

# On a shared property of deontic and epistemic modals\*

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## Abstract

Epistemic modals encode an evidential restriction, requiring that the speaker have inferential evidence for the prejacent (Karttunen, 1972). Stone (1994) and von Stechow and Gillies (2010) encode this restriction lexically in e.g. *must*, which (given a unified treatment of modals, Kratzer 1991) raises the question: what happens to this restriction when *must* receives a deontic interpretation?

I claim that both deontic and epistemic modals have in common a requirement that their prejacent be inferred from some premises (Glass, 2013). I argue, following Lance and Little 2006, that this is a property of moral reasoning quite generally; in epistemic modal bases, it amounts to an inferential evidence requirement. Deontic and epistemic modals form a natural class with respect to this property to the exclusion of other modal bases; I argue that it is what prevents their acceptability in certain exclamatives (cf. \**Wow, must Sue be the murderer!*). It also offers insight into why languages like English sometimes lexicalize these two modal bases to the exclusion of others.

## 1 Introduction

Modals like the English *must* and *may* can receive an epistemic or deontic interpretation, but cannot receive some other interpretations (e.g. an ability interpretation, Hacquard, 2011).<sup>1</sup> The same is true for some modals in other languages: *mesti* ('must') in Malay (Drubig, 2001), Egyptian Arabic *laazim* ('must'), and Tamil modal suffixes (Palmer, 1986).

Despite this lexical tendency to treat deontic and epistemic modality as a natural class, it's relatively hard to find ways in which these two flavors behave semantically similarly to the exclusion of others. Instead, epistemic modals seem to behave differently from all other 'root' modal flavors, including deontic modality. In particular, epistemic modals tend to scope high while root modals tend to scope low, as is evident in their interaction with other quantifiers and in their temporal anchoring (Ippolito, 2002; Hacquard, 2009,

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<sup>1</sup>I will focus on the contrast between deontic and epistemic interpretations on the one hand and ability and future interpretations on the other. There are a few additional modal flavors distinguished in the descriptive literature which are available for *must*: teleological (e.g. *In view of his goals, John must pass the test*) and bouletic (e.g. *In view of his desires, John must pass the test*). I will set these aside for now, as I am unaware of any significant way in which they differ from deontic modality. I will however briefly return to bouletic modals (and *should* and *ought*) in §4.

2011). Given this, from a semantic point of view, it's surprising to find a lexical kinship between deontic and epistemic modality across languages.

Meanwhile, epistemic modals display some semantic properties that seem best encoded in the lexical entries of modals like *must*: an anaphoricity requirement (Stone, 1994); an indirect evidence requirement (von Stechow and Gillies, 2010); and a flexibility in terms of whose knowledge is reflected in the modal base (von Stechow and Gillies, 2011). Because *must* can additionally receive a deontic interpretation, these proposals inadvertently predict that deontic *must* displays similar behavior. At the moment, it is unclear whether these predictions are borne out.

I will argue that we can reconcile the linguistic evidence for a kinship between deontic and epistemic modality with at least some recognized properties of epistemic modality if we assume that modals like *must* impose what I'll call an 'inference requirement': a requirement that the prejacent be inferred from some premises, a set of propositions reflecting contingent and logical assumptions about the context at the time of utterance. This proposal is effectively an extension of the epistemic modal account in Stone 1994 to deontic modals, following suggestions in Glass 2013. In the case of epistemics, the consequence is an inferential evidence requirement (similar to the one described in von Stechow and Gillies, 2010). In the case of deontics, as discussed in Lance and Little 2006, this same requirement is manifested as a normative claim that admits of exceptions.<sup>2</sup>

My evidence for treating deontic and epistemic modality as a natural class in this way comes from the unacceptability of *must* (and to a large extent *may*) in inversion exclamatives, exemplified in (1).<sup>3</sup>

- (1) a. \*(Wow,) Must/May Sue be the murderer! *epistemic*  
b. \*(Wow,) Must/May Sue complete the assignment on time! *deontic*

In contrast, inversion exclamatives can be headed by modals with other interpretations, as illustrated in (2).

- (2) a. (Wow,) Can Sue dance! *ability*  
b. (Wow,) Will Sue be mad! *future indicative*  
c. (Wow,) Would Sue like to win the race! *future subjunctive*

I will argue that exclamations are unacceptable in contexts in which the speaker has inferential evidence for the prejacent; that this is what explains the contrast in acceptability between (1) and (2), and gives credence to an account in which deontic and epistemic modality both indicate that the prejacent was inferred from a salient set of premises.

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<sup>2</sup>I am indebted to Nate Charlow for pointing out the relevance of this work.

<sup>3</sup>This empirical claim is sensitive to certain intonational and stress patterns; for instance, the inversion exclamation *\*Man, must Sue complete the assignment!* has a distinct interpretation from a superficially similar utterance with no intonation break after *man*: *MAN must Sue complete the assignment!* (McCready, 2009). I will address these subtleties in §3.

In this paper, I will be focusing on the so-called ‘strong’ necessity modal *must* (and its possibility counterpart *may*), leaving aside the so-called ‘weak’ necessity modals *ought* and *should*. While these weak necessity modals arguably receive epistemic in addition to deontic interpretations (e.g. *It ought to be raining by now*), they differ in substantial enough ways from strong necessity modals to warrant putting them aside, at least for now (von Fintel and Iatridou, 2008). It is, however, worthwhile noting that these weak necessity modals are in general unacceptable in inversion exclamatives.

## 2 A semantics for deontic and epistemic *must*

In this discussion, I’ll focus on matrix (read: unembedded) sentences in the absence of other scoping elements. I’ll begin by discussing the evidential restriction encoded by epistemic modals (§2.1) and one strength-based account of it; I’ll then present the analysis of epistemic modals as anaphoric to generalizations in Stone 1994 (§2.2). In §2.3, I extend a version of this analysis to deontic modals, allowing for a unified account of the deontic and epistemic interpretations of modals like *must*.

### 2.1 The evidential requirement on epistemic modals

It’s widely recognized that matrix sentences containing bare epistemic modals  $M$ , of the form  $M(\phi)$ , are infelicitous in contexts in which the speaker has direct evidence for  $\phi$  (Karttunen 1972, though see De Haan 1999 for a dissenting opinion). This is typically illustrated with the pair in (3):

- (3) a. It is raining.  
b. It must be raining.

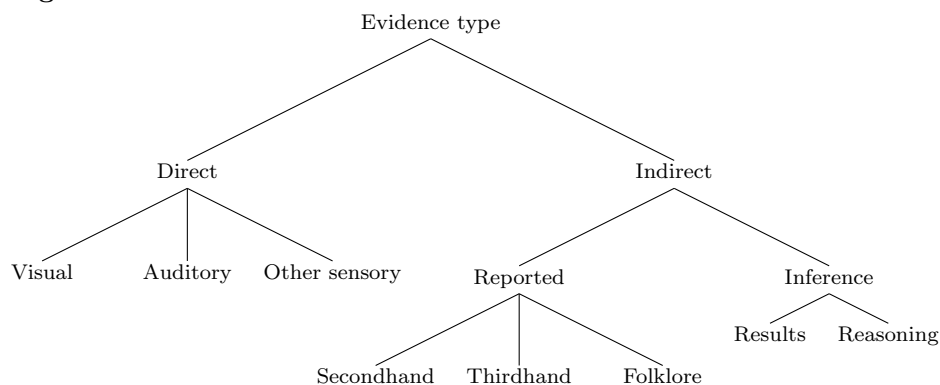
In a context in which the speaker is looking out the window, watching the rain fall, (3-a) is acceptable, but (3-b) is not. In contrast, (3-b) is acceptable and natural in a context in which the speaker has only seen someone enter the building with a wet umbrella.

