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On Modal Subjectivity

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Epistemic modals have long been observed to be ambiguous between a speaker-oriented interpretation (Lyon's 1977 'subjective' interpretation) and an interpretation that reflects general knowledge (the 'objective' interpretation). In recent work, Papafragou (2006) argues that subjectively interpreted epistemics are non-truth conditional, and that this results from them being indexical to the speaker and time of utterance. I argue against Papafragou's claim and end by presenting an alternative perspective of the facts based on a distinction between determinate and indeterminate modal bases.

Keywords modality, subjectivity, epistemology, speaker perspective, predicates of taste, evidentials, indexicals, exhaustivity

Introduction

Epistemic modals are unique among modals in that they can be interpreted either objectively or subjectively. In the former interpretation, (1) takes on a meaning like 'Possibly given how the world is, John lives in Brooklyn.' In the latter, it means something more like 'Possibly given what I know, John lives in Brooklyn.'

(1) John may live in Brooklyn.

Papafragou (2006) further argues that the distribution of subjectively interpreted epistemic modals is restricted relative to objectively interpreted ones. She adopts a version of recent contextualist accounts of the subjective/objective distinction to account for these distributional restrictions: she argues that subjectively interpreted epistemics are unacceptable in certain contexts because they are indexical to the speaker and time of utterance.

While I believe that contextualist approaches (e.g. Stephenson 2007; von Fintel and Gillies 2011) work appropriately in accounting for the subjective/objective ambiguity, I question Papafragou's claims about the behavior of subjectively interpreted epistemic modals (henceforth 'subjective epistemics') and her explanation of it.

I'll first characterize the subjective and objective distinction in epistemic modals from two different perspectives. I'll then present Papafragou's claims about the distributional differences between subjectively and objectively interpreted epistemics, and her account associating these differences with the subjective/objective distinction. I'll finally argue that there are reasons to be skeptical of this association and of

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Papafragou's account of it. I end by presenting an alternative way to view some of the data which relies on a notion of modal exhaustivity.

1 Background: the subjective/objective distinction

There has been a great deal of recent work in philosophy of language and formal semantics on the semantics of epistemic modals. While the Kratzerian approach (Lewis 1986; Kratzer 1991) to modals is generally accepted as standard, some behavior of epistemic modals seems to warrant some revision to this approach. I'll briefly introduce the standard theory and then the data that threatens it.

Kratzer's innovation was to unify the semantic contribution of modals through two parameters: a modal could have either universal or existential quantificational force (its modal force), and it could have one of a variety of different flavors (its modal base: epistemic, deontic, dispositional, stereotypical...). Under this analysis, *may* and *must* differ in terms of their modal force, but both can have a deontic or epistemic modal base.

(2) For a context of utterance c; an index of evaluation i consisting of a pair of an evaluation world w' and an evaluation time t^i; and a contextually-valued function f_c from evaluation worlds and evaluation times to a set of accessible worlds:

a. $[\![\text{may } \phi]\!]^{c,i} = 1$ iff $\exists w' \in f_c(i) : [\![\phi]\!]^{c,\langle w',t^i\rangle} = 1$

b. $[\![\text{must } \phi]\!]^{c,i} = 1$ iff $\forall w' \in f_c(i) : [\![\phi]\!]^{c,\langle w',t^i\rangle} = 1$

And *must* and *have to* may differ in their modal base, but both encode universal quantification.

The result is a semantic account of modals which unifies their meaning while allowing for the potential variation in meaning of a particular modal (like the epistemic/deontic ambiguity of *must*). In unifying modals, Kratzer's analysis predicts, at least: a) that all modals either encode existential or universal force; b) that a modal can in principle receive any value for ϕ but may lexically restrict the possible values for ϕ; and c) that modals will differ from each other in no other respect. It's this last prediction that epistemic modals seem to pose a problem for.

Epistemic modals display an interpretational variability with respect to the holder of the relevant beliefs (the 'judge' or 'assessor'; see respectively Lasersohn 2005; MacFarlane 2010). In some contexts, a sentence containing an epistemic modal seems to convey something about what's generally known (the objective interpretation); in other contexts, a sentence with the same modal seems to convey something about what the speaker knows (the subjective interpretation). I'll begin by presenting Lyons' discussion of these meanings; I'll then present them in terms of their parallel with Predicates of Personal Taste.

Lyons' explanation of the interpretational variability is as follows:

> In principle, two kinds of epistemic modality can be distinguished: objective and subjective. This is not a distinction that can be drawn sharply in

> the everyday use of language; and its epistemological justification is, to say the least, uncertain. [...]
>
> (3) Alfred may be unmarried
>
> [...] Under one interpretation of [(3)], the speaker may be understood as subjectively qualifying his commitment to the possibility of Alfred's being unmarried in terms of his own uncertainty. If this is what the speaker meant, he might appropriately have added to [(3)] some such clause as *...but I doubt it* or *and I'm inclined to think that he is*, which clearly indicate the subjectivity of the speaker's commitment. [...]
>
> But now consider the following situation. There is a community of ninety people; one of them is Alfred; and we know that thirty of these people are unmarried, without however knowing which of them are unmarried and which are not. In this situation, we can say that the possibility of Alfred's being unmarried is presentable, should the speaker wish to so present it, as an objective fact. The speaker might reasonably say that he knows, and does not merely think or believe, that there is a possibility (and in this case a quantifiable possibility) of Alfred's being unmarried; and, if he is irrational, his own subjective commitment to the truth or falsity of the proposition "Alfred is not married" might be quite unrelated to his knowledge of the objective possibility, or degree of probability (1/3), of its truth, in the way that a gambler's subjective commitment to the probability of a particular number coming up in roulette might be quite unrelated to the objective possibilities. (797-8)

