somewhere else?

The present account can neatly account for this, but first observe that the interpretation of *Might* as just a consistency test appears to be quite inappropriate. When Ben is wondering whether he might go to reception, he is not just reflecting on his information. He is not inspecting his knowledge, with the question, "Well, is my information state consistent with this possibility?" Also, saying that Sybille believes that Ben might stay home does not just require that her information state be consistent with that possibility. The fact that her information does not exclude such a possibility is not sufficient for such an attribution to be true. (For, otherwise she could be attributed all kinds of epistemic possibilities about the whereabouts of my cousins whom she has never heard of.) Also, a question with *might* in it, as in (11) would really be no question. Assuming the common ground is public, we are all supposed to know whether it does or does not exclude the possibility that Ben goes somewhere else. Neither does it seem to ask for our beliefs about the common ground. (Like, "We are having a common ground together, but we don't know what it is.")

On the account presented in the previous section these statements gain full weight. Example (9) can be taken to state that Nicholas indeed wonders whether there is a reaonably possible update of his current state into one in which he comes—or if there is no such update. This does not require deciding yet, it is more like deciding if it is still conceivable to possibly decide positive. (Of course, if the outcome is negative, he would consistently decide he will not go, we hope.) Likewise, example (10) can be taken to state that Sybille believes that there is a reasonably possible update of her state to one in which Nicholas stays home. And finally, example (11) may be taken as a genuine question whether there is a reasonably possible update of the common ground in which $\phi$ holds.

Surely, much more needs to be done to formally elaborate these proposals. As above, we need to take into account indexical beliefs about the actual discourse situation, the way the interlocutors think it may or may not develop, and so on. Page limitations, however, again prohibit us to go into details.

## 5   Conclusion

In this paper I have presented a more or less classical interpretation of statements of epistemic possibility, according to which $\Diamond\phi$ states that $\phi$ holds in an

update, or resolution, of the common ground. These statements are have content, which make them suitable for use in non-trivial attitude reports and questions about epistemic possibilities. These epistemic modal statements can also be understood to guide or focus the inquisitive actions of the discourse participants. By staging and explaining *Might* utterances within a context of investigative discourse, *Might* can be seen to guide and focus our inquisitive actions.

For substantial parts of the present proposal, intuitive motivation has been given. Modeling data or information in terms of non-excluded possibilities has been given the required philosophical motivation in the work of Frege, Wittgenstein, and Tarski. Modeling questions has been independently motivated using the tools and ideas of decision theory, as it has been most perspicuously formulated in the proposals from (van Rooy 2003). By understanding discourse acts as moves towards the goal of an optimal inquisitive discourse, we may now also gain understanding the use of possibilities 'attended to'.

The perspective on the use of modality statements in discourse, which I have offered in this paper, can be taken motivate the idea of attending to possibilities, stipulated in(Yalcin 2008; Roussarie 2009; Brumwell 2009; Groenendijk & Roelofsen 2009). Nevertheless, approaches like those mentioned do not seem to elicit explanations like those given here. The reason is that they tend to understand or explain reasonable discourses in terms of the structural properties of each individual utterance relative to those of the local situation. They rely on notions of 'congruence', 'answerhood' or 'compliance', which are entirely local properties of utterances, in given discourse situations. These notions, however, will not serve to explain why and when it makes sense to ask questions which one doesn't have, or to provide information not asked for.

The present proposal seeks to understand the discourse contributions as more or less reasonable attempts to engage in the larger project of achieving an optimal inquisitive discourse. It is only relative to the wider goal of effective and reliable communication, of situated agents, that we can understand what the individual contributions can be taken to try or mean. In such a setting, it appears to be very reasonable indeed to sometimes raise questions and provide data which have been unsolicited, and, typically, to raise possibilities to attention, like we do with epistemic modality statements. A global perspective on discourse, and I think this is the one Grice originally must have had in mind, seems to automatically make sense of these contributions.

I would like to conclude the paper with a final observation, in line with the present discussion. First, maybe Goldbach's second conjecture is true, while it is false to say that it might be true. We simply don't know. Second, it is not so that we might be all wrong about everything. Surely, this is not to say that we are right about anything.

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