As von Fintel and Gillies (2010) point out, this difference complicates discussion of “Karttunen’s Problem”: the question of which is logically stronger:  $\phi$  or  $must(\phi)$ . Whereas many have concluded that  $must(\phi)$  is weaker (Groenendijk and Stokhof, 1975; Lyons, 1977; Kratzer, 1991), von Fintel and Gillies conclude, based on the evidential complications, that this is a false dichotomy (p.361): “weakness and indirectness are not two sides of a single coin at all. They are just different. Any arguments for a weak semantics need to be more than just reminders that *must* carries an indirect evidential signal.”

There is an important question of exactly what sort of evidence *must* requires (I’ll discuss epistemic possibility modals at the end of the section). I will agree with the characterization, in von Fintel and Gillies (2010), that *must* requires “the presence of an indirect inference or deduction rather than of a direct observation” (p.351). I will however treat this requirement as an **inferential** evidence requirement, as opposed to an **indirect** evidence requirement. This distinction will be made clear in what follows.

von Fintel and Gillies, following Willett 1988, endorse a particular typology of evidence based on distinctions lexically encoded in evidential markers across languages, as shown in Figure 1 (see also de Haan, 2005; Aikhenvald, 2006). As is appropriate for evidential languages, this typology differentiates based on the *type* of the evidence received, not on the *strength* of the evidence received. This distinction will be made clear in what follows.

**Figure 1.**



A speaker has direct evidence for a proposition that references an eventuality iff the speaker has seen, heard or otherwise sensorily perceived that eventuality. Examples include seeing it rain; hearing the bell ring; and smelling the pie burning. A speaker has reported or hearsay evidence for a proposition  $\phi$  if the speaker has learned that  $\phi$  from some third party, or if  $\phi$  is a matter of common cultural knowledge (folklore), etc.

Finally, there are two ways, according to this typology, by which a speaker can have inferential evidence for a proposition  $\phi$ : the speaker can infer that  $\phi$  from some physical evidence that she interprets as an indicator of  $\phi$  (the ‘results’ reading); or she can infer that  $\phi$  from other things she knows (the ‘reasoning’ reading). An example of the former is inferring that John is home from seeing his shoes and bag in the hallway; an example of the latter is inferring that John is home from knowing what time it is coupled knowing John’s schedule (and that he is reliable and punctual, etc.).

These evidential distinctions are demonstrated below with data from Tsafiki, a Barbacoan language spoken in Ecuador (Dickinson, 2000, 407–408). (4-a) demonstrates the direct-evidence interpretation that

Tsafiki sentences which lack an overt evidential marker receive. (4-b) illustrates the Tsafiki reportative evidential. Tsafiki has two distinct inferential evidentials: the one in (4-c) is used when the speaker has inferred the prejacent from sensory evidence, while the one in (4-d) is when the speaker has inferred the prejacent from information already in her knowledge base. Notably, evidential languages mark the strongest evidence in a situation in which the speaker has more than one type of evidence for a proposition.

- (4) a. Manuel ano fi-e.  
 Manuel food ate-DECL  
 ‘Manuel ate.’ (The speaker saw him.)
- b. Manuel ano fi-nuti-e.  
 Manuel ano ate-EV<sub>1</sub>-DECL  
 ‘Manuel has eaten.’ (They said so.)
- c. Manuel ano fi-nu-e.  
 Manuel food ate-EV<sub>2</sub>-DECL  
 ‘Manuel ate.’ (The speaker sees the dirty dishes.)
- d. Manuel ano fi-nki-e.  
 Manuel food ate-EV<sub>3</sub>-DECL  
 ‘Manuel ate.’ (He always eats at 8:00; it’s now 9:00.)

I will argue here that the evidential requirement encoded in epistemic modals like *must* is an **inferential requirement**: a requirement that the speaker have inferential evidence (of either the ‘results’ or ‘reasoning’ variety) for the prejacent.<sup>4</sup> This characterization is importantly different from a prohibition against direct evidence (or a requirement that the speaker have *indirect* evidence) because, as Figure 1 shows, the two make different predictions with respect to reported evidence. It is also different from a prohibition against reliable evidence (a strength-based characterization), because inferential evidence can be reliable or indefeasible. These different perspectives have been blurred in recent accounts, so I will tease them apart here.

I thus agree with the observation that utterances of *must*( $\phi$ ) “signal that the prejacent was reached through an inference rather than on the basis of direct observation or trustworthy reports” (von Stechow and Gillies, 2010, 353). But von Stechow and Gillies elsewhere characterize the evidential restriction encoded by *must* and other epistemic modals as a prohibition against direct evidence (p372): “the modal signals that [the speaker’s] information isn’t direct”.

If the evidential restriction encoded by *must* was really just a prohibition against direct evidence (instead of a requirement for inferential evidence), we would predict that *must*( $\phi$ ) is acceptable in cases of reported or hearsay evidence. But it is not. Imagine a situation in which John is listening to the radio using earphones in a room with Sue. John hears the news report that the President has been shot. In this scenario, he can

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<sup>4</sup>Although see Winans *to appear* for evidence that *will* is even more picky than this, at least in certain syntactic contexts.

relay this news to Sue by saying, *The President's been shot* or *They say the President's been shot*, the latter being a typical use of a reportative evidential in evidential languages. But it is infelicitous, in this context, for John to report *The President must have been shot*.<sup>5</sup>

Furthermore, the evidential restriction encoded by epistemic modals needs to be a restriction about evidence type, not a restriction about the strength of the evidence (although Matthewson 2014 presents a dissenting view). In other words, an utterance of *must*( $\phi$ ) requires that the speaker have inferred that  $\phi$  from some set of premises, but it doesn't require that the speaker's evidence for  $\phi$  be defeasible or unreliable. While there might be a tendency for direct evidence to be reliable and for inferential evidence to be unreliable (you might have more confidence that John is home if you see him at home than if you infer that he's home from knowledge of his schedule), evidence type does not necessarily correlate with evidence strength.

Davis et al. (2007) address this point in great detail. Two brief examples will suffice to illustrate the point: a speaker could have direct evidence for  $\phi$  but might be hallucinating, in which case their evidence is unreliable. Or a speaker could have inferential evidence from nondefeasible, non-contingent premises, as in the case of a mathematical proof, the conclusions of which are notoriously quite natural with epistemic necessity modals, as in *Therefore, x must equal 2*.

Despite this, the account in von Fintel and Gillies (2010) is formalized in terms of a prohibition against reliable or strong evidence rather than a requirement in terms of the type of evidence. Informally, it requires that the speaker's evidence for the prejacent must "fail to directly settle whether"  $\phi$ , p.372. This might, as they suggest, appropriately prohibit *must* in cases in which the evidence source is a trustworthy report, but it does not make the right predictions in scenarios like the two discussed above when the strength of evidence does not correlate in expected ways with the type of evidence.

von Fintel and Gillies first define what it means to count as evidence for a proposition: they use the term 'kernel' – represented as a set of propositions  $K$  – for privileged information that counts as evidence in the context. They then characterize *must* as a prohibition on evidence that "directly settles" the prejacent (5) in a context of evaluation  $c$  and a world of evaluation  $w$ .