This is a useful illustration of the two meanings, one I'll come back to. It's also worthwhile to foreshadow Lyons' theory of the difference between the two interpretations: that while statements with objectively interpreted epistemics are assertions, statements with subjectively interpreted epistemics "are not acts of telling; [...] their illocutionary force is in this respect similar to that of questions, which are also non-factive" (799). He concludes, based on other data, that objective epistemics are interpreted like other modals, as part of the truth-conditional content, while subjective epistemics contribute to non-truth-conditional content, at the illocutionary level. This distinction arguably applies to the interpretation of a sentential adverb like *apparently* as its interpreted in a VP- and CP-modifying position, respectively, as in (4).

(4) a. John is apparently at the store.
    b. Apparently, John is at the store.

Another way of viewing the subjective/objective distinction is relative to a parallel with Predicates of Personal Taste (PPTs). (This parallel is explored in great depth in Lasersohn 2005; Stephenson 2007). The idea is that PPTs and epistemics both have a reading in which they reflect the judgment of the relevant community – the objective interpretation – as well as a reading in which they reflect the judgment of

the speaker (the subjective interpretation). Evidence for the subjective interpretations comes from the parallel behavior of the two sorts of terms in two conditions: their behavior embedded under the predicate *think* and their behavior in disagreements.

When embedded under *think*, epistemics and PPTs can both receive a subjective interpretation linked to the subject of *think*, as demonstrated in (5). (Examples from Stephenson 2007).

(5) a. Sam thinks the dip is tasty.
b. Sam thinks it might be raining.

In (5-a), *tasty* is interpreted as 'tasty to Sam' (instead of to the speaker or the relevant community). In (5-b), *might* is interpreted as 'possible given what Sam knows'. While Stephenson shows that there are subtle differences between PPTs and epistemics in these constructions – in examples like (5) this dependence on the attitude holder is optional for PPTs and obligatory for epistemics – these examples suffice to demonstrate that PPTs and epistemics can both have a subjective interpretation, and that this subjective interpretation can but need not be oriented to the speaker. This is in contrast to e.g. deontically interpreted modals, as in (6).

(6) Sam thinks the dip needs to/must be onion.

In (6), the deontic modals can't be interpreted relative to Sam, but can only mean that it's Sam's belief that there are rules requiring that the dip (at the party) be onion dip.

A second context which shows that epistemics and PPTs can be interpreted subjectively is in discourses of disagreement. These contexts additionally demonstrate what Lasersohn (2005) calls speakers' "autocentric perspectives": that speakers tend to assert and accept and reject others' assertions using themselves as judges. I'll present the data (again from Stephenson 2007) and then return to this point.

(7) A: Where's Bill?
B: He's in his office.
C: Nuh-uh! He doesn't work on Fridays.

In (7), C uses *nuh-uh* to disagree with B's claim that Bill is in his office. But when B's answer involves a PPT or an epistemic modal, the disagreement takes on a slightly different character.

(8) A: Where's Bill?
B: I'm not sure. He might be in his office.
C: Nuh-uh, he can't be. He never works on Fridays.

(9) A: How's the cake?
B: It's tasty.
C: Nuh-uh, it isn't tasty at all!

In (8) and (9), B seems to be expressing a subjective proposition: that for all he knows, B is in his office, and that the cake is tasty to him. In disagreeing, C doesn't deny these descriptions of B's mental state, but rather denies having a similar mental

state. In these sentences, C's disagreements are subjectively oriented to C. In (8) C is asserting that, for all she knows, Bill cannot be in his office; in (9) C is asserting that the cake isn't tasty to her.

This "faultless disagreement" is a hallmark of both PPTs and epistemic modals. They show that a statement involving these terms can be interpreted relative to the speaker. They also show that, when a speaker asserts a subjectively interpreted proposition, interlocutors accept or reject that statement using themselves as judges. (This point is also made in Hawthorne (2004); it's also recently been presented as 'first-person-based genericity' in Moltmann (2010).)

To summarize this discussion of objective and subjective interpretations: epistemic modals seem to be unique among the class of modals in that they can be interpreted either objectively or subjectively. The objective interpretation seems to track real probabilities: in Lyons' description, a probability calculated from exhaustively surveying the possible outcomes, and in Lasersohn and Stephenson's descriptions, the possibility interpreted relative to what the relevant community knows. The subjective interpretation, in unembedded contexts, is oriented to the speaker (and to the subject of an embedding verb in embedded contexts).

In the next section, I'll discuss attempts to formalize this interpretational variation in compositional semantic theories.

