A Pragmatic Solution to the Problem with *Might*[*]

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1 INTRODUCTION

Disagreement data like the following have played an important role in developments in the theory of epistemic modals over the last decade or so:

(1) **A**ndrea: Paul might have been at the party last night.
Bertrand: {You're wrong, No way, Thats false}, he was in Barbados.

Since Kratzer (1977), the standard conception of epistemic modals like *might* within formal semantics has been that they quantify over a modal base comprising the set of all worlds compatible with 'what is known'. This immediately raises the question: known by who?[1] An intuitive answer to this question is: known to the speaker. The intuition is that a speaker's assertion of a *might*-claim is licensed by their own knowledge state, not by the presumption that they have authoritative command of some other knowledge state. Let's call this view—namely, that the epistemic state relevant to the interpretation of matrix epistemic modals is the speaker's—SOLIPSISTIC CONTEXTUALISM, following Yanovich (2014). Despite the intuitive appeal of solipsistic contextualism, a surprisingly broad consensus has emerged that data like (1), the relevance of which was first noted by Hawthorne (2004), are fatal to solipsistic contextualism.

The reason why data like (1) and other discourse data like it (q.v. Yalcin 2011, Swanson 2011, Knobe & Yalcin 2014, MacFarlane 2014) have been taken to be problematic for solipsistic con-

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[1]Note that this question is not specific to frameworks in which modals are quantifiers over worlds—it's also pertinent to probabilistic accounts of epistemic modality (Swanson 2011, 2015, Lassiter 2011, 2016, 2015, Moss 2015). The question for these theories becomes: probable in whose estimation?

textualism is this: if **A**'s claim is a claim about **A**'s own knowledge state, i.e. it is true iff Paul having been at the party last night is an epistemic possibility available to **A** at the time of utterance, then **B**'s response of *you're wrong* should mean 'your epistemic state does not actually allow for that possibility'. But that's not what is going on in (1). Rather, **B**'s response expresses that the prejacent is not an epistemic possibility *for him* (and goes on to specify why that is so). Intuitively, an interlocutor's disagreement with a *might*-claim is licensed by the relationship of that *might*-claim to their own epistemic state, not the speaker's, an intuition that is seemingly at odds with the intuition that underlies solipsistic contextualism. As Stalnaker (2014) puts it, "The puzzle is that no way of pinning the relevant knowledge state down seems to be able to explain both why we are in a position to make the epistemic "might" claims we seem to be in a position to make, and also why it is often reasonable to disagree with "might" claims made by others" (pp. 137-138).

The responses to this problem that have been proposed in recent literature are wide-ranging. Some proposals hold onto the basic Kraterzian contextualist picture, while pursuing non-solipsistic approaches to the choice of modal base that matrix epistemic modals quantify over— for instance von Fintel & Gillies (2011) propose that epistemic modals are radically ambiguous in terms of what modal base they are to be interpreted relative to, giving rise to a 'cloud' of possible denotations, and Yanovich (2014) proposes that the denotation of epistemic modals is sensitive to extragrammatical factors like the practical goals of the current conversation. Other proposals, which we could call, speaking loosely, 'relativist' approaches (Egan et al. 2005, Egan 2007), treat epistemic modals as sensitive to contextual parameters like judges (Stephenson 2007), information states (Yalcin 2007, Stalnaker 2014), or contexts of assessment (MacFarlane 2011). Still other proposals, which we could call, speaking loosely, 'expressivist' or 'nonfactualist' approaches (Yalcin 2011, Rothschild 2012, Swanson 2015), embrace views in which *might*-claims don't have standard propositional denotations at all, treating *might* as a syncategorematically-defined update operator (Veltman 1996) that indicates that its prejacent is a 'live possibility' (Willer 2013) or expresses lack of belief in the complement of its prejacent (Hawke & Steinert-Threlkeld 2016).

My goal in this paper is to argue that the consensus that motivated the move from solipsistic contextualism to the family of approaches cited above, namely that data like (1) are incompatible with the solipsistic contextualist view, was premature. I show that disagreement data like (1) are not problematic for the solipsistic contextualist view *simpliciter*, but rather are problematic for the solipsistic contextualist view *in conjunction with* some standard Stalnakerian assumptions about the pragmatics of assertion. Therefore, the solution to the problem could be either to change the semantics of epistemic modals, or to change the pragmatics of assertion (or both). Prior literature has focused overwhelmingly on the former path; I develop here a solution following the latter path.

I present here a revised Stalnakerian pragmatics of assertion that behaves identically to Stalnaker (1978) for all sentences whose semantics does not reference the epistemic state of the speaker, but which accurately derives the disagreement behavior of matrix epistemic modals from their solipsistic contextualist interpretation. The informal version of this pragmatics of assertion, which is developed formally below, is that when a speaker asserts a sentence, they are presenting themselves as though they know it to be true—i.e. they are predicating something of their

epistemic state—and they are proposing that the context be modified to reflect their own epistemic state in the way they've highlighted. On this view of assertion, the explanation for the discourse behavior of epistemic modals follows from their interaction with the epistemic nature of assertion, rather than from a special semantics for epistemic modals. Though I take the possibility of a pragmatic solution to defang some arguments for the desirability of the proposals cited above, I stop short of arguing that situating a solution in the pragmatics is superior to the semantic approaches cited above on strict grounds of empirical adequacy. However, after presenting my positive proposal I point out some desirable features of maintaining the solipsistic contextualist view of epistemic modals, and some desirable consequences of the proposed model of assertion.

The structure of this paper is as follows: In §2 I briefly show that the assumptions we make about the pragmatics of assertion play a crucial role in the problem (1) poses for the solipsistic contextualist interpretation of epistemic modals. In §3, I present my positive proposal, a conservative reframing of the Stalnakerian pragmatics of assertion that derives the disagreement behavior of matrix epistemic modals from their solipsistic contextualist interpretation while preserving Stalnakerian update for assertions of sentences that do not reference the epistemic state of the speaker. In §4 I discuss some reasons why it is desirable to maintain the solipsistic contextualist account of matrix epistemic modals, and highlight some ramifications of the proposed model of assertion.

2   THE ROLE OF ASSERTION IN THE DISAGREEMENT PROBLEM

Let's revisit the problem of disagreement over *might*-claims and work through the explanation of why it is a problem for solipsistic contextualism a little more carefully.

Consider, first, a disagreement that doesn't involve an epistemic modal claim.

(2)   **A**: Paul was at the party last night.
       B: {You're wrong, No way, That's false}, he was in Barbados.

One intuitive account of what is going on here is that in this interaction, when **A** asserts p, she is presenting herself as if it is true given her knowledge. When **B** rejects p, he is presenting himself as if p is incompatible with his knowledge. The same intuitive account of what's going on seems to extend to disagreement over *might*-claims as well. Consider (1), repeated here as (3):

(3)   **A**: Paul might have been at the party last night.
       B: {You're wrong, No way, That's false}, he was in Barbados.

We can characterize this interaction along the same lines as the disagreement over a non-modal claim above: when **A** asserts *might-p*, she is presenting herself as if p is a possibility given her knowledge. When **B** rejects *might-p*, he is presenting himself as if p is not a possibility given

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his knowledge. This seems like the same thing as is going on with non-modal disagreements. So what is the problem?