- (5) Fix a  $c$ -relevant kernel  $K$ :
- i.  $\llbracket \text{must } \phi \rrbracket^{c,w}$  is defined only if  $K$  does not directly settle  $\llbracket \phi \rrbracket^c$

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<sup>5</sup>In a scenario in which John hears from Bill that it is raining outside, and Sue then asks him if it's raining outside, John can felicitously respond, *Bill said so, so it MUST be raining outside*. As far as I can tell, these utterances are different from standard uses of reportative evidentials because they generally require focal stress on *must*; they require that the evidence source be made explicit; and they are more natural if the prejacent already have been introduced in the discourse. In these cases, the utterance also seems to reflect a certain authority on behalf of the source. In light of the unacceptability of *must* in more canonical reported evidence cases, like the radio example above, I will tentatively suggest that these acceptable cases involve a third-person report *in addition to* an inference from the source's authority, making it a more natural fit for inferential evidentials. This is in direct contrast to the conclusions drawn in Matthewson (2014).

- ii. If defined,  $\llbracket \text{must } \phi \rrbracket^{c,w} = 1$  iff  $B_K \subseteq \llbracket \phi \rrbracket^c$

The first clause of (5) encodes their version of the evidential restriction as part of the definedness conditions of a *must*( $\phi$ ) statement.<sup>6</sup>

What it means for a kernel to “directly settle” the prejacent  $\phi$  is clearly central here; von Fintel and Gillies say (p.372), “The basic intuition is that  $K$  can fail to directly settle whether  $P$  even though  $K$  entails whether  $P$ ; epistemic modals carry an evidential signal that exploits that gap”. As discussed above, this doesn’t necessarily rule out direct evidence because sensory evidence from a hallucinating individual doesn’t entail the prejacent; it also doesn’t succeed in allowing all types of inferential evidence, because inferential evidence from non-defeasible premises *does* entail the prejacent in the relevant sense.

I’ll end this section by discussing the scope of the restriction presented here. I’ve argued that epistemic *must* encodes an evidential restriction, and that this restriction is best characterized as a requirement that the speaker’s evidence be inferential, rather than a restriction against weak or unreliable evidence. I thus differ with von Fintel and Gillies on exactly how this restriction should be formulated, but I agree with them that the restriction isn’t isolated to *must*. It is arguably a property of epistemic possibility modals like *may* and *might* as well as epistemic *ought*.

von Fintel and Gillies emphasize that “Our claim isn’t that *must* uniquely carries this extra evidential component over and above its quantificational oomph. Our claim is that epistemic modals in general carry this signal” (p.373). Their lexical entry for the epistemic possibility modal *might* (given the definition in ??, a context of evaluation  $c$  and a world of evaluation  $w$ ) is in (6).

- (6) Fix a  $c$ -relevant kernel  $K$ :
- i.  $\llbracket \text{might } \phi \rrbracket^{c,w}$  is defined only if  $K$  does not directly settle  $\llbracket \phi \rrbracket^c$
  - ii. If defined,  $\llbracket \text{might } \phi \rrbracket^{c,w} = 1$  iff  $B_K \cap \llbracket \phi \rrbracket^c \neq \emptyset$

In (6), *might* has an evidential requirement but encodes a weaker, existential requirement in its truth conditions. Because *might*( $\phi$ ) requires only that there be some world in the modal base compatible with  $\phi$ , it is markedly harder to detect the presence of an evidential restriction of a bare modal. But, because presupposition and other types of not-at-issue content project outside of negation, we can detect an evidential requirement when *might* (and other epistemic possibility modals) are embedded under negation. (7) is their example involving epistemic *can* (von Fintel and Gillies, 2010, 373).

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<sup>6</sup>von Fintel and Gillies (2010: 368) characterize the evidential restriction of *must* as a presupposition by a process of elimination; they reject the idea that evidentiality is encoded in a conventional implicature in terms of specific details of the account of conventional implicature in Potts (2005). But because evidentials generally introduce new information, the evidential restriction is arguably better thought of as non-truth-conditional, not-at-issue content (Murray, 2010).

- (7) [Billy, seeing brilliant sunshine]  
 a. It's not raining.  
 b. ??It can't be raining.

In contrast, these sentences are acceptable in a context in which the speaker has only indirect evidence that it isn't raining; von Fintel and Gillies label (7-b) acceptable in a context in which Billy sees people enter a windowless room from outside wearing 'sun gear' like hats, sunglasses and parasols.

It remains to be seen whether this inferential evidential restriction is a necessary property of epistemic modals across languages (although there's some evidence it could be; Matthewson et al., 2007); for now, I will agree with von Fintel and Gillies that it is a property of the English epistemic modals *must*, *may*, *might*, and *ought*. In the next section, I present an account of this inferential restriction that allows for an extension to the deontic counterparts of these modals.

## 2.2 The inferential evidence requirement

In his 1994 paper, Matthew Stone proposed a semantic analysis for epistemic *must* formalizing Palmer's (1986: 59) intuition that "it is the notion of deduction or inference from known facts that is the essential feature of *must*, not just the strength of commitment by the speaker. For *must* does not have the same kind of meaning as the adverbs *certainly*, *definitely*, etc., which are, indeed, indications simply of the speaker's confidence or commitment." His is an account of the evidential restriction based on evidence type rather than evidence strength, and I will adopt it and extend it in what follows.

Part of Stone's argument against characterizing the evidential restriction of *must* in terms of reliability or validity comes from the frequent use of *must* to mark conclusions in mathematical proofs, "where every step of reasoning meets the strictest criteria of validity" (p.183). Informally, Stone's analysis of *must* treats it as anaphoric to an argument that justifies the conclusion of the prejacent. Doing so, he suggests, "it serves [speakers'] communicative intentions to make the dependence of claims on evidence particularly clear" (p.183). His informal description of the meaning of *must*( $\phi$ ) is in (8).

- (8) Some particular collection of facts  $A$ , salient in the common ground, provide (or have provided) a decisive reason to adopt the belief that  $\phi$ .

Decisive reasons for the belief that  $\phi$  can be logical (i.e., can entail  $\phi$ ) but can also be defeasible.

To implement his account, Stone draws on the notion of (potentially defeasible) generalizations from accounts of default reasoning in Reiter (1980), Harman (1986), and Simari and Loui (1992) (later developed in Horty, 2012). This is at least in part because his account "depends on a model of reasoning in which



defeasible conclusions may be adopted on the basis of packages of evidence natural enough that speakers can refer to them in conversation” (p.185).

Stone first establishes the nature of the set of possible premises for an inference (p.186): “The formalization starts from a context  $\kappa$  consisting of a set  $K$  of established propositions consisting of ground formulas  $K_C$  and (logical) rules  $K_N$  and an additional set  $\Delta$  of defeasible rules.” He also defines what constitutes an argument for a given proposition: effectively, a set of propositions  $T$  (a subset of established propositions  $K$ ) counts as an argument for a proposition  $h$  in a context  $\kappa - \langle T, h \rangle_\kappa$  – if  $h$  is entailed by any context that includes  $T$  and standard common ground assumptions in that context.