2 Contextualist accounts of subjectivity

Some have argued that the subjective interpretations of epistemics require a notion of truth in which it's calculated relative to a judge-oriented context (as well as a world of evaluation and a time of evaluation). These relativists include Egan, Hawthorne, and Weatherson (2005) and MacFarlane (2010) for epistemics and Lasersohn (2005) for PPTs. Lasersohn's proposed lexical entry for the PPT *tasty* is shown in (10). Here, *tasty* is interpreted relative to a context of evaluation c which consists of a world of evaluation w, a time of evaluation t and a judge j. When an unembedded PPT is interpreted subjectively, context will fix j to be the speaker. When *tasty* is interpreted objectively, context will fix j to be some contextually salient group (which arguably includes the speaker; see Stephenson 2007).

(10) $[\![\text{tasty}]\!]^{c;w,t,j} = \lambda x.x$ tastes good to j in w at t

Based on her observations that PPTs and epistemic modals behave similarly with respect to the properties discussed above, Stephenson (2007) extrapolates Lasersohn's account to one of epistemics:

(11) a. $[\![\text{might}]\!]^{c;w,t,j} = \lambda p.$ there is some world w' compatible with j's knowledge in w at t such that $p(w')(t)(j) = 1$
b. $[\![\text{must}]\!]^{c;w,t,j} = \lambda p.$ every world world w' compatible with j's knowledge in w at t is such that $p(w')(t)(j) = 1$

A competing approach to the interpretational variability of PPTs and epistemics is a contextualist one. In relativist theories, it's the character (in the sense of Kaplan

1989) of a proposition containing a PPT or epistemic which varies from context to context. In contextualist theories, the judge parameter is encoded in the truth-conditions, and so it's the content of the proposition which varies from context to context. Following Papafragou (2006), I'll use (12) as a canonical formulation of a contextualist account of the interpretational variability of epistemic modals.[1]

(12) For a context of utterance c; an index of evaluation i consisting of a pair of an evaluation world w' and an evaluation time t^i; a contextually supplied group G_c and a function f_x which delivers the set of worlds compatible with what x knows:

a. $[\![\text{may } \phi]\!]^{c,i} = 1$ iff $\forall x \in G_c : \exists w' \in f_x(i) : [\![\phi]\!]^{c,\langle w',t^i\rangle} = 1$

b. $[\![\text{must } \phi]\!]^{c,i} = 1$ iff $\forall x \in G_c : \forall w' \in f_x(i) : [\![\phi]\!]^{c,\langle w',t^i\rangle} = 1$

In a context in which *may* or *must* receives a subjective interpretation (which von Fintel and Gillies refer to as the 'solipsistic' interpretation), G_c is a singleton set containing the speaker. In a context in which the epistemics receive an objective interpretation, G_c can receive a variety of different values corresponding to any sort of "relevant community" (Teller 1972; DeRose 1991).

In (12), the epistemic modals are functions from propositions ϕ, and the truth of an epistemic proposition is interpreted relative to a context c and an index i consisting of a world and time of evaluation. In this respect it is similar to (11). It differs in that the judge parameter is part of the proposition, encoded in a contextual variable G_c. Part of the motivation for this analysis is the apparent bindability of the judge, as evidenced in (5).

3 Epistemics and truth conditions

Relativist and contextualist accounts of epistemics are both Kratzerian, they analyze epistemic modals as quantifiers over possible worlds, and thus predict that modals affect the truth-conditions of a proposition (they differ in whether it's the character or content that's effected). Other accounts of epistemic modals have argued that their contribution to the meaning of an utterance is (at times) non-truth-conditional, and thus should be encoded as something more akin to an illocutionary force operator. I mentioned above that Lyons (1977) is a proponent of this view. It's also articulated in (Halliday 1970:349): "[Epistemic modality] ... is the speaker's assessment of probability and predictability. It is external to the content, being a part of the attitude taken up by the speaker: his attitude, in this case, towards his own speech role as 'declarer' ".

Papafragou's (2006) goal is to argue that both views are, in a way, correct: that both sorts of epistemic modals contribute to a sentence's truth conditions, but that in the case of subjective epistemics this contribution is indexical to the speaker and time of utterance, and this causes it to behave as if it were non-truth-conditional. I'll first

[1] Papafragou (2006) attributes (12) to a draft of von Fintel and Gillies (2011). In the published version, the authors explicitly reject this precise characterization because it cannot be general across modals; f is explicitly defined in terms of epistemic accessibility. However, it will suffice for this paper, as my goal is to discuss Papafragou's account and contextualist approaches to epistemics generally.

review her arguments that subjectively interpreted epistemics behave in a way that makes them seem non-truth-conditional (§3.1); I'll then describe her suggestion of how this might be accounted for in a contextualist approach (§3.2). In the following section, I'll present my arguments against Papafragou's conclusion and present an alternative way to characterize the subjective/objective distinction.

3.1 Distributional restrictions of some epistemics

First, Papafragou (2006) considers the behavior of epistemic modals in the antecedents of conditionals (based on Cohen 1971; Wilson 1975). Her explanation:

> According to this test, the contrastive interpretation of but does not contribute to truth conditions:
>
> (13) If Jane comes to the party but John doesn't, the party will be a disaster.
>
> Consider which of the following needs to hold in order for the party to be a disaster: (i) Jane comes to the party; (ii) John doesn't come to the party; (iii) there is a contrast between (i) and (ii). Clearly, (iii) is irrelevant, hence that aspect of the meaning of but does not contribute to the propositional content of the utterance. (ibid.)