Though the informal characterizations of the two disagreements given above seem parallel to each other, only the first follows from the standard Stalnakerian pragmatics of assertion, as originally outlined in Stalnaker (1978). On this view of assertion, to assert a sentence is to propose that all interlocutors agree to behave as though the actual world is a member of the proposition that sentence denotes. More formally, an assertion is a proposal that the context set (i.e., the set of worlds considered to be candidates for the actual world for the purposes of the conversation) be intersected with the proposition denoted by the asserted sentence.

In the former case, that of non-modal disagreement, the speaker has proposed that the context set be intersected with the proposition p, the result of which would be that all of the worlds in the context set would be p-worlds. Assuming that the addressee is being sincere, her rejection of that proposed update indicates that she thinks the actual world is not a p-world, and so doesn't want to exclude all non-p worlds from the context set.

In the latter case, assuming both the solipsistic contextualist semantics of matrix epistemic modals and the Stalnakerian pragmatics of assertion, the speaker has proposed that the context set be intersected with the proposition $might$-p (the set of all worlds in which $might$-p is true). In order to generate a propositional denotation for $might$-p, its modal base must be fixed— if the relevant modal base is taken to be the speaker's epistemic state, then the denotation is the set of all worlds in which the speaker's epistemic state doesn't rule out p. So the result of the speaker's proposed update would be the exclusion from the context set of all worlds in which the speaker's epistemic state doesn't rule out p. Given this, the addressee's rejection of the proposed update would indicate that she does not think that the actual world is a world in which the speaker's epistemic state doesn't rule out p. In other words, the addressee should be understood to be rejecting the speaker's description of her own epistemic state. That this interpretation of the disagreement in (3) is unavailable, and that the actual interpretation of that disagreement is that **B** believes the $might$-claim's prejacent to be false, are both wholly unexpected on this view.

What I want to stress about the above explanation is that the solipsistic contextualist truth conditions for $might$ don't render the disagreement in (3) unexpected all by themselves. It's only when they're implemented within a theory of what a speaker is *doing* with a sentence's denotation when they assert it that we make any predictions whatsoever about what information that assertion is putting forward—i.e. what update to the conversational context is being proposed—and what it means to disagree with with that assertion—i.e. under what circumstances an interlocutor is justified in rejecting the proposed context update.

In the next section, I present a formal proposal for a conservative reframing of Stalnaker's account of assertion that captures the parallelism of the intuitive accounts given for the two disagreements above. In this pragmatics, rather than assertion putting forward a propositional denotation directly, when a speaker makes an assertion she presents herself as though she knows the asserted sentence to be true—i.e. she predicates of her epistemic state that the asserted sentence is true at every world in it—proposes that the context be modified to reflect her own epistemic state in the way she has highlighted.

3 THE ACCOUNT

In this section I will present a revised Stalnakerian pragmatics of assertion, and implement within it the widely-adopted Ordering Semantics for modals, familiar from Kratzer (1981, 1991). I show that the resulting system accurately predicts the observed disagreement behavior of *might*-claims given a solipsistic contextualist semantics, and that it derives a novel, informative update potential for *might*-claims. I will proceed in three steps. First, in §3.1, I'll present the basic system, and apply it to the assertion of a sentence whose semantics makes no reference to the speaker's epistemic state, showing that it derives the same results as Stalnaker (1978): intersection of the context set with the proposition denoted by the asserted sentence. Then, in §3.2, I'll implement a simplified version of the Kratzerian semantics for *might*, that does not involve ordering sources, to show how reference to epistemic modality at the matrix level derives different results than are derived for sentences that make no reference to the speaker's epistemic state. Specifically, I will show that the proposed pragmatics derives exactly the update proposed by Veltman (1996) for *might*-claims: the context set will be left unaltered if it has a non-trivial intersection with the prejacent, and anomaly will result otherwise. Because this implementation derives Veltman's update, it inherits the problems of that proposal (Willer 2013, Rudin 2017)—it is inherently uninformative. The Ordering Semantics was designed in part to render possibility modals more informative, and so in §3.3, I'll implement the full Ordering Semantics, extending the representation of contexts from the Stalnakerian context set to a tuple of a context set and an ordering source, and show that the proposed pragmatics derives a novel update potential for assertions of *might-p*: it falls out of the pragmatics that such an assertion is a proposal that p be added to the context's ordering source. This implementation comprises the final form of this paper's central proposal.

3.1 THE BASIC PRAGMATIC SYSTEM

I assume, following Stalnaker (1978), that a conversational context comprises a set of possible worlds, representing the set of all worlds mutually assumed to be candidates for the actual world for the purposes of the conversation. This set is called the CONTEXT SET.[2]

(4) CONTEXTS:
     A context c is a set of worlds.

I assume, still following Stalnaker, that assertions are proposals to add information to the context, resulting in the shrinking of the context set.[3] I will not, however, model assertions as proposals to add propositions to the common ground, from which the context set is derived via grand intersection. The novel component of the pragmatic system developed here is that

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[2]For more finely elaborated models of conversational context, see e.g. Roberts (1996), Ginzburg (1996), Farkas & Bruce (2010). I assume this extremely simple notion of context for presentational simplicity, as the elaborations provided by the models above are irrelevant to the phenomena I discuss here.

[3]In §3.3 I will extend the model of contexts from a context set to a tuple of a context set and an ordering source. In that model, information can be added to the context either by shrinking the context set or by adding propositions to the ordering source.

a speaker's assertion is modeled not as putting forward a proposition and asking that it the context set be intersected with it, but as putting forward a set of epistemic states and asking that the context set be modified such that it becomes a member of that set. I turn now to the motivation for such a system.

Call the set of all worlds compatible with an agent's knowledge in world w at time t that agent's EPISTEMIC STATE in w at t.[4]

(5) EPISTEMIC STATES:
An epistemic state i is a set of worlds.

When a speaker asserts a sentence denoting a proposition p, they're presenting themselves as though they know it to be true (q.v. Williamson 2000). This triggers the following pragmatic reasoning process for their interlocutors: *the speaker has just claimed that they know the sentence they've asserted to be true—if they really knew the sentence to be true, what would their epistemic state look like?* If the speaker indeed knows a sentence denoting p to be true, that means that p is true at every world in the speaker's epistemic state; when a speaker asserts a sentence, they have predicated of their epistemic state that that sentence is true at every world in it.

We can formally generate the set of epistemic states that the speaker is presenting herself as having a member of by applying a 'meta-intensionalization' operator to the denotation of the sentence she has asserted:

(6) META-INTENSIONALIZATION:
META-INTENS $= \lambda p.\lambda i.[\forall w : w \in i]p(w) = 1$

The variable i ranges over epistemic states—that is to say, it ranges over functions from worlds to truth values (i.e. characteristic functions of sets of worlds), just like the variable p does. To facilitate readability I use the variable p to represent propositional denotations, and I use the variable i to represent information states, though they are the same kind of formal object.[5]

The crux of the pragmatics of assertion I propose here is this: when a speaker makes an assertion, in addition to portraying herself as having an epistemic state that is a member of the set generated by meta-intensionalizing the denotation of the sentence she has asserted, she is also proposing that the context set be modified to reflect her epistemic state in the way she has highlighted—i.e., is should be modified such that it becomes a member of that set of epistemic states.

To put it very informally, I propose that when a speaker makes an assertion, she is putting forward a set of epistemic states, and saying: my epistemic state is one of these, and the context set should be one of these too.[6]

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[4]I will suppress reference to the relevant world and time throughout the rest of the paper, whenever doing so will cause no confusion.