Stone also provides a definition of what it means for an argument  $T$  to **justify** a proposition  $h$  in a context  $\kappa$  (notated as  $\kappa \models \langle T, h \rangle_\kappa$ ). Informally, in Stone’s account, arguments are constructed step-by-step from subarguments, and an argument justifies a proposition if “after a certain point in this induction, no further evidence against it comes to light” (p.186). This notion of a justified argument is invoked in the definition of truth in a context  $\kappa$ , given in (9). The end result is the semantics for epistemic *must* in (10), characterized in terms of two semantic arguments: a sentence  $S$  and a contextually salient argument  $A$ .

(9)  $\llbracket S \rrbracket$  is true in  $\kappa$  if and only if  $\kappa \models \llbracket S \rrbracket$  (i.e., if  $\llbracket S \rrbracket$  is justified in  $\kappa$ ).

(10)  $\llbracket \text{Must } S(A) \rrbracket$  is true in  $\kappa$  if and only if  $\kappa \models \langle A, \llbracket S \rrbracket \rangle_\kappa$ .

According to (10),  $\text{must}(\phi)$  is true iff there is a salient argument  $A$  that justifies  $\phi$ .

The analysis therefore invokes anaphora to a salient argument to account for the inferential evidence restriction encoded by epistemic *must*. This innovation makes a particularly useful prediction:  $\text{must}(\phi)$  can be false while  $\phi$  is true. Stone’s example of such a situation is a context in which two potentially conflicting arguments are taken for granted (i.e. are in  $K$ ), namely:

- (11) a.  $A_1$ : A (recently) struck match is a hot match (unless it was wet when struck).  
 b.  $A_2$ : Something that has (recently) been boiled is hot and wet.

In a context in which it’s known that a match has been struck, but also that it’s been boiled, the proposition “The match is hot” is true. But the sentence *The match must be hot* is either true or false, depending on whether  $A_1$  or  $A_2$  is a (or the most) contextually salient argument for *must*. This is illustrated in the following (felicitous) exchange:

- (12) A: The match was struck, so it must be hot.  
 B: Well, no. It is hot because it was boiled. It didn’t light.

This example highlights the same point made in von Stechow and Gillies (2010), namely, that determining the

relative strength of  $\phi$  and  $must(\phi)$  is significantly complicated by the evidential restriction of  $must$ .

The account in Stone 1994 reinforces the claim from §2.1 that the semantics of  $must$  (and, arguably, other epistemic modals) should require that the prejacent follow from an argument or generalization. The above example highlights the need to ensure that these arguments can (but need not) be defeasible. In the next section, I'll argue that this inferential requirement can be used to explain the apparent affinity between deontic and epistemic modality.

### 2.3 A common account for deontic and epistemic modals

I claim here that what deontic and epistemic  $must$  have in common is that they require that the prejacent follow from some argument or generalization (and nothing stronger). This claim involves, in effect, extending the semantics of Stone's (1994) epistemic  $must$  to its polysemous deontic use, following Glass 2013.

The idea that deontic  $must$  statements also require inferential evidence is echoed in some areas of ethical theory. Lance and Little (2006) draw an explicit parallel between epistemic and deontic reasoning (in contrast to e.g. reasoning about aesthetics). According to them, epistemic and deontic reasoning have in common that they are inferences from a set of potentially defeasible premises (Aristotle's *hos epi to polu*, 'for the most part' generalizations). Their characterization of the type of inference involved relies on a notion of a defeasible normative generalization, which itself "involves two parts: understanding what happens in circumstances that are in some sense privileged, and, second, understanding... which deviations [are] acceptable" (p.312). In the case of moral reasoning, this amounts to a) knowing whether an action is wrong in an idealized situation, and b) knowing which (if any) circumstances could nevertheless justify that action (a context-sensitivity referred to as 'switch valence'). Examples include (p.306-7) causing pain (acceptable when it's "constitutive of athletic challenge"); lying (acceptable when done to Nazis, or as part of a game); and not heeding the express wishes of competent agents (acceptable "in the S&M room").

Effectively, the claim is that "[m]oral understanding, while drenched in exception, is understanding of a structure, not merely a series of instances" (Lance and Little, 2006, 319). This understanding of a structure is the natural result of knowledge of these normative generalizations along with an ability to infer from them based on the particulars of a given context. Horty (2012) embraces this parallel, as well, in his formal treatment of reasons as defaults (parallel to Stone's 1994 treatment of epistemic modals): he argues that defeasible generalizations in ethics and epistemology help account for the generalizations, used in natural language, that are "useful for our ordinary reasoning" (p.10). However, I take my claim that deontic reasoning involves inferential evidence to be compatible with the view that prejacentes are inferred from moral or ethical

intuitions instead of (or in addition to) general principles (e.g. Dancy, 1983).

I am not in a position to evaluate these ethical theories, but I find them encouraging for a semantic theory that attempts to explain the morphological connection between epistemic and deontic modals via an inferential evidence restriction. Important for the present discussion is that deontic and epistemic judgments have in common an inference from some premises, not – at least for my purposes – that these premises be defeasible. As Stone (1994) already pointed out, epistemic *must* is perfectly acceptable in cases in which the prejacent  $\phi$  is inferred from a logical truth (or a series of logical truths), in e.g. mathematical proofs. Lance and Little (2006) argue that, in the case of moral reasoning, the relevant premises are by nature defeasible, but I will take a weaker stance, namely that the relevant premises in both cases are potentially defeasible.

There is, however, one important difference between moral judgments and epistemic judgments: I can make an epistemic judgment (i.e. decide that  $\phi$  is true) without inferring from a set of premises, but (as Lance and Little and others have argued) I cannot make a deontic judgment without inferring from a set of premises or an intuition. In other words, deontic judgments depend on deontic reasoning, but epistemic judgments may or may not depend on epistemic reasoning. In the epistemic realm, the difference corresponds to the difference between having direct (or reported) evidence for  $\phi$  versus having inferential evidence for  $\phi$ . The consequence is that a definition of *must* that requires that the prejacent be inferred from some premises prohibits the use of epistemic *must* in certain contexts (ones not involving inference), but does not prohibit the use of deontic *must*, because inference is always involved in cases of moral judgment.

As a result of this difference, an account of deontic and epistemic *must* in which it carries an inference requirement – i.e., an extension of Stone’s (1994) account to the deontic domain – predicts that deontic modals will not display something parallel to an inferential evidence restriction: a commitment that  $\phi$  is inferred from certain premises will rule out some uses of epistemic *must*, but not of deontic *must*. We will thus have to look elsewhere for evidence that deontic and epistemic modals have in common this inferential restriction. This is the topic of §3.

Below is a modal-semantic proposal for a common account of deontic and epistemic *must*. It represents a basic extension of the inferential analysis of epistemic *must* in Stone 1994 to deontic modals. It characterizes *must* in both cases as acceptable only if the prejacent is justified according to some salient set of premises  $K$  in the context of utterance. I will therefore refer to these modals as ‘inferential modals’.

This approach was anticipated by Glass (2013), who argues that deontic and epistemic modals have in common that they “invoke a body of rules of some sort: for deontic *must*, these are normative rules such as “do not litter,” and for epistemic *must*, descriptive rules about how things tend to unfold, such as

“wet umbrellas indicate rain” (p2). Her focus was on addressing Karttunen’s Problem, and she encodes the inferential restriction in the ordering source of the modal.