She presents (14) to demonstrate that subjective epistemics cannot scope under conditionals while objective epistemics can.

(14) a. ?If Paul may get drunk, I'll be mad at him.
b. If Paul may get drunk, I am not coming to the party.

She says relatively little in defense of the claim that the salient difference between (14-a) and (14-b) is the subjective/objective difference. I'll return to discuss these examples in §4.

Papafragou (2006) next claims that subjectively and objectively interpreted epistemics differ in their embeddability under "factive predicates or verbs of telling" (p1690).

(15) a. ?It is surprising that Superman must be jealous of Lois.
b. ?Spiderman told me that Superman must be jealous of Lois.

Her explanation is that "epistemic modality deals with the speaker's qualification of the proposition expressed by the utterance, and as such cannot carry a factivity guarantee or be reported as a statement of fact" (ibid.). In contrast are the arguably objectively interpreted epistemics in (16) (p1697):

(16) a. It is surprising that the victim must have known the killer.
b. The police told reporters that the victim must have known the killer.

Finally, Papafragou (2006) argues that the meaning contributed by subjectively interpreted epistemic modals cannot be agreed or disagreed with (i.e. cannot be the target of assent or dissent; p1691).

(17) This professor must be smart.
  a. ?Is that so? (= Is it the case that this professor must be smart?)
  b. ?I don't believe it. (= I don't believe that this professor must be smart)
  c. ?That's not true. (= It is not true that this professor must be smart)
  d. ?I agree. (= I agree that this professor must be smart)

The claim is not that it's infelicitous to follow the utterance in (17) with these assents or dissents, but rather than they can target only the embedded proposition ϕ (='The professor is smart') rather than the modalized proposition $m(\phi)$.

Papafragou (2006) draws on these three tests to support her claim that, while objectively interpreted epistemic modals clearly contribute to the truth conditions of a sentence, the status of subjectively interpreted epistemics is much less straightforward. This is an intriguing conclusion because it has the potential to reconcile previous literature on epistemic modals wherein there seems to have been disagreement with respect to whether or not the contribution of epistemics is truth-conditional. It also parallels an ongoing debate in the evidentials literature: it's been observed there that languages seem to vary with respect to whether or not their evidentials are truth-conditional (most notably Izvorski 1997) or non-truth-conditional (most notably Faller (2002), who argues that some evidentials in Cuzco Quechua modify illocutionary force operators).

3.2 *Papafragou's proposal: here-and-now indexicality*

Papafragou's analysis of the distributional difference between subjective and objective epistemics relies on von Fintel and Gillies's analysis of epistemic modals as incorporating a group parameter. It consists of roughly three key points: 1) all epistemic modals contribute truth-conditional content; 2) subjectively interpreted epistemics differ from objectively interpreted ones in that the speaker is the only member of the group from which the epistemic possibility or necessity is calculated; and 3) in such cases, epistemics function like an indexical to both the speaker and the time of utterance, and it's this indexicality that is responsible for the unusual behavior of subjective epistemic modals.

Papafragou's first premise allows her to work within a Kratzerian framework. Her claim is that there is general evidence that subjective epistemics contribute truth-conditional content, and that there's an independent explanation for their unorthodox behavior in conditionals, under emotive factives, and in tests of assent and dissent. One argument in favor of truth-conditionality comes from a direct comparison of a subjectively modalized proposition and its non-modal counterpart.

(18) a. My grandfather must be sick.
  b. My grandfather may be sick.
  c. My grandfather is sick.

She says:

> If epistemic modal verbs do not contribute to the proposition expressed, all three utterances should express the same proposition (that the speaker's grandfather is sick), albeit with different degrees of speaker commitment. It follows that, if in fact that person is very healthy, what the speaker has said in [(18)] is false – and furthermore, false for exactly the same reasons throughout [the sentences in (18)]. However, most people would agree that, in these circumstances, the speaker has said something false only in [(18-c)]. In [(18-a)] or [(18-b)], the speaker has simply said that, as far as she knows, it is necessary/possible that her grandfather is sick. This fact suggests that epistemic interpretations of modals belong to the propositional content of the utterance – for which the speaker can be held accountable at later stages of the conversational exchange. (p1693)

A further argument for the claim that even subjectively interpreted modals contribute truth-conditional content is that they can scope under negation (p1693-4). However, she acknowledges that this argument cannot be made with modal verbs for syntactic reasons; although von Fintel and Iatridou (2003) provide evidence that modals like *have to* and *need to* are quite naturally interpreted as narrow-scope epistemics.

Papafragou's (2006) second premise – that subjectively interpreted epistemics differ from objectively interpreted ones in that the speaker values the group or judge parameter – is borrowed from the hidden indexical accounts of epistemics (like the one in von Fintel and Gillies (2011), repeated below from (12)).