[5]In §3.3, we'll change our conception of epistemic states from a set of worlds to a tuple of a set of worlds and an ordering source, rendering i and p no longer of the same type.

[6]For a model that makes a clear formal decomposition of assertion into these two components, speaker commitment and proposed update, see Farkas & Bruce (2010), Farkas & Roelofsen (2017)

To put it more formally:

(7) ASSERTION:
  a. LICENSING:
      A speaker is licensed in asserting a proposition p iff her epistemic state is a member of META-INTENS(p)
  b. UPDATE (informal version):
      When a speaker asserts a proposition p, she is proposing that the context be modified in the most conservative possible way such that it becomes a member of META-INTENS(p)

This notion of update requires some unpacking. I assume, following Veltman (1996) among many others, that information growth in a well-behaved conversation is monotonic—if a conversational context requires non-monotonic modification, that is a signal that something has gone wrong, and the conversation has been defective in some way. If the context is only a set of worlds, as I've been assuming so far, there is only one way to monotonically increase the information represented by that set: to remove worlds from it.[7] I will rely on the following notion of refinement in enforcing monotonicity of update:

(8) REFINEMENT:
      A context c' is a refinement of a context c ($c' \leq_r c$) iff $c' \subseteq c$

Monotonicity of update can be enforced with the following stipulation:

(9) MONOTONICITY CONDITION ON CONTEXT UPDATE:
      For any context update mapping an input context c_i to an output context c_o, $c_o \leq_r c_i$

This defines the space of possible modifications that can be made to the context—so what exactly does it mean to modify the context 'in the most conservative possible way'?

(10) UPDATE (formal version):
      When a speaker asserts a sentence denoting p in a context c, she is proposing that a p-commensurate and p-conservative function be applied to c

There are three concepts that need to be defined to make sense of this update condition.

(11) COMMENSURATIVITY:
      For any function f, proposition p, f is p-commensurate iff $[\forall c : c$ is p-compatible]$f(c) \in$ META-INTENS(p)

Informally: the context update associated with an assertion of p must result in the context becoming a member of the set of epistemic states a speaker presents herself as having a member of by virtue of her assertion.

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[7]Note, again, that in §3.3 the representation of contexts will be extended to a tuple of a context set and an ordering source, expanding the possible ways of increase the information represented by the context to either removing worlds from the context set or adding propositions to the ordering source.

(12)　CONSERVATIVITY:
　　　For any function f, proposition p, f is p-conservative iff $[\forall p' : [\forall c : c$ is p-compatible$]f(c)$
　　　$\in$ META-INTENS$(p')]p \subseteq p'$

Informally: the context update associated with an assertion of p must not guarantee that the resulting context entail anything that isn't already entailed by p.

(13)　COMPATIBILITY:
　　　For any context c, proposition p, c is p-compatible iff $[\exists c' : c' \leq_r c]c' \in$ META-INTENS(p)
　　　$\wedge\ c' \neq \varnothing$

Finally: when we thinking about p-commensurativity and p-conservativity, we should restrict our attention to contexts that have non-empty refinements that are members of META-INTENS(p)—i.e., contexts that could be updated to reflect the speaker's information state without resulting in anomaly. I take compatibility to also be a condition on the cooperativity of an assertion: an assertion of p is only cooperative relative to a p-compatible context, as if the context is not p-compatible, it will be impossible for the update to be successful.

The overall view of update we get from the definition in (10) is that the assertion of a sentence denoting p is assigned an update potential that guarantees that the resulting context be a member of META-INTENS(p) without guaranteeing that the context entail anything not entailed by p.

Before we move on to a concrete example, it is important that we define the licensing condition for disagreement. I take disagreement to also interact crucially with META-INTENS(p), the set of all possible epistemic states the speaker could have if they indeed know the sentence they've asserted to be true:

(14)　DISAGREEMENT:
　　　A speaker is licensed in disagreeing with an interlocutor's assertion of p if her epistemic state is not p-compatible.[8]

In other words, when a speaker A disagrees with an assertion of p by a speaker B, A is presenting herself as though there is no way in which she could monotonically update her epistemic state to make it share the relevant property that B has predicated of her own epistemic state: that of being a member of META-INTENS(p). This follows from the role the context is taken to play in a Stalnakerian framework: the representation of the information that all interlocutors are willing to commit to for the purposes of the conversation. If the proposed update would result in a context that is incompatible with an interlocutor's epistemic state, she is licensed in rejecting that update.

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[8]Note that I've written 'if' and not 'iff' here. This is a particularly strong form of disagreement; speakers can also reject assertions if they believe the speaker to have insufficient evidence for their claim, for example, even if they don't know the claim to be false. For expository ease, I focus in this paper exclusively on cases in which it can be inferred that the speaker's disagreement is licensed by the condition in (14).

3.1.1 A SIMPLE EXAMPLE

Modulo the addition of ordering sources in §3.3, the above comprises the entire system put forward in this paper. I'll now walk through a concrete example to make the operation of the system clear.

Consider a simple sentence like *John is dead*. I assume the following propositional denotation for this sentence, abstracting away from irrelevant complexities:

(15) $[\![\text{John is dead}]\!] = \lambda w.dead'(j)(w)$

When a speaker asserts this proposition, she presents herself as though her epistemic state is a member of META-INTENS($\lambda w.dead'(j)(w)$) and proposes that the context be made a member of that set.

(16) META-INTENS($\lambda w.dead'(j)(w)$)
      $= (\lambda p.\lambda i.[\forall w : w \in i]p(w) = 1)(\lambda w.dead'(j)(w))$
      $= \lambda i.[\forall w : w \in i]dead'(j)(w) = 1$

For this proposition, the set of epistemic states the speaker could possibly have if she knows it to be true is the set of all subsets of the proposition itself. To see this, imagine a set of worlds W containing three worlds, w_1, w_2, and w_3. The proposition denoted by *John is dead* maps w_1 and w_2 to 1, and w_3 to 0. Relative to this set of worlds, the denotation of (16) is this:

(17) $\left\{ \begin{array}{c} \{w_1, w_2\} \\ \{w_1\} \quad \{w_2\} \\ \varnothing \end{array} \right\}$

In this case, META-INTENS(p) returns the set of all epistemic states containing only p-worlds. We will see in §3.2 that this will not be the case for propositions whose semantics makes direct reference to the speaker's epistemic state.

3.1.2 UPDATE POTENTIAL

Given that in this case, META-INTENS(p) is the set of all subsets of p, it is trivial to derive the update condition associated with the assertion: it is Stalnakerian update, i.e. intersection of the context set with p.

To see this, recall the update condition from (10). It specifies that the update potential of the assertion of a proposition p is an operation that guarantees that any p-compatible context to which it is applied will become a member of META-INTENS(p), but doesn't guarantee that the resulting contexts will entail anything not entailed by p. Recall as well that we've assumed that updates must take the form of monotonic information increase, i.e. the only maneuver available to us is to remove worlds from the context set. Given that we're dealing with a proposition p whose meta-intensionalized denotation is simply the set of all of its subsets, this means that we

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need an operation that will render the context set a subset of p, without removing any worlds that aren't necessary to achieve that—an operation that will remove all and only those worlds from the context that prevent it from being a subset of p. Intersecting the context set with p is precisely such an operation. Because this reasoning follows from the characteristic structure of (17), it follows that this model of assertion predicts that Stalnakerian updates will be associated with all propositions p whose meta-intensionalized denotations comprise the set of all subsets of p—i.e., those that do not directly reference the speaker's epistemic state. In §3.2, we'll see how a proposition referencing the speaker's epistemic state can lead to a meta-intensionalized denotation that does not have the property of being closed under subset.