I will maintain Stone’s use of the variable  $K$  to range over a set of established propositions, including logical rules and contingent (defeasible) premises.

- (13) For some accessibility relation  $R$  and ordering source  $g$  salient in  $c$ :
- a.  $\llbracket \text{must } \phi \rrbracket^{c,w}$  is defined iff there is some salient set of propositions  $K$  such that  $K$  justifies  $\phi$  in  $c$ .
  - b. If defined,  $\llbracket \text{must } \phi \rrbracket^{c,w}$  is true iff  $\forall w' [wRw' \rightarrow \phi(w')]$

Like the analysis in von Fintel and Gillies (2010), (13) encodes the inferential restriction as a precondition on the truth or falsity of  $\text{must}(\phi)$ . This means that a sentence of the form  $\text{must}(\phi)$  will be undefined if there is no salient  $K$  in  $c$  that justifies  $\phi$ . Unlike the analysis in Stone (1994), I will leave unspecified what it means for a set of premises to justify a proposition, although it is entirely plausible that Stone’s account or some equivalent can be extended to handle the deontic cases as well as his original epistemic cases.

Instead of defining the relationship between  $K$  and  $\phi$  in terms of indirectness or  $K$ ’s inability to “directly settle” whether  $\phi$ , (13) requires there be a set of propositions  $K$  that justifies  $\phi$  in  $c$ . This accounts for  $\text{must}$ ’s apparent reliance on inference while prohibiting neither logical entailments nor defeasible generalizations. Along with others in the evidential literature, I will assume that some pragmatic mechanism (possibly similar to scalar implicature) explains why elements that encode a requirement for a weak type of evidence are generally interpreted as prohibiting stronger types of evidence (e.g. direct evidence). Alternatively, the restriction in (13-a) could be strengthened from an existential requirement to a requirement about the strongest evidence salient in the context.

I’ll discuss an epistemic and a deontic example that are correctly predicted to be acceptable. Imagine that  $A$  and  $B$  are in a windowless room, watching a group of people enter from outside with wet umbrellas. In this scenario,  $A$  can felicitously and truthfully utter to  $B$ , *It must be raining outside*. (13) predicts that this utterance is felicitous because a set of propositions  $K$  – containing the proposition that people are entering from outside with wet umbrellas – is salient in the context of utterance and also justifies the prejacent under normal circumstances. The sentence is true because it holds in all the nearby worlds accessible from the world of evaluation by the salient epistemic modal base.

(13) makes several further predictions about the above situation. First, that the utterance is infelicitous or undefined if the relevant premise (that people are entering with wet umbrellas) is not salient in the context of utterance. Imagine a different scenario in which  $A$  sees people entering in from outside with wet umbrellas, then walks down the hall to  $B$ ’s office. In this scenario,  $A$ ’s utterance *It must be raining outside*

is infelicitous, unless it is followed by an explicit introduction of the relevant evidence (*...I just saw some people come in with wet umbrellas*).

Second, it predicts that this reference to a set of premises – as an explicit part of the non-truth-conditional content – can be indirectly denied in discourse, like other not-at-issue content (Potts, 2012). This is demonstrated in (14).

- (14) A: (Watching people enter with wet umbrellas) It must be raining outside.  
B: Hey, wait a minute, they're washing the roof right now. So you can't conclude that for sure.

Third, (13) – by virtue of its anaphora to a salient  $K$  – preserves the prediction from Stone's (1994) account that  $\phi$  can be true while  $must(\phi)$  is false, depending on which  $K$  is salient. Stone's example is repeated below from (12):

- (15) A: The match was struck, so it must be hot.  
B: Well, no. It is hot because it was boiled. It didn't light.

$A$ 's utterance is anaphoric to a particular set of premises: the inference from a match being struck to its being lit to its being hot.  $B$ 's response challenges the validity of this inference while endorsing the conclusion that  $\phi$ . If these predictions are right, they support the treatment of the evidential restriction of  $must$  as anaphora to a salient generalization, instead of encoding it in e.g. the ordering source (as Glass 2013 does).

Finally, (13) predicts that epistemic  $must(\phi)$  is undefined in a context in which the speaker does not have inferential evidence for  $\phi$ , or has better than inferential evidence for  $\phi$ . This distinction is made in evidential systems across languages, e.g. the Tsafiki data in (4). Inferential evidence is a *type* of evidence; it is not characterized relative to direct and reported evidence by its weakness. In a situation in which the speaker looks out the window and sees it raining, her conclusion that it is raining comes from a salient perceptual event, not from inference. In a situation in which the speaker hears from a colleague that it's raining, her conclusion comes from a salient speech event. In these cases, an utterance of *It must be raining outside* is predicted by (13) to be undefined because the conclusion is not justified by inference (or because it is justified by stronger evidence than inference).

There is a deontic parallel to these epistemic cases. Imagine that  $A$  and  $B$  know that Sue and John are driving to Las Vegas tomorrow, and they learn that John doesn't have a driver's license. In this context,  $A$  can felicitously and truthfully utter to  $B$ , *Sue must do all the driving tomorrow*. (13) predicts the utterance to be felicitous because there is a salient generalization in the context that justifies the prejacent: namely, that John doesn't have a driver's license. Notice that this information is arguably distinct from the modal base invoked by the modal, presumably one modeling the rules of the road in the world of evaluation. The

sentence is true in this scenario because it holds in all of the nearby accessible worlds.

As in the epistemic example, the salient information from which the prejacent is inferred must be salient in the discourse. In the above scenario, if *A* and *B* both know that Sue and John are driving to Las Vegas, but only *A* knows that John doesn't have a license, the statement *Sue must do all the driving tomorrow* would be odd unless it were followed by *A*'s explanation of her evidence for the prejacent. By virtue of its salience, *K* can also be challenged in discourse. Imagine again that *A* and *B* learn together that John doesn't have a driver's license, but *B* additionally knows that Bill is joining them on their trip.

- (16) A: Sue must do all the driving tomorrow.  
B: Hey, wait a minute, Bill has a driver's license. So you can't conclude that.

We can also establish a scenario, inspired by the Stone example, that makes it possible for  $\phi$  to be true while at least some utterance of *must*( $\phi$ ) is false. In a scenario in which *A* and *B* know that Sue and John are driving to Las Vegas tomorrow, the following exchange is felicitous:

- (17) A: John doesn't have a license, so Sue must do all the driving tomorrow.  
B: Well, no. Sue must do/is doing all the driving tomorrow because she's the only one insured on her car.

As in the epistemic cases, this discussion about the inference *A* is making in her utterance of *must*( $\phi$ ) seems independent of the modal base and ordering source of the modal: intuitively, the exchange in (16) holds fixed a circumstantial modal base in which Sue abides by the laws of the road and an ordering source prioritizing worlds that are as similar as possible to the world of evaluation.

One final comment on the analysis: unlike the other accounts discussed, (13) doesn't characterize *must* as lexically restricting the modal bases or accessibility relations available to *must*. Stone (1994) and von Stechow and Gillies (2010) do so because their definitions of *must* are explicitly restricted to its epistemic uses; Glass (2013) proposes two separate but parallel lexical entries for deontic and epistemic *must*. It remains to be seen whether such a restriction is necessary; it's possible that deontic and epistemic modals are the only ones that carry an inferential requirement.