(19) For a context of utterance c; an index of evaluation i consisting of a pair of an evaluation world w' and an evaluation time t^i; a contextually supplied group G_c and a function f_x which delivers the set of worlds compatible with what x knows:

a. $[\![\text{may } \phi]\!]^{c,i} = 1$ iff $\forall x \in G_c : \exists w' \in f_x(i) : [\![\phi]\!]^{c,\langle w',t^i\rangle} = 1$

b. $[\![\text{must } \phi]\!]^{c,i} = 1$ iff $\forall x \in G_c : \forall w' \in f_x(i) : [\![\phi]\!]^{c,\langle w',t^i\rangle} = 1$

Papafragou characterizes subjective interpretations of epistemic modals as those in which G_c – the relevant group in the context of utterance c – consists of only the speaker in c.

Papafragou's (2006) final point is that it's this indexicality that is responsible for the idiosyncratic behavior of subjective epistemics. If this is the case, then "the presence of indexicality is responsible for the fact that subjective interpretations of epistemic modal expressions escape standard tests for truth-conditionality" (p1696). This accounts for why subjective epistemics behave more like performatives (as suggested in Lyons 1977).

She does not present an account of how this indexicality could result in this idiosyncratic behavior. Rather, she supports her case by arguing that subjective epistemics and performatives like *I conclude (that)* are subjected to parallel restrictions. She points out that a performative like *I conclude* is indexical to the speaker and

time of utterance. If performatives and subjective epistemics display certain behavior at the exclusion of objectively interpreted epistemics, and if subjective epistemics, too, are indexical to the speaker and time of utterance, then it seems reasonable to attribute e.g. their unacceptability in antecedents of conditionals to the here-and-now indexicality of the two constructions.

Specifically, she argues:

> "[C]rucially, both subjective epistemics and performatives are tied to the here-and-now of the conversational exchange. In this sense, subjective epistemic modals are close to a class of mental verbs such as *think, infer, conclude* and *conjecture*, even though not illocutionary force indicators themselves." (p1696)

The idea is that these verbs, inflected for the first person and in the present tense, refer to the speaker and the time of utterance in the same way that subjective modals do, and it is this part of their content that results in their awkwardness in the antecedents of conditionals and their inability to be denied.

Papafragou (2006) thus subjects *I conclude* to the same three tests that differentiated subjective and objective epistemics above. She argues that *I conclude*, in the present tense, cannot be embedded under emotive factives like *be surprised* (p1697):

(20) ?I am surprised that I conclude that the Earth is flat.

And that *I conclude*, in the present tense, is unacceptable in the antecedents of conditionals, as (21-a) shows (p1696). This same sentence is fine if the tense is changed to future (21-b) or if the subject of *conclude* is not the speaker (21-c).

(21)
a. ?If I conclude that the Earth is flat, then I'm in trouble.
b. If in the future I conclude that the Earth is flat, then I'm in trouble.
c. I my students conclude that the Earth is flat, then I'm in trouble.

While she doesn't reproduce the assent/dissent tests for *I conclude*, it's easy enough to do so here:

(22) I (hereby) conclude this professor is smart.
a. Is that so? (#Is it true that you just concluded that?)
b. I don't believe it. (#I don't believe that you just concluded that)
c. That's not true. (#It is not true that you just concluded that)
d. I agree. (#I agree that you just concluded that)

The fact that contextualist accounts characterize subjectively interpreted modals as indexical to the speaker and time of utterance, coupled with the observation that subjectively interpreted modals also fail these assent/dissent tests, suggests that it's this indexicality which is responsible for the unique behavior of subjective epistemics.

In sum: In the contextualist proposals in Stephenson (2007); von Fintel and Gillies (2011) and Papafragou (2006), the difference between subjectively and objectively interpreted epistemics is attributed to the different way in which context values the variable G_c ranging over groups of knowers. (In the former, G_c corefers

with the speaker; in the latter, it picks out a salient group of knowers which arguably includes the speaker.) Papafragou (2006) argues that it is this judge parameter that accounts for the inability of subjective epistemics to occur in the antecedents of conditionals, be embedded under emotive factives like *be surprised*, and possibly to scope under other quantifiers. While Papafragou doesn't provide a specific semantic account of the correlation between epistemic subjectivity and these distributional restrictions, she relies on a characterization of subjective epistemics under the von Fintel/Gillies analysis as having indexical content, and draws parallels between subjective epistemics and other speaker- and time-of-utterance-oriented indexicals like *I conclude*.

4 A different perspective

I find the contextualist accounts of epistemic modals compelling, and I support the arguments in e.g. Stephenson (2007) and von Fintel and Gillies (2008, 2010, 2011) that epistemics incorporate some sort of judge parameter which can account for the parallel behavior of epistemics and PPTs. I do however have some worries about Papafragou's (2006) conclusions with respect to the similarities between subjective epistemics and performatives and therefore about her account of data like (14) and (15). I begin this section by discussing these worries. I end by presenting an alternative take on the unusual behavior of epistemic modals in some contexts.

4.1 Worries about the data

There are at least two respects in which Papafragou's (2006) arguments are vulnerable: a) if the idiosyncratic behavior she observes with respect to conditionals and emotive factives could be independent of the subjective/objective distinction; and b) if subjective epistemics and performatives like *I conclude* behave differently in ways relevant to here-and-now indexicality. I'll present some evidence of both types.