3.1.3 Disagreement

Finally, consider what a speaker does when they disagree with an assertion of *John is dead*: they represent themselves as though their epistemic state is not p-compatible. Recalling the definition of p-compatibility from (13), this means that in disagreeing with an assertion of p, the speaker represents themselves as though no subset of their epistemic state (other than the empty set) is a member of META-INTENS(p). As in the case at hand META-INTENS(p) is simply the set of all subsets of p, the disagreer therefore represents herself as though there are no p-worlds in her epistemic state—i.e., as though she knows p to be false.

In the next section we'll see that if the sentence includes a matrix epistemic modal (interpreted in the solipsistic contextualist fashion), its meta-intensionalized denotation will not be the set of all subsets of its propositional denotation, and so update and disagreement will both proceed slightly differently.

3.1.4 The role of sets of sets of worlds

Before we move on, let me briefly comment on the fact that the proposed pragmatics of assertion involves, at some step of the computation, the generation of a set of sets of worlds.

The use of sets of sets of worlds in the modeling of context update is a familiar feature of a variety of proposals—see for instance Beaver (2001), Willer (2013), and Ciardelli et al. (2013). However, I have not proposed that the context itself be lifted to a set of sets of worlds, as Beaver and Willer do, nor have I proposed that sentences denote sets of sets of worlds, as in Inquisitive Semantics. Rather, in my proposal these sets of sets of worlds enter the picture only as part of a pragmatic reasoning process about how the speaker is characterizing her epistemic state, and how she is proposing that the context be updated. The model of contexts and how they are updated that I am presenting here is still the familiar Stalnakerian one: the context is a set of worlds, and it is updated by having worlds removed from it.

There is an especially strong parallel between my meta-intensionalized denotations, which often result in sets that are closed under subset, and the concept of a sentential denotation in Inquisitive Semantics, which treats all sentential denotations as being closed under subset. However, closure under subset is not an inherent property of the sets of sets of worlds generated

by my meta-intensionalization operation, and in the next section we'll see that that operation generates sets with quite different properties when applied to *might*-claims.

3.2   IMPLEMENTING THE SIMPLEST SEMANTICS

In this section, I show how this model of assertion interacts with the simple quantificational semantics for *might* (Kratzer 1977). I'll show that the model derives the 'consistency test' semantics for *might* (proposed by Veltman 1996 in the context of Update Semantics) from the interaction between the simple quantificational semantics and the proposed model of assertion. This will suffice to show that the proposed model of assertion can account for the disagreement behavior of *might*-claims given the solipsistic contextualist semantics for *might*. However, the consistency test semantics has been criticized for predicting all assertions of *might*-claims to be informationally trivial (see e.g. Willer 2013). In §3.3, I show how the ordering semantics of Kratzer (1981, 1991), which assigns a stronger semantics to *might*, interacts with the model of assertion, deriving a novel, informative update for *might*-claims.

The simple semantics for *might* which we will be concerned with in this section is as follows:

(18) $[\![might]\!] = \lambda p.\lambda w.[\exists w' : w' \in \text{EPIST-WORLDS}_w]p(w') = 1$
Where EPIST-WORLDS_w is the set of all worlds compatible with a contextually salient body of knowledge in w

Recall that we are assuming the solipsistic contextualist semantics for epistemic modals—that assumption amounts to the stipulation that EPIST-WORLDS_w will, for a matrix epistemic modal, be the set of all worlds compatible with what the speaker knows in w.

If we meta-intensionalize a *might*-claim, given this semantics, we get the following:

(19)   a. $[\![\text{John might be dead}]\!] = \lambda w.[\exists w' : w' \in \text{EPIST-WORLDS}_w]dead'(j)(w') = 1$
b. $\text{META-INTENS}([\![\text{John might be dead}]\!])$
     $= \lambda i.[\forall w : w \in i][\exists w' : w' \in \text{EPIST-WORLDS}_w]dead'(j)(w') = 1$

Recall that meta-intensionalization in a way of formalizing pragmatic reasoning about how the speaker is presenting her epistemic state. Therefore, i ranges over candidates for EPIST-WORLDS_{w0}, the speaker's epistemic state in the world of utterance. Given the solipsistic contextualist assumption that for any world w, EPIST-WORLDS_w represents the epistemic state of the speaker in w, what (19b) gives us is the set of all epistemic states belonging to the speaker comprised solely of worlds in which her epistemic state contains a p-world. In order to make sense of what this set of epistemic states looks like, we need to make some assumptions about the logical structure of the epistemic accessibility relations that are invoked by epistemic modals, in order to understand what it means to say that a world w'' is epistemically accessible (at time t) from a world w' that is epistemically accessible (at time t) to the speaker in w (at time t).

A speaker's epistemic accessibility relation in a world w at a time t represents the set of all worlds they consider at t to be live epistemic possibilities for which world they're in. I make the assumption that a speaker in w at t does not consider worlds in which their knowledge is different than it is in w at t to be live candidates for what world they are in. This is an intuitive enough assumption, which can be captured by assuming that epistemic accessibility relations R obey the following five axioms:

(20)   For all worlds w:
    a.   SERIAL: $\exists w' : w\mathrm{R}w'$
    b.   REFLEXIVE: $w\mathrm{R}w$
    c.   TRANSITIVE: $(w\mathrm{R}w' \wedge w'\mathrm{R}w'') \rightarrow w\mathrm{R}w''$
    d.   SYMMETRIC: $w\mathrm{R}w' \rightarrow w'\mathrm{R}w$
    e.   EUCLIDEAN: $(w\mathrm{R}w' \wedge w\mathrm{R}w'') \rightarrow w'\mathrm{R}w''$

The axiom of seriality represents the assumption that speakers always have at least one world epistemically accessible to them. The axiom of reflexivity represents the assumption that speakers always consider the world they're in to be epistemically possible. These represent commonplace assumptions about the nature of epistemic (as opposed to doxastic) modality. The other three axioms guarantee that every world that is epistemically accessible from a world w is epistemically accessible from every other world accessible from w. These are the five axioms that define an S5 modal logic (see Garson 2016, especially §8)—it is a common assumption in the linguistic and philosophical literature on epistemic modality that epistemic accessibility relations are S5 modal logics (see e.g. Stalnaker 2014, p.140). Assuming epistemic accessibility relations to be S5 modal logics means that epistemic accessibility relations define fully connected graphs over the worlds in a speaker's epistemic state. For a concrete example, assume that the speaker is in w_1, and that her epistemic state is $\{w_1, w_2, w_3, w_4\}$. By the axioms above, her accessibility relation over that set of worlds looks like this:

(21)
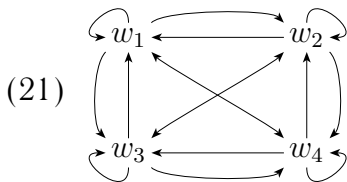
This graph illustrates the generalization made above: that the consequence of the assumption that epistemic accessibility relations are S5 modal logics is that every world that is epistemically accessible from a world w is epistemically accessible from every other world accessible from w. This generalization can be stated in the following, less graph-theoretic way: the speaker's epistemic modal base is identical in all worlds epistemically accessible to her. This is restated below:

(22) $[\forall w' : w' \in \text{EPIST-WORLDS}_w]\text{EPIST-WORLDS}_{w'} = \text{EPIST-WORLDS}_w$

Let's return to the meta-intensionalized denotation in (19b), repeated as (23), with this assumption in hand.