Ability modals don't need to involve inference, as (18) shows (Austin, 1970; Brennan, 1993; Hackl, 1998).

- (18) John can ride horses/a horse. *ability*

(18) is acceptable in a context in which the speaker has seen John ride a horse before, which arguably counts as direct evidence for the prejacent. It also seems acceptable in a context in which the speaker has been informed that John rides horses. This suggests, in contrast to deontic and epistemic *must*, that ability *can*

does not encode an inference requirement, or isn't an inference modal.<sup>7</sup>

Future modals, as well, don't seem to encode an inferential restriction, although this is less clear.<sup>8</sup> The example in (19) suggests that *will* can be interpreted with respect to an epistemic modal base (although this use might be restricted to generic statements; Haegeman 1983).<sup>9</sup>

(19) As far as I know, oil will float on the water.

It is relatively hard to conceive of what would count as direct, perception-based evidence for a claim about the future (crystal balls aside). But we can conclude that *will* is not an inferential modal because it is compatible with even the strongest, most reliable reported evidence for an eventuality, so . Imagine that Mary's daughter Sue is graduating high school and is deciding which university to attend. On the day she is required to make a decision, Sue announces to Mary that she will attend UCLA. Mary can then report to her friend:

(20) Sue will attend UCLA in the fall.

In this scenario, Mary has reported evidence for the prejacent, resulting in a felicitous utterance. This suggests that the future *will*, unlike deontic and epistemic *must*, does not carry an inferential restriction.

In presenting this account of deontic and epistemic *must*, I've made the following claims: Epistemic *must* carries an evidential restriction requiring that the speaker have inferential evidence for the prejacent. This evidential restriction is best characterized, as in Stone 1994, as anaphora to a set of premises from which the speaker is justified in concluding the prejacent. Deontic and epistemic *must* have this evidential restriction in common (Glass, 2013); this correctly predicts that the the salient generalization to be denied in discourse for both interpretations. And it has the potential to offer insight into why deontic and epistemic modalities are often co-lexicalized across languages.

As I've suggested, there is some additional linguistic evidence in favor of this analysis. There is indepen-

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<sup>7</sup>It's interesting to note that *can* also receives an deontic and epistemic interpretation, depending on context. ((7-b) is an example of the former; as an example of the latter, Hackl 1998 gives: *John can be married to his cousin, according to law.*) These interpretations, like the deontic and epistemic interpretations of *must*, seem to have an inferential requirement. I've suggested here that (18) is evidence that *can* – in contrast to *must* – doesn't lexicalize an inferential requirement; if this is the case, it remains to be seen why the deontic and epistemic interpretations of *can* are restricted to inferential evidence.

<sup>8</sup>See Klecha (2014) for very compelling arguments that *will* is a modal. His analysis, in (i), treats *will* as encoding universal quantification over worlds in the modal base  $M$  as well as existential quantification over future times  $j$ .

(i)  $[[\text{will}]]^{w,i} = \lambda p \forall v \in M(w,i) [\exists j > i [p(j)(v)]]$

Klecha offers several empirical arguments in favor of a modal analysis of *will* and its subjunctive counterpart *would*. Primary among them is the ability of *will* to interact with *if*-clauses in conditionals and to participate in modal subordination.

<sup>9</sup>There is no clear consensus on this issue, however. Giannakidou and Mari (2013) argue that the future does not encode epistemic knowledge but rather direct or reported partial knowledge. They argue that this difference corresponds to a difference in speaker confidence for the prejacent (high confidence in the case of the future, relatively low in the case of epistemics). Palmer 1986 and De Haan 1999 claim that the future is not an evidential, and Winans *to appear* argues that *will* and *must* are both epistemic modals but differ slightly in their evidential restrictions.

dent reason to think that exclamations, a type of expressive speech act, are incompatible with inferential evidence. And it seems as though exclamations – or at least exclamations in which the modal is prominent in a certain way – are unacceptable with deontic and epistemic modals (but not with other modals).

### 3 Modals and inversion exclamatives

In this section, I argue that exclamations are incompatible with inferential evidence, and therefore that they can function as a test for the analysis above; namely, the claim that deontic and epistemic modals carry an inferential restriction. I begin by reviewing exclamations generally; I then argue that the data from inversion exclamatives present at least some compelling reasons to think that deontic modals – like epistemic modals – carry an inferential requirement.

An exclamation is a type of speech act in which the speaker expresses that the content of the exclamation is unexpected. I use the term *exclamative* to refer to a subset of exclamations formed from syntactic objects other than declarative sentences. Examples of each sub-type of exclamation are in (21) (from Rett, 2008).

- |      |                                 |                              |
|------|---------------------------------|------------------------------|
| (21) | a. Robin baked a blueberry pie! | <i>sentence exclamative</i>  |
|      | b. What a pie Robin baked!      | <i>wh-exclamative</i>        |
|      | c. (Oh,) The pie Robin baked!   | <i>nominal exclamative</i>   |
|      | d. (Boy,) Did Robin bake a pie! | <i>inversion exclamative</i> |

I use the term ‘express’ in the Kaplan (1999) sense: as content that “displays something which either is or is not the case.” This unexpectedness is typically speaker-oriented (Harris and Potts, 2009), and typically manifests itself as something like surprise. They can also be uttered insincerely (Searle, 1969; Rett, 2011). So a speaker’s utterance of the *wh*-exclamative *What a beautiful apartment!* represents the apartment as having exceeded her expectations whether or not the representation is accurate. In previous work, I’ve characterized the illocutionary force of exclamation as a function from a proposition to a speech act uttered by a speaker  $s$  in a context  $C$ , as in (22) (Rett, 2011). This definition will be supplemented later in this section.

- (22) E-FORCE( $p$ ), uttered by  $s_C$ , 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  $p$ .

Exclamatives are exclamations formed from strings other than declarative sentences. Inversion exclamatives, which receive disproportionate attention in what follows, are formed with sentences that display subject-auxiliary inversion. When a declarative sentence contains no auxiliary, its tense is inverted (and the verb *do* is inserted to support it morphologically), as in (23).<sup>10</sup>

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<sup>10</sup>Subject-auxiliary version is most commonly associated with *yes/no* questions in English, but there are many ways in which



- (23) a. Robin baked a pie. *declarative sentence*  
 b. Did Robin bake a pie! *inversion exclamation*

In other work, I've argued that exclamationatives (but not sentence exclamationatives) have in common that they denote degree properties at some level (Rett, 2009, 2011). Among other things, this explains why *wh*-exclamationatives cannot be headed by e.g. *who* (\**Wow, who she met the other day!*), and why exclamationatives like *What scholars we met yesterday!* can be used to exclaim about the degree to which the scholars were scholarly but not to express surprise that three unlikely scholars were met yesterday.

### 3.1 Inversion exclamationatives and inferential evidence

In this section, I focus on inversion exclamationatives in particular. I return in §3.3 to discuss the extent to which the claims made here extend to exclamationatives generally. Inversion exclamationatives are infelicitous in contexts in which the speaker's strongest evidence for the content of the exclamationative is inferential. I will motivate this claim using inversion exclamationatives that do not contain modal auxiliaries; I will then discuss the consequences of this claim for the class of inferential modals.