Recall that the original observation was that all kinds of epistemic modals can be interpreted subjectively; in particular, that the universal *must* and the existentials *may* and *must* all exhibit interpretational variability. However, while it is arguably true that *must* is awkward when it's embedded under emotive factives and verbs of telling ((23), repeated from (15)), this is not the case for the existential epistemics, as (24) shows.

(23) a. ?It is surprising that Superman must be jealous of Lois.
b. ?Spiderman told me that Superman must be jealous of Lois.

(24) a. It is surprising that Superman may/might be jealous of Lois.
b. Spiderman told me that Superman may/might be jealous of Lois.

Recall that Papafragou (2006) claims that the acceptability of an epistemic in a conditional varies with whether or not that epistemic is interpreted subjectively or objectively. But the ability of an epistemic to occur in the antecedent of a conditional seems to vary more with the proposition than with whether the modal is objectively

or subjectively interpreted.

To both Lyons (1977) and Papafragou (2006), the canonical difference between objectively and subjectively interpreted epistemics is the difference between the sentence in (25) as it is uttered by a meteorologist or a layman.

(25) It might rain tomorrow.

The intuition is that a layman could only be making a subjective report, while a meteorologist is likely to be making an objective report. But (25) seems acceptable in the antecedent of a conditional regardless of whether it's interpreted objectively or subjectively. ((26-a) is my attempt to bring out a subjective interpretation; (26-b) and (26-c) my attempt to bring out an objective interpretation.)

(26) a. If it might rain tomorrow, I should bring an umbrella to work.
b. If it might rain tomorrow, everyone will bring their umbrellas to work.
c. Sam thinks that, if it might rain tomorrow, he should bring an umbrella to work.

This is in contrast to other propositions, which seem unacceptable in antecedents regardless of whether they're interpreted subjectively or objectively. For me, these tend to involve the universal *must*.

(27) a. ?If it must have rained last night, my garden will be flooded.
b. ?If it must have rained last night, the record for rainfall in LA in November will have been broken.
c. ?Sam thinks that, if it must have rained last night, his garden will be flooded.

At the very least, these data indicate that Papafragou's (2006) claims about the subjective/objective distinction are instead claims about the subjective/objective distinction *relative to* the universal/existential distinction. At the most, they indicate that her claims are more appropriately claims about the universal/existential distinction. There are known differences between epistemic *must* and epistemic *might/may*; for instance, it's been claimed that *must*, in constrast to *may* and *might*, needs to take a stative complement (Giorgi and Pianesi 1998; Hacquard 2009). It's also been claimed that *must*, again in contrast to *may* and *might*, is a discourse anaphor, and is only licensed in a discourse in which there is a relevant and salient argument (Stone 1994; Stone and Hardt 1999). These differences are surely relevant and will condition the extent to which the differences exhibited in (23)–(27) impact Papafragou's claim.

There's another way in which Papafragou's arguments are vulnerable: if the parallel between subjective epistemics and performatives like *I conclude* falls apart in contexts relevant to here-and-now indexicality. First, while *I conclude* is awkward embedded under *It is surprising...* (the data is repeated in (28)), a number of other phrases that are arguably here-and-now indexicals are not (29).

(28) a. ?It is surprising that John must live in Brooklyn.
b. ?It is surprising that I conclude that John lives in Brooklyn.

(29) a. It is surprising that I think that John lives in Brooklyn.
b. It is surprising that it follows from what I currently know that John lives in Brooklyn.

Specifically, *I think* presumably also picks out the speaker and time of utterance, as does *what I currently know*. But these phrases are nevertheless acceptable under *be surprising*.

There is plausibly a difference in acceptability within Papafragou's class of mental verbs in this context with respect to those that are stative (e.g. *think, believe* and *follow from*) and those that are not (e.g. *infer, conclude, conjecture*). But it's not clear to me given Papafragou's discussion why subjective epistemics should pattern with non-stative mental verbs rather than stative ones.

That said, it's not at all clear what it is about emotive factives like *be surprised* that's supposed to block a speaker/time-of-utterance indexical. Presumably, emotive factives in the first-person and present tense express an emotion which itself invokes the speaker and the time of utterance. But the subjectively interpreted *must* is awkward under *be surprised* whether or not *surprise* is oriented to the speaker.

(30) ?Bill finds it surprising that John must live in Brooklyn.

We can turn to another construction to test Papafragou's hypothesis: exclamation. I've recently argued that the illocutionary force operator of exclamation is a function from propositions to speech acts which reference the speaker, the time of utterance and the world of evaluation (Rett forthcoming). (In this respect the utterance of an exclamative is similar to the utterance of an *I'm surprised...* assertion, although they differ in other important respects (Rett 2008).) I characterize the illocutionary force of exclamation as follows:

(31) E-FORCE(p), uttered by s_C at t, is appropriate in a context C if p is salient and true in w_C. When appropriate, E-FORCE(p) counts as an expression that s_C had not expected that p prior to t.

So the utterance of an exclamation *(Wow,) John arrived on time!* is appropriate in the context of utterance if it is salient and true that John arrived on time, and it counts as an expression on the part of the speaker that, some time prior to the time of utterance, he had not expected John to arrive on time.