(23) $\lambda i.[\forall w : w \in i][\exists w' : w' \in \text{EPIST-WORLDS}_w]dead'(j)(w') = 1$

In this formula, both i and EPIST-WORLDS_w represent the speaker's epistemic state, via the pragmatic reasoning that the meta-intensionalizer represents and the assumption of solipsistic contextualism, respectively. i ranges over candidates for EPIST-WORLDS_{w0}; for each w in each i, EPIST-WORLDS_w represents the speaker's epistemic state in w. By (22), then, for every i, EPIST-WORLDS_w will be equivalent to i for all w in i. In other words, (23) will be equivalent to (24):

(24) $\lambda i.[\forall w : w \in i][\exists w' : w' \in i]dead'(j)(w') = 1$

This formulation makes it clear that the universal quantification is vacuous, allowing us to simply the formula to the following:

(25) $\lambda i.[\exists w : w \in i]dead'(j)(w) = 1$

In other words, assuming both the solipsistic contextualist and the simple quantificational semantics for *might*, the meta-intensionalized denotation for *might-p* is the set of all epistemic states that contain at least one p-world. Imagine again a set of worlds W containing w_1, w_2, and w_3, where the proposition denoted by *John is dead* maps w_1 and w_2 to 1, and w_3 to 0. Relative to this set of worlds, (25) looks like this:

(26) $$\left\{ \begin{array}{c} \{w_1, w_2, w_3\} \\ \{w_1, w_2\} \quad \{w_1, w_3\} \quad \{w_2, w_3\} \\ \{w_1\} \, \{w_2\} \end{array} \right\}$$

Note that this set has a different structure from the previous meta-intensionalized denotation that we saw in (17). We saw in the previous section that the meta-intensionalized denotation of a proposition that makes no reference to the speaker's epistemic state will simply be the set of all subsets of that proposition. What we've seen here is that when a proposition makes reference to the speaker's epistemic state, meta-intensionalizing it does not necessarily result in the set of all subsets of that proposition, not by any special stipulation but entirely from the interaction between the proposition's invocation of the speaker's epistemic state, and the meta-intensionalizer's invocation of the speaker's epistemic state.

3.2.1 DISAGREEMENT

The formulation of the felicity of disagreement given in (14) specifies that in disagreeing with an assertion of p, a speaker presents herself as though her epistemic state is not p-compatible. The meta-intensionalized denotation of *might-p*, given in (26), is the set of all sets of worlds including at least one p-world. Given the definition of compatibility in (13), a speaker's epistemic state is not *might-p*-compatible relative to the denotation in (26) iff it has no p-worlds in it. This captures precisely the intuitive meaning of disagreement over *might*-claims: when a speaker disagrees with a *might*-claim, she presents herself as though p is incompatible with her

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knowledge. This paper's model of assertion predicts that disagreement is licensed by the disagreer's lack of epistemically accessible p-worlds, and communicates that the degreer thinks p is false, even though the semantics of *might* invokes only the assertor's epistemic state.

3.2.2 UPDATE POTENTIAL

In the previous section, we derived intersective updates as the update potential for all propositions whose meta-intensionalized denotations comprise a proposition and all of its subsets—this is because intersection is the most conservative operation that guarantees that one set will become a subset of another. That logic does not go through for a meta-intensionalized denotation that is not closed under subset, like (26).

So what will the update potential for a *might*-claim will be, if not intersection? To see the answer to this, consider first which contexts are compatible (in the sense of (13)) with the denotation in (26). All contexts either have a p-world in them, or have no p-worlds in them. Contexts with no p-worlds in them are not compatible with this denotation: no refinement of them is a member of (26). Contexts with p-worlds in them are already members of (26), as it is the set of all sets of worlds containing at least one p-world. In other words, it is a logical necessity that any context is either incompatible with (26), or is already a member of it. For contexts of the latter class, no further modification is necessary to make it a member of (26), so the most conservative update is to leave it alone. For contexts in the former class, no monotonic modification can make it a member of (26), so the update fails.[9]

To summarize: the update potential of *might-p*, given the simple quantificational semantics for *might*, is exactly that proposed by Veltman (1996): it leaves the context untouched if it has a p-world in it, and it is anomalous otherwise. It's worth noting that this result, which Veltman (1996) achieved by analyzing *might* is a syncategorematically-defined update operator, is derived from the interaction between the fully general proposal for the operation of assertion and the simple quantificational semantics of *might* given by Kratzer (1977)—the special behavior of *might*-claims comes without needing to treat them as denoting anything other than a standard proposition.

One immediate problem for the Veltmanian consistency test semantics for *might* is that it renders *might*-claims intrinsically uninformative (Willer 2013). The Ordering Semantics for modality (Kratzer 1981, 1991) was designed to address informativity issues related to modal claims, strengthening possibility modals and weakening necessity modals. In the next section, I show how the model of assertion can be extended to implement the Ordering Semantics. I do this by extending the notion of contexts and epistemic states from a set of worlds to a tuple of a set of worlds and an ordering source; I show that this extension has no effect on the way sentences whose semantics don't invoke ordering sources interact with the pragmatics of

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[9]Peter Klecha (p.c.) notes that this result follows only given the assumption that all updates are monotonic. If information growth were allowed to be non-monotonic, i.e. if updates were allowed to add worlds to the context, the update potential of *might-p* relative to a context with no p-worlds in it could be to add p-worlds to the context. A fuller discussion of the possibilities made available by non-monotonic update systems, and the problems posed by them, is outside the scope of this paper.

assertion, and then I show how it derives a novel, informative update effect for *might*-claims, without sacrificing the feature that speakers are licensed to disagree with *might*-claims when they have no p-worlds in their epistemic modal base.

3.3   THE FINAL IMPLEMENTATION

In this section, I extend the model of assertion to include ordering sources in its representation of contexts and epistemic states. The Ordering Semantics for modality (Kratzer 1981, 1991) is predicated on just such an extension—it takes the interpretation of epistemic modals to be sensitive to not just a set of worlds, but a set of worlds plus a set of propositions from which an ordering over them is to be induced. The Ordering Semantics for *might* takes it to entail what Kratzer calls HUMAN POSSIBILITY, which I've presented here as simplified via the limit assumption (Portner 2009 p.66):

(27)   HUMAN POSSIBILITY:
$[\![might]\!] = \lambda p.\lambda w.[\exists w' : w' \in \text{BEST}_{C_w}]p(w') = 1$
Where C_w is a tuple of an epistemic modal base b_w and an epistemic ordering source O_w, a set of propositions known to be especially normal or likely
Where $\text{BEST}_{C_w} = \{w' : w' \in b_w \land \neg\exists w'' \text{ s.t. } w'' >_{O_w} w'\}$
Where $\forall w', w'', w' \geq_{O_w} w''$ iff $\forall P \in O_w, w'' \in M \to w' \in M$ ($w' >_{O_w} w''$ iff $w' \geq_{O_w} w''$ and $w'' \not\geq_{O_w} w'$)

This amounts to treating *might* as quantifying over a special subset of an epistemic modal base: the set of all worlds in that modal base that are maximally normal or likely. This allows for more informative *might*-claims—rather than entailing that the prejacent is merely not ruled out by the relevant body of knowledge, they entail that the prejacent is represented among the most normal/likely options highlighted by the relevant body of knowledge.[10] The solipsistic contextualist interpretation of the Ordering Semantics for epistemic modals is that in addition to the relevant epistemic modal base for the interpretation of matrix epistemic modals being the set of all worlds compatible with the speaker's knowledge, the relevant epistemic ordering source is the set of all propositions known by the speaker to be especially normal or likely.