The inversion exclamationative in (24) is most naturally interpreted as expressing the speaker's surprise at how fast the car goes. In what follows, I'll assume that (24) is uttered in a context in which the car's reference is clear, the car's speed is in fact high, and both are salient.

- (24) (Wow,) Does that car go fast!

(24) is felicitous in this type of context if the speaker has just witnessed the car going fast. This is a direct evidence context, where the speaker has visual evidence of the content of the exclamationative. It is also felicitous in a context in which the speaker has just heard from an interlocutor that the car goes up to 200mph. This is a hearsay or reportative evidence context.

In contrast, (24) is infelicitous in a context in which the speaker has only inferred the content of the exclamationative. It is infelicitous in a context in which the speaker has examined the engine under the hood (but not e.g. seen the car perform), and it is infelicitous in a context in which the speaker knows that John only drives incredibly fast cars, and sees a picture of John in the car in question. This is in contrast to the sentence *That car must go fast*, which (as we've seen) is compatible with inferential evidence.

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inversion exclamationatives differ from *yes/no* questions (see McCawley, 1973), suggesting that the inversion in exclamationatives comes about for other reasons, e.g. the inversion triggered by *only* (Progovac, 1993).

- (i) Only last night \*(I did)/(did I) eat pizza for the first time.

I interpret this as showing that inversion exclamatives carry an evidential restriction: they are infelicitous if the speaker’s best evidence for their content is inferential. I will address the extent to which this restriction holds of exclamations generally in §3.3. In what immediately follows, I’ll argue that inversion exclamatives thus provide a useful test for which modal auxiliaries require inferential evidence and which do not.

Recall that inversion exclamatives can be headed by modals as well as by the auxiliary verb *do*, as in (2) (repeated in (25)). But as McCawley (1973) observed, they are unacceptable with deontic and epistemic modals, as in (1) (repeated in (26)).

- |      |    |   |                           |
|------|----|---|---------------------------|
| (25) | a. | (Wow,) Can Sue dance!                                 | <i>ability</i>            |
|      | b. | (Wow,) Will Sue be mad!                               | <i>future indicative</i>  |
|      | c. | (Wow,) Would Sue like to win the race!                | <i>future subjunctive</i> |
| (26) | a. | *(Wow,) Must/May Sue be the murderer!                 | <i>epistemic</i>          |
|      | b. | *(Wow,) Must/May Sue complete the assignment on time! | <i>deontic</i>            |

The judgments in (25) and (26) reflect the utterance of these strings as exclamatives, which (in the case of inversion exclamatives) means that they receive an intonation pattern distinct from that of *yes/no* questions, in particular a high level intonation with emphasis, typically manifested in lengthening effects (Bartels, 1999). This intonation is brought out by particles like *wow*, but these particles are not obligatory.<sup>11</sup>

We can see that the contrast in (25) and (26) tracks the speaker’s type of evidence. Imagine that Mary is a detective investigating a murder, and she has just discovered incontrovertible proof that Sue perpetrated the crime (say, she received the results of a critical DNA test). In this scenario, her conclusion that Sue is the murderer is based on an inference from a set of premises, which licenses an epistemic modal in the assertion in (28-a). But in this scenario, despite the relevance and truth of the proposition, and despite Mary’s having recently learned it, an utterance of (28-b) is unacceptable. It cannot be felicitously used to express surprise at the proposition that Sue must be the murderer (or even at the extent to which she must be the murderer).

- |      |    |                                 |
|------|----|---------------------------------|
| (28) | a. | Sue must be the murderer.       |
|      | b. | *Wow, must Sue be the murderer! |

The same can be done with deontic modals. Imagine that Bill is Sue’s father and helps keep track of

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<sup>11</sup>Some particles, like *man* and *boy*, can cause an inversion sentence to receive a reading slightly different from an exclamative interpretation. The two interpretations are exemplified in (27), and discussed at length in McCready (2009).

- |      |    |                            |
|------|----|----------------------------|
| (27) | a. | Man, does Robin like cake! |
|      | b. | MAN does Robin like cake!  |

The particle in (27-a) receives what McCready refers to as ‘comma intonation,’ and corresponds to the inversion exclamatives addressed here. In contrast, (27-b) receives McCready’s ‘integrated intonation,’ and receives an interpretation similar to but arguably distinct from exclamatives. In what follows, I will only make claims about exclamations like (27-a), and will stick to the particle *wow* to attempt to bring out this intonation unambiguously.

Sue's schoolwork. Sue's teacher imposes relatively modest penalties for late assignments, but Sue still isn't doing well in the class. Bill has just learned, however, that the teacher will not be accepting this particular homework assignment late; he has also just learned that Sue needs to pass the assignment in order to pass the class. In this scenario, his utterance of (29-a) is appropriate and felicitous; he has inferred the prejacent from a set of premises (including the teacher's new policy and Sue's current grade in the class). However, he cannot felicitously utter (29-b); it cannot be used to express surprise at the proposition that Sue must complete the assignment on time (or even at the extent to which she must).

- (29) a. Sue must complete the assignment on time.  
b. \*Wow, must Sue complete the assignment on time!

In contrast is the ability interpretation of e.g. *can*. Imagine a scenario in which Beth is at a club, watching Sue dance the samba extremely well. In this situation, it's felicitous for her to utter (30-a) to Joe. It is also felicitous for her to utter (30-b). In this context, Beth's utterance of (30-b) counts as an expression of surprise that Sue can dance (or, more naturally, about the high extent to which she can; Rett 2011).

- (30) a. Sue can dance.  
b. Wow, can Sue dance!

As discussed in §2.3, this is arguably because ability modals are not inferential modals; there is no sense in which a claim about John's abilities requires inference (although it is compatible with inference). In fact, Hackl (1998) uses compatibility with direct evidence as a test for the difference between epistemic uses of *can* and its uses as a circumstantial, opportunity or ability modal (p.14).

(25) shows that the modals *will* and *would* pattern with *can* in this respect, suggesting that they are not inferential modals. As I argued in §2.2, this is plausibly because these modals also do not encode an inferential restriction. Imagine a scenario in which Mary hears from her meteorologist friend that it will rain a substantial amount tomorrow. In such a context, she can felicitously utter either (31-a) or (31-b).

- (31) a. It will rain tomorrow.  
b. Wow, will it rain tomorrow!

It therefore seems like the distribution of modals in inversion exclamatives differentiates between inferential and non-inferential modals, which is what we expect given that exclamations seem to be incompatible with inferential evidence.

### 3.2 Alternative explanations

In this section, I discuss and reject several alternative explanations for the distinction in (25) and (26). First, the unacceptability of deontic and epistemic modals in inversion exclamatives cannot be attributed to the non-assertoric force of inversion exclamatives. *Yes/no* questions also lack assertoric force, but license deontic and epistemic modals.

- |      |  |                  |
|------|--|------------------|
| (32) | a. Can Sue dance?                            | <i>ability</i>   |
|      | b. Will/Would Sue be mad?                    | <i>future</i>    |
|      | c. Might Sue be the murderer?                | <i>epistemic</i> |
|      | d. Must Sue complete the assignment on time? | <i>deontic</i>   |

In contrast, auxiliary modals are unacceptable as the heads of imperatives (cf. *\*Can dance!* for *Be able to dance!*), which suggests that the distinction in (25) and (26) is exclamative-specific.