If this characterization of exclamatives is right, and if Papafragou's hunch is right, we would expect the performative *I conclude* to be unacceptable in exclamations because it is a here-and-now indexical. And this is in fact what we see.[2] This is demonstrated in (32) for proposition exclamations, in (33) for *wh*-exclamatives and in (34) for nominal exclamatives.

(32) a. Wow, (*I conclude) John arrived on time!
b. Wow, (*I conjecture) Sally likes kombucha!

(33) a. What a teacher (*I conclude) John is!

[2]For what it's worth, exclamatives, too, are unacceptable in the antecedent of conditionals, and at least part of their content can't be directly denied. See Rett (forthcoming) for discussion.

b. (Just think of it!) How terribly much money (*I conjecture) he might have!

(34) a. Oh, the places (*I conclude) she'll go!
b. Boy, the things (*I conjecture) he'll do for notoriety!

However, subjectively interpreted epistemic modals of all sorts are perfectly acceptable in these types of exclamations:

(35) a. Wow, John must have arrived on time!
b. Wow, Sally might like kombucha!

(36) a. (Given what I know,) What a teacher John must be!
b. (Just think of it!) How terribly much money he might have!

(37) a. Oh, the places she might visit!
b. Boy, the things he must do for notoriety!

Since there is independent reason to believe that the speech act of exclamation invokes the speaker and time of utterance, and since this correctly predicts the unacceptability of performatives in exclamations, the acceptability of epistemic modals in exclamations like (36) puts a great deal of tension on Papafragou's claim that subjective modals behave they way they do because they are indexicals to the speaker and time of utterance.

I'll mention a related puzzle as a brief side note: epistemic modals are acceptable in *wh*-exclamatives and nominal exclamatives, but neither epistemic nor deontic modals can head inversion exclamatives (for discussion see McCawley 1973).

(38) a. *Boy, must she like cake! cf. *Boy, does she like cake!*
b. *Boy, must she go to the store! cf. *Boy, does she have to go to the store!*
c. *My, could she have taken the stapler! cf. *My, can she staple!*

To my knowledge, there is no satisfactory account of this restriction; since it cuts across not just all epistemic modals but deontic modals as well, it seems only possibly related to other quirky behavior of subjectively interpreted epistemics.

To sum up this section: there is reason to doubt Papafragou's (2006) claim that all subjectively interpreted epistemic modals are unacceptable in the antecedent of conditionals and under e.g. emotive factives. This is in part because these contexts seem to be sensitive to the distinction between *must* and *might*, while the subjective/objective distinction is arguably not. Additionally, there is reason to doubt Papafragou's claim that subjectively interpreted epistemic modals pattern in these respects with performative verbs like *I conclude* because they are indexical to the speaker and time of utterance. In linguistic contexts which are themselves thought to be here-and-now indexical, like the illocutionary force of exclamation, it's true that performatives are unacceptable. But these same contexts allow epistemic modals, however they're interpreted.

4.2 *The subjective/objective distinction revisited*

I'd like to propose an alternative view of the data based on Lyons's (1977) insight into the subjective/objective distinction, which I'll repeat here:

> But now consider the following situation. There is a community of ninety people; one of them is Alfred; and we know that thirty of these people are unmarried, without however knowing which of them are unmarried and which are not. In this situation, we can say that the possibility of Alfred's being unmarried is presentable, should the speaker wish to so present it, as an objective fact. The speaker might reasonably say that he knows, and does not merely think or believe, that there is a possibility (and in this case a quantifiable possibility) of Alfred's being unmarried; and, if he is irrational, his own subjective commitment to the truth or falsity of the proposition "Alfred is not married" might be quite unrelated to his knowledge of the objective possibility, or degree of probability (1/3), of its truth, in the way that a gambler's subjective commitment to the probability of a particular number coming up in roulette might be quite unrelated to the objective possibilities. (797-8)

It seems true that Lyons' contexts distinguish an objective and subjective interpretation (between what is generally known and what is known to the speaker). But it also seems true that the contexts distinguish knowable truth and unknowable truth, based on whether the modal is calculated according to a determinate or indeterminate modal base. In Lyons' scenarios, the objective interpretation is one in which the modal base is determinate and finite: to evaluate the truth of the sentence *Alfred may be unmarried*, we are asked to hold fixed the fact that Alfred is one of ninety members of the community and that thirty community members are married. The subjective interpretation, on the other hand, is much less straightforward. In the gambling example, the gambler's subjective commitment to the probability of his winning, Lyons admits, could be "quite unrelated to the objective possibilities". In this case, the truth of the subjective proposition could could invoke a modal base which is vague or indeterminate from the hearer's point of view.

From this perspective, there is a distinction between a subjectively and objectively interpreted modal but there is also a distinction between modal propositions whose truth can or cannot be calculated precisely on a determinate and finite modal base. The objective interpretation might tend to correlate with a scenario in which the truth of the modal proposition is calculable, but it need not. If this is right, then it could very well be that some of the observations made in Papafragou (2006) could have to do with a vague or indeterminate modal base rather than a subjectively interpreted epistemic modal.

The difference between knowable and unknowable (to the hearer) truth could explain the observation made in the previous section that the unacceptability of a modal proposition in the antecedent of a conditional seems to vary more with the proposition than it does with the orientation of the judge. Recall that *It might be rain tomorrow* seems universally acceptable in antecedents; this could be that

weather forecasts generally tend to reflect meteorological forecasts, which might be characterized as an exhaustive investigation of finitely many (determinate) possible worlds.