The Ordering Semantics is predicated on this extension of the epistemic state relevant to the interpretation of an epistemic modal from a modal base to a tuple of a modal base and an ordering source.

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[10]Note that probabilistic semantics for modals also allow for stronger possibility modals. Probabilistic accounts generally treat epistemic modals as entailing that their prejacents are associated with epistemic probability above some threshold. This analysis has been applied to a variety of phenomena: for example to statements of comparative probability by Lassiter (2015), to strengthening inferences associated with statements of epistemic possibility by Rudin (2016), and to free choice inferences by Santorio & Romoli (2017). (Cf. Holliday & Icard 2013, who argue that it is more difficult to pull apart the empirical predictions made by probabilistic and Kratzerian accounts than is often claimed.) A probabilistic semantics for epistemic modals could be implemented within the proposed pragmatics of assertion in a manner parallel to the implementation of the Ordering Semantics: extend the notion of a context from a set of worlds to a tuple of a set of worlds and a probability measure (Yalcin 2010); the update potential for epistemic modals could involve Jeffrey conditioning the context's probability measure (Jeffrey 1992). The full elaboration of a probabilistic implementation is outside the scope of this paper.

(28) EPISTEMIC STATES (ordering version):
An epistemic state i is a tuple $\langle b_i, O_i \rangle$
Where b_i is a set of worlds, and O_i is a set of propositions.

The purpose of the context in a Stalnakerian framework is to represent the epistemic state characterized by what all conversational participants are willing to commit to for the purposes of the conversation. If our conception of epistemic states is not just a set of worlds, but a tuple of a set of worlds and an ordering source, that needs to be reflected in the conversational context as well. I will use a different variable to refer to contexts, though they are the same kind of formal object as individuals' epistemic states, for ease of readability.

(29) CONTEXTS (ordering version):
A context c is a tuple $\langle b_c, O_c \rangle$
Where b_c is a set of worlds, and O_c is a set of propositions.

The addition of ordering sources to the conception of an epistemic state means that there are now two possible ways to monotonically increase the information expressed by an epistemic state: to remove worlds from its modal base, or to add propositions to its ordering source. I revise the notion of refinement below, to capture this:

(30) REFINEMENT (ordering version):
A context c' is a refinement of a context c ($c' \leq_r c$) iff $b_{c'} \subseteq b_c$ and $O_c \subseteq O_{c'}$

Because contexts and epistemic states are now tuples, of which a modal base is only one component, we will need to make small adjustments to two previous definitions:

(31) COMPATIBILITY (ordering version):
For any context c, proposition p, c is p-compatible if $[\exists c' : c' \leq_r c]c' \in \text{META-INTENS}(p) \wedge b_{c'} \neq \varnothing$

(32) META-INTENSIONALIZATION (ordering version):
$\text{META-INTENS} = \lambda p.\lambda i.[\forall w : w \in b_i]p(w) = 1$

In these definitions, reference to a context and an epistemic state, respectively, have been changed to explicitly reference the modal base of that context and epistemic state. All other definitions from §3.1 persist unchanged.

3.3.1 NON-EPISTEMIC PROPOSITIONS

In this version of the model of assertion, propositions whose semantics do not refer to epistemic ordering sources will behave the same as before. To see this, let's revisit the example of *John is dead*. Meta-intensionalization will proceed just as in (16):

(33)   META-INTENS$(\lambda w.dead'(j)(w))$
      $= (\lambda p.\lambda i.[\forall w : w \in b_i]p(w) = 1)(\lambda w.dead'(j)(w))$
      $= \lambda i.[\forall w : w \in b_i]dead'(j)(w) = 1$

Because we are now treating epistemic states i as tuples $\langle b_i, O_i \rangle$, rather than as simple sets of worlds, this meta-intensionalized denotation is a set of such tuples: all such tuples in which the proposition denoted by *John is dead* is true at every world in the modal base. Note that the ordering source has no effect on the truth of this proposition, and so the speaker is not giving any information about what their private ordering source is like—the set of all epistemic states they could have contains all states whose modal base is a subset of p, irrespective of what the ordering source is:

(34)   (33)$= \{i : b_i \subseteq \{w : dead'(j)(w) = 1\}\}$

The update potential associated with an assertion of *John is dead*, then, will be the same Stalnakerian update potential as before we added ordering sources into the mix: intersection of the context's modal base with p. Any context that has no p-worlds in its modal base will not be p-compatible, as there is no way to either subtract worlds from the modal base or add propositions to the ordering source that will result in the modal base becoming a (non-empty) subset of p. Assuming that we're dealing with a p-compatible context, with at least one p-world in its modal base, altering the context's ordering source could not possibly change whether it is a member of the set given in (34), as altering the ordering source would have no effect on whether the modal base is a subset of p. That leaves us with the strategy of removing worlds from the context's modal base. Again, the most conservative way to remove worlds from the modal base to guarantee that it will be a subset of p is to intersect it with p.

Disagreement over assertions of such propositions also works the same as before: the disagreer is presenting herself as though her epistemic state is not p-compatible; as discussed above, an epistemic state is not compatible with (34) iff its modal base has no p-worlds in it. Therefore, the disagreer is presenting herself as though she knows p to be false.

3.3.2 *Might*-CLAIMS

We've seen that assertions of propositions that do not reference the speaker's epistemic state work the same in the ordering version of the model of assertion as they did in the version without ordering sources. What about assertions of *might*-claims?

(35)   a. ⟦John might be dead⟧ $= \lambda w.[\exists w' : w' \in \text{BEST}_{C_w}]dead'(j)(w') = 1$
     b. META-INTENS(⟦John might be dead⟧)
        $= \lambda i.[\forall w : w \in b_i][\exists w' : w' \in \text{BEST}_{C_w}]dead'(j)(w') = 1$

Again, the assumption of solipsistic contextualism for matrix epistemic modals allows us to simplify this. Solipsistic contextualism is the notion that C_w, the contextually-supplied tuple of a modal base and an ordering source, corresponds to the speaker's epistemic state in w. Recall

that i ranges over candidates for the speaker's epistemic state in the world of utterance. By the same reasoning presented in §3.2, b_w must be equivalent to b_i for all w in i. I will extend the assumption that the speaker's knowledge does not vary across the worlds epistemically accessible to her to ordering sources as well. Given this assumption, O_w is equivalent to O_i for all w in i. It follows that C_w is equivalent to i for all w in i. This means that (35b) is equivalent to this:

(36) $\lambda i.[\forall w : w \in b_i][\exists w' : w' \in \textsc{best}_i]dead'(j)(w') = 1$

Again, the universal quantification is vacuous, allowing us to simplify to this:

(37) $\lambda i.[\exists w' : w' \in \textsc{best}_i]dead'(j)(w') = 1$

Recall that $\textsc{best}_i$ is that subset of b_i that is maximal with respect to the ordering source O_i. In words, (37) is the set of all epistemic states whose modal base contains at least one p-world that is maximal with respect to its ordering source.

3.3.3 UPDATE POTENTIAL

How can we determine the update potential of the denotation in (37)? Let's first split the set of all possible contexts in two, and look at the set of all contexts whose modal base has an empty intersection with the proposition p denoted by *John is dead*. All such contexts are incompatible with (37)—there can be no p-worlds in $\textsc{best}_c$ if there are no p-worlds in b_c, and no refinement of such a context can reintroduce p-worlds into b_c, by (30). Because all such contexts aren't *might-p*-compatible, we can safely restrict our attention to the set of all contexts whose modal base contains at least one p-world. Contexts in this set may or may not already be members of (37), depending on whether their ordering source picks out a p-world as maximal. The question facing us is: what operation will guarantee that all such contexts will become a member of (37) without guaranteeing that the resulting context will entail anything stronger than (37)?

Adding p to the context's ordering source is exactly such an operation. It is commensurate with (37) by definition (11), meaning that adding p to the ordering source of any context with a p-world in its modal base will result in that context being a member of (37). To see this, consider the definition of maximality relative to an ordering source given in (27), repeated here:

(38) $\textsc{best}_c = \{w' : w' \in b_c \wedge \neg\exists w'' \text{ s.t. } w'' >_{O_c} w'\}$
      where $\forall w', w'', w' \geq_{O_c} w''$ iff $\forall P \in O_c, w'' \in M \rightarrow w' \in M$
      where $w' >_{O_c} w''$ iff $w' \geq_{O_c} w''$ and $w'' \not\geq_{O_c} w'$

A world w in c's modal base is maximal with respect to that context's ordering source (i.e., is a member of $\textsc{best}_c$) iff there are no worlds in the modal base that are members of a proper superset of the propositions in the ordering source that w is a member of. This has the logical consequence that for any proposition p in O_c, as long as there is at least one p-world in b_c, there will be a p-world in $\textsc{best}_c$. The only way a p-world w could fail to be maximal with respect to an ordering source that includes p is if there is some other world that is a member of a proper

superset of the ordering propositions that w is a member of, guaranteeing that such a world is also a p-world—i.e., if p is in the ordering source, the only thing that can be ranked strictly higher than a p-world is another p-world.

This demonstrates that adding p to the ordering source of a context whose modal base contains at least one p-world guarantees that that context will become a member of (37), the set of all contexts c such that BEST_c contains a p-world.

It should also be clear that adding p to the ordering source is conservative with respect to (37) given definition (12), satisfying the other half of the update condition. Adding p to the ordering source does not guarantee that any non-p world will become maximal with respect to the ordering, and so the update does not guarantee that contexts updated with it will entail anything other than *might-p*.

(39) UPDATE POTENTIAL FOR *might-p*:
An assertion of *might-p* relative to a context c is a proposal that p be added to O_c

This update is informative: the resulting context is a proper refinement of the context prior to the update. On this account, an assertion of a *might*-claim is a proposal that the context be made to pick out the prejacent as a particularly normal/likely possibility (cf. the discussion of 'live possibility' in Willer 2013).

3.3.4 DISAGREEMENT

Disagreement over *might*-claims given the Ordering Semantics is predicted to work exactly as it did for the simple semantics. As we saw in the discussion above, the only contexts that are incompatible with the meta-intensionalized denotation of *might-p* are those whose modal base has no p-worlds in it. As disagreement is licensed by the disagreer's epistemic state being incompatible with that denotation, a disagreer is presenting themselves as though they have no p-worlds epistemically accessible to them, just like in the implementation of the simple semantics for *might*.

4   RAMIFICATIONS AND FUTURE DIRECTIONS

I've shown above that the phenomenon of disagreement over *might*-claims is not intrinsically problematic for the solipsistic contextualist interpretation of the Kratzerian semantics of epistemic modals. My proposed model of assertion derives the disagreement behavior of *might*-claims from their solipsistic contextualist semantics, as a consequence of its basic tenet that an assertor is asking that the context be modified to resemble her epistemic state in the relevant way. I've also shown that this view of assertion leads to a novel, informative update potential for *might*-claims given the proper implementation of the Ordering Semantics for modality.

My goal in this paper has been a modest one: simply to show that the problem posed by disagreement data is not necessarily a problem for the solipsistic contextualist semantics, but

could equally well be solved by revising our formal implementation of the pragmatics of assertion. I don't believe that what I've done can be shown to be superior on grounds of strict empirical adequacy to previous solutions that proceeded by altering the semantics of epistemic modals. However, I do believe there are reasons why one might prefer the pragmatic solution I've proposed here to the semantic solutions explored in prior literature. In this section, I turn to those reasons.

I discuss three strengths of this proposal. The first has to do with preserving the insights of the classical Kratzerian worldview into the possibility for modals to vary in flavor and force. The second deals with the potential to explain which expressions exhibit 'assessment sensitive' behavior, and the potential to link such expressions to non-assessment-sensitive expressions like first-person belief ascriptions. The third deals with the potential for a unified generalization about the interpretation of matrix and embedded epistemic modals. The final two discussions touch on areas in which the present proposal suggests possibilities for future work.

4.1   VARIATION IN FLAVOR AND FORCE

In my proposal, I've shown how an update potential for *might*-claims can be derived from the interaction between the classical Kratzerian semantics for modals and a pragmatics of assertion in which the speaker's epistemic state plays a crucial role. The differences in update potential between *might*-claims and sentences that do not reference the speaker's epistemic state is derived from the way the pragmatics of assertion interacts with a *might*-claim's invocation of the speaker's epistemic state. This concern with deriving the update potential of a sentence from the interaction between its truth-conditional denotation and a general update condition is not shared by accounts within Update Semantics that treat *might* as a syncategorematically-defined update operator (i.e. Veltman 1996, Willer 2013). Such accounts identify the meanings of *might*-claims directly with the updates carried out by their utterance.

Such accounts abandon a crucial element of the Kratzerian program. One of the basic concerns of Kratzer (1977) is explaining why single lexical items can encode multiple modal flavors. To choose one familiar example, the necessity modal *must* is ambiguous between a deontic and an epistemic interpretation. Treating modals as quantifying over a contextually-supplied modal base provides an elegant explanation of the possibility of a modal to vary in modal flavor: any modal imposes a condition on what modal bases it's willing to interact with, potentially allowing only one flavor of modal base, but potentially allowing more than one. More recent work has investigated the phenomenon of variable-force modals (e.g. Deal 2011, Bochnak 2015, Yanovich 2016). The possibility of a modal to vary not only in its flavor but its force is also captured by the Kratzerian view, on which quantificational force is a degree of freedom made available by the basic scaffolding of modal semantics.

It's not clear how insights like these can be preserved on a view in which epistemic modals are treated as special update operators, rather than as modals with the same sorts of denotations as modals of non-epistemic flavor. Defining *might* as a special update operator sacrifices a view of what its semantics shares with the semantics of other possibility modals like *can*; giving the meaning of epistemic modals exclusively in terms of their update potential makes it mysterious

how a single modal, like Bochnak's (2015) *-eʔ*, could vary between epistemic possibility and epistemic necessity readings. It is for this reason that I advocate for a view on which epistemic modals are just modals, and their special update effects follow from the way their epistemicity interacts with the epistemicity of assertion.