Unmodalized sentences in future tense/aspect, however, are generally unacceptable in antecedents of conditionals (Haegeman and Wekker 1984).

(39) a. *If it will rain tomorrow, I will bring my umbrella.
b. *If you will finish your paper by Friday night I will be surprised.

The truth of futurate sentences like these are arguably unknowable. One exception are "assumed likelihood" uses of *will*, which are noticeably more acceptable in antecedents (among others Palmer (1979); examples from Haegeman and Wekker (1984) p46):

(40) a. If you will smoke a pack a day you will never get rid of that cough.
b. If you will not be in receipt of a scholarship or Award or if the Award will be inadequate to meet the full fees and expenses of your course and your maintenance, please state how you propose to meet those fees and expenses.

It seems reasonable that the difference between the sentences in (39) and the ones in (40) could have to do with the extent to which context has restricted the relevant possible worlds according to which the truth of the propositions is evaluated.

On the other hand, *It might rain tomorrow* could be subjectively interpreted in a context in which the speaker's evidence for his claim is based on something significantly more idiosyncratic and opaque than a meteorological forecast. In a context in which John bases his predictions of the weather on subtle differences he detects in his bum leg, I believe, a sentence like (41) becomes relatively unacceptable.

(41) #If it might rain tomorrow, Jeb will stay inside.

Like Papafragou, I intend this to be a gesture at an account rather than an analysis. I cannot offer a semantics of the conditional such that it's formally explicit why *if* requires a determinate modal base. And this suggestion cannot be extended to explain Papafragou's observation (in (15)) that epistemically interpreted *must* cannot be embedded under *surprise* (but, as I've mentioned, there are extant theories about the difference between *must* and *may* which could potentially account for this fact). But I do believe that it could be relevant to Papafragou's observations about the assent/dissent tests, repeated from (17):

(42) A: This professor must be smart.
B: ?Is that so? (= Is it the case that this professor must be smart?)
B′: ?I don't believe it. (= I don't believe this professor must be smart)

Recall that the PPT data informed us that, if A utters a sentence with a subjectively interpreted element, his interlocutor B will tend to evaluate its truth relative to himself (to B). So if A's statement in (42) is uttered in a context which promotes the subjective interpretation of *must* but which also leaves vague the modal base

from which A is basing his statement, then B will interpret it from his perspective as judge. . . but will still not know how to value the epistemic modal base. This could explain B's inability to engage in the discourse with the modal proposition denoted by A's sentence.

To sum up: Papafragou (2006) observed that some epistemics are awkward in the antecedents of conditionals, and that in some contexts the meaning contributed by an epistemic can't be explicitly agreed with or denied. While she believes that these epistemics are those which are subjectively interpreted, I've suggested here that it could be those epistemics which invoke modal bases which are vague or indeterminate from the hearer's perspective. While contexts which promote a subjective interpretation will tend to be contexts in which the speaker's modal base is vague or indeterminate (and while contexts which promote objective interpretations will tend to be those in which the modal base is clear or determinate), this isn't necessarily the case, and I suspect that a more careful controlling of these two distinct components of the meaning of an epistemic modal (as well as more careful attendance to the *must/may* distinction) will bring us a long way in solving the puzzle of epistemic modals.

Conclusion

It's relatively clear that epistemic modals are unique among modals in their ability to be interpreted objectively or subjectively. Contextualist analyses of the phenomenon account for the difference by encoding into the meaning of epistemics a pragmatic variable corresponding to the judge or assessor. It also seems to be true that epistemic modals are restricted in their distribution relative to other modals: some instances of epistemics are unacceptable in the antecedents of conditionals, and some seem to be awkward when embedded under emotive factives or verbs of telling.

Papafragou (2006) argues that these distributional restrictions are positively correlated with an epistemic modal's being interpreted subjectively. In an attempt to explain this correlation, she claims that subjectively interpreted modals are prohibited in the same contexts as performatives like *I conclude...*, and that this is due to the fact that both are indexical to the speaker and time of utterance.

I've presented some data that strains this analogy and therefore Papafragou's explanation of the distributional restrictions on epistemic modals. At least one of the contexts she mentions – embedding under emotive factives or verb of telling – seems to differentiate between *must* and *might*, not between subjectively and objectively interpreted modals. But her observation that some epistemics are unacceptable in the antecedents of conditionals, and that the meaning contributed by some epistemics cannot be directly agreed with or denied, are genuine challenges to any semantic account of epistemics. I've suggested here that these characteristics could instead be characteristics of propositions which invoke a vague or indeterminate modal base.

Part of the discussion of subjective epistemics in Papafragou (2006) draws on an interesting parallel in evidentials. Across languages, evidential markers seem to vary on whether or not they contribute to truth conditions (e.g. Faller 2002; Matthewson

2010). If what I've argued above is correct, then the parallel properties demonstrated by many evidentials (including an inability to be directly agreed with or denied) could have to do with either the indeterminacy of a speaker's modal base or evidence source from the perspective of the hearer. A benefit of future work on this topic will be a better understanding of epistemics, evidentials, and the relationship between the two.

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