4.2 ASSESSMENT SENSITIVITY AND FIRST-PERSON BELIEF REPORTS

MacFarlane (2014) develops a relativist notion of truth in which interpretation functions are parameterized to a 'context of assessment'. When a speaker makes an assertion, the context of assessment is her own epistemic state; when an addressee interprets that utterance, his own epistemic state is the context of assessment. MacFarlane treats epistemic modals as having a semantics that is sensitive to the context of assessment, explaining the generalization that speakers tend to assert *might*-claims on the basis of their own information, and tend to reject *might*-claims on the basis of their own information as well, irrespective of who asserted them. Sensitivity to the context of assessment is taken to be a featured shared by other expressions like predicates of personal taste (Lasersohn 2005, Pearson 2013).

My proposed model of assertion also produces the result that speakers assert *might*-claims on the basis of their own knowledge, as do listeners. My proposal could be seen as simply moving MacFarlane's contexts of assessment out of the semantics and into the pragmatics of assertion. What is gained by such a maneuver? Why take this to be pragmatic instead of semantic?

I will highlight two insights that such a maneuver allows. First, on MacFarlane's view, it is difficult to say why a given expression should be assessment sensitive. At this risk of being tautological, for an expression to be assessment sensitive, its semantics must be sensitive to the context of assessment. Epistemic modal claims are assessment sensitive, on this view, by virtue of the proposal that their semantics is sensitive to this parameter; it would be trivial to render them assessment-invariant, by removing reference to that parameter from their semantics. On my view, however, the 'assessment-sensitivity' of epistemic modal claims follows directly from their semantics: the fact that they invoke the speaker's epistemic state interacts in a particular way with the act of assertion's invocation of the speaker's epistemic state, leading to 'assessment sensitive' behavior.

The proposed pragmatics of assertion makes principled predictions about the 'assessment-sensitivity' of various expressions: any and all expressions whose semantics reference the speaker's epistemic state will be licensed on the basis of the speaker's epistemic state, but able to be disagreed with on the basis of the listener's epistemic state. This is due to the fact that an assertor is taken to be asking that the context be modified to reflect her epistemic state in the relevant respect, licensing disagreement if the disagreer is unwilling to endorse the resulting context. I would like to highlight one particular prediction of this view, which is not a prediction that follows from a semantic view of assessment sensitivity.

Consider the exceptional assertive force of sentences of the form *I think that p*.

(40) **A**: I think that Bill is the murderer.
      B: You're wrong that Bill is the murderer, he was in the drunk tank that night.

It's widely noted in the literature that assertions of first-person *think*-claims often seem to assert their prejacent, and that disagreement directly with the prejacent is appropriate. The pragmatics of assertion developed in this paper appears to predict this result: the speaker is predicating of her epistemic state that it is characterized by whatever degree of belief in p is entailed by *I think that p*, and is proposing that the context be modified to reflect that degree of belief in p as well.[11]

I take the full formal development of how the proposed pragmatics of assertion interacts with first-person belief and attitude ascriptions to be outside of the scope of this paper, but it is a promising avenue for future work.

4.3   UNIFYING MATRIX AND EMBEDDED EPISTEMICS

The interpretation of epistemic modals is quite constrained in both matrix and embedded contexts. Speakers seem to assert sentences with matrix epistemic modals on the basis of their own information, and disagree with sentences with matrix epistemic modals on the basis of their own information as well.[12] Embedded epistemic modals appear to always be interpreted relative to the embedding subject, i.e. in the sentence *John thinks that it might be raining*, the embedded *might*-claim must be interpreted as a claim about John's epistemic state. These two generalizations have been copiously discussed independently, but it has been difficult to see what generalization links the constraints on the interpretation of matrix and embedded epistemic modals. I would like to point out a tentative link that is suggested by my proposal.

A natural proposal for the interpretation of embedded epistemic modals, especially from the perspective of accounts in which their interpretation is sensitive to a parameter specifying the relevant epistemic state, is to have the semantics of embedding verbs set the value of that parameter as it will be used in the interpretation of their clausal complements. Stephenson (2007), who assumes a judge-dependent semantics for epistemic modals, proposes that verbs like *think* make their subject the judge relative to which the interpretation of their complements proceeds. Yalcin (2007) proposes that epistemic modals are interpreted relative to an information state parameter; to explain the infelicity of embedded epistemic contradictions like *Suppose that it's raining and it might not be raining*, he proposes that *suppose* shifts that information state parameter to the set of supposition worlds. Generalizing this strategy, Anand & Hacquard (2013) propose that all embedded epistemics need to be supplied with a modal base by the embedding verb—'representational attitudes' like *think* supply an epistemic modal base by shifting the information state parameter to their subject's thought-worlds; 'non-representational' clausal embedding verbs shift the information state parameter to the empty set, rendering embeddings of *might*-claims under them infelicitous, as in *John demanded that Paul might be innocent*.

The pragmatics of assertion that I've proposed also has the result that epistemic modals are dependent on an epistemic state provided by a higher operator for their interpretation. As I've

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[11]Thanks to Jérémy Pasquereau for helpful discussion of this point.

[12]Egan et al. (2005) discuss cases in which this generalization appears not to hold. See Stephenson (2007) §4.5 for a rebuttal.

shown in §3.2, assuming the solipsistic contextualist interpretation of epistemic modals results in them being interpreted relative to the epistemic state variable abstracted over by the meta-intensionalization operator. This suggests a potential unification of the interpretation of matrix and embedded epistemic modals: in each case, the epistemic state relative to which the modal is interpreted must be supplied by a higher operator.

I will note at this point that I've been agnostic throughout this paper about how exactly the solipsistic contextualist interpretation of matrix epistemic modals arises, simply assuming that the epistemic state relevant to their interpretation is the speaker's. Though the solipsistic contextualist view is intrinsically incompatible with views that take *might*-claims to lack propositional denotations, it is not necessarily incompatible with theories that treat epistemic modals as sensitive to special parameters, like Yalcin's information state parameter. Such theories are solipsistic contextualist insofar as they include a component that guarantees that that parameter will be set to the epistemic state of the speaker in matrix contexts. Yalcin's account suggests a way of making the impressionistic parallel the above paragraph draws between matrix and embedded epistemic modals more concrete and formal. On Yalcin's account, we could derive the solipsistic contextualist interpretation of matrix epistemic modals by taking the meta-intensionalizer to shift the information state parameter to the speaker's epistemic state—this would be quite of a piece with the pragmatic reasoning that the meta-intensionalizer represents.

I've refrained from implementing a Yalcin-style account in §3 because the main goal of this paper is to show that the proposed pragmatics of assertion derives disagreement behavior for *might*-claims from any semantics that returns a solipsistic contextualist interpretation for matrix epistemic modals. Considerations of the best way to derive that interpretation are orthogonal to that main point. For that reason, I leave a fuller elaboration of the Yalcin-style account sketched above, and an exploration of how it relates to other possible ways of deriving the solipsistic contextualist interpretation of matrix epistemic modals from the interaction of the proposed pragmatics of assertion with an independently-motivated semantics for epistemic modality, to future work.

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