Second, it doesn't appear as though the distinction in (25) and (26) reflects independent syntactic differences between *must/may* and the other modals.<sup>12</sup> *Must* and *may* cannot occur with cliticized negation, in contrast to the other modals, as (33) shows; this has been attributed to certain syntactic restrictions on the movement of these auxiliaries (Zwicky and Pullum, 1983).

- |      |   |
|------|---|
| (33) | a. John can't/won't/wouldn't go to the party. |
|      | b. John *mayn't/*mustn't go to the party.     |

The weak necessity modal *should* is instructive here: it can occur with cliticized negation (e.g. *shouldn't*) but it is nevertheless unacceptable in inversion exclamatives (e.g. *\*(Wow,) Should Sue complete the assignment on time!*). While I have put weak necessity modals aside as a more complicated case than strong necessity modals, I take these data to show that an account that reduces the data in (25) and (26) to syntactic differences will not be sufficient. Certainly, all of these modals can participate in subject/auxiliary inversion in *yes/no* questions. On a related note, it also seems as though an account of *must* as a positive polarity item (PPI; Iatridou and Zeijlstra, 2009; Homer, 2012) will not suffice to account for (26), as *may* is not characterized as a PPI in these theories.

Third, exclamatives are scalar; I've argued that they denote degree properties at some level (Rett, 2009, 2011). Yet inferential modals don't differ from other modals their gradability.<sup>13</sup> A typical test for gradability is the ability to be modified by an intensifier like *very* or to form a comparative. None of the auxiliary modals

<sup>12</sup>Thanks to Lauren Winans (p.c.) for help with this point.

<sup>13</sup>While modal auxiliaries don't seem to be gradable, this does not mean, as Lassiter (2011) and Klecha (2013) have argued, that their modal bases are intrinsically non-scalar (cf. *It's more that Sam is at home than that Bill is at home*). For our purposes, the relevant conclusion is this: in looking for an explanation of why deontic and epistemic modals are unacceptable in inversion exclamatives, we cannot appeal to their lack of gradability, because standard tests for gradability characterize *can*, *will*, *must* and *may* as equally non-gradable.

in (25) and (26) pass these tests; (34-b) is from Lassiter 2011.

- (34) a. Sam can/will (\*more than Bill) dance (\*more than Bill). *ability/future*  
b. Sam must/may (\*more than Bill) be at home (\*more than Bill). *epistemic/deontic*

There is of course an acceptable reading of these sentences in which they mean something like, ‘Sam is capable of dancing more often than Bill’ or ‘It must be the case that Sam is home more often than Bill.’ This is a frequency reading, in which the comparative targets the event variable of the verb, not the modal; see Doetjes 2004 for details.

Fourth, there are a number of ways in which epistemic modals have been observed to differ from other modals – in particular, root modals – but in these phenomena, deontic modals pattern with other root modals, not epistemics. The differences can be best summarized in terms of scope: epistemic modals tend to be interpreted high; root modals tend to be interpreted low (Hacquard, 2009, 2011). This is evident in their interaction with other quantifiers; epistemic modals tend to scope above quantifiers like *every*, and root modals below (Brennan, 1993).

- (35) a. #Every radio can get Chicago stations and no radio can get Chicago stations. *ability*  
b. #(By law,) Every radio may get Chicago stations and no radio may get Chicago stations. *deontic*  
c. Every radio may get Chicago stations and no radio may get Chicago stations. *epistemic*

The epistemic interpretation of the modal in (35-c) is not reported to be contradictory: the sentence is interpreted as reporting an epistemic possibility that every radio get Chicago stations, along with an epistemic possibility that none do. The explanation is that this lack of contradiction is due to the fact that epistemic modals – but not root modals, including deontic ones – scope outside of individual quantifiers. But because both epistemic and deontic modals are prohibited from appearing in inversion exclamatives – to the exclusion of e.g. ability modals – we cannot attribute the difference between (25) and (26) to known differences between epistemic and root modals.

To sum up: inversion exclamatives – even those without modals – are incompatible with inferential evidence. It turns out they are also unacceptable with the epistemic and deontic interpretations of the modals *must* and *may*, which I characterized in §2 as ‘inferential modals,’ lexically encoding an inferential evidence requirement.

I have restricted my claim about inferential modals to *must* and *may*, but weak necessity modals like *should* and *ought* are also unacceptable in inversion exclamatives, as (36) shows.

- (36) a. \*(Wow,) Should he shut his mouth!  
b. \*(Wow,) Ought John to turn in his homework!

Despite this, I will continue to put weak necessity modals aside; they differ from strong necessity modals in a number of ways I cannot control for here (Iatridou and Zeijlstra, 2009).<sup>14</sup> I will also remain agnostic on the status of possible bouletic or gnomonic interpretations of these modals.

### 3.3 Inferential evidence and other types of exclamation

I've argued that inversion exclamatives are incompatible with inferential evidence for their content. There is some evidence that this prohibition is attributable to the nature of mirativity or speaker surprise; there is other evidence that it is not. For the purpose of this paper, I will stipulate the inferential restriction for inversion exclamatives. It remains to be seen how general this restriction is, and why it exists. However, it does seem that the more tolerant an exclamation construction is of inferential evidence, the more tolerant it is of inferential modals.

*Wh*-exclamatives are relatively unacceptable in inferential evidence contexts. Holding fixed the relevance of the President's tallness (and assuming he is tall in the world of evaluation), (37) is acceptable in a context in which the speaker has just seen the President (a direct evidence context), or read online that he is 6'1" (a reportative context).

(37) How very tall the President is!

But it seems odd in a context in which the speaker has seen evidence from which she can (reliably) infer that the President is tall: if she sees the height of the teleprompter at a speech or if she sees a bathtub at the White House that was custom-made for him. In these contexts, an epistemic modal seems much more appropriate: *Wow, the President must be tall!*

And, as expected, possibility inferential modals are unacceptable in *wh*-exclamatives (38), while non-inferential modals are acceptable (39).

- |      |   |                  |
|------|---|------------------|
| (38) | a. *How very tall the President may/might be! | <i>epistemic</i> |
|      | b. ?What a big car she may drive!             | <i>deontic</i>   |
| (39) | a. What a big mountain she can climb!         | <i>ability</i>   |
|      | b. What a smart student she will be!          | <i>future</i>    |

But the acceptability of deontic and epistemic *wh*-exclamatives is improved with a stronger modal force (see also Rett 2012).

(40) a. How very tall the President must be! *epistemic*

<sup>14</sup>As Nate Charlow (p.c.) points out, *should* seems to be scalar in the way that other modal auxiliaries aren't: it's fine to say *Sam should wash his hands after work more than Bill should*.

b. What a big car she must drive!

*deontic*

Sentence exclamations are relatively compatible with inferential evidence. (41) is acceptable in a context in which the speaker has seen Sue in her new car (i.e. when there is direct evidence of the proposition). It is also acceptable in a context in which the speaker has just heard from a friend that Sue has bought a new car (reported evidence of the proposition).

(41) (Wow,) Sue bought a car!

It seems relatively acceptable in inferential evidence contexts as well. Suppose that John knows that Sue has always wanted to buy a car, and not having one is one of her biggest regrets. Then imagine that John sees a large withdrawal from Sue's bank account amounting to the cost of a new car. In this context – an inferential evidence context – (41) seems felicitous.

Both inferential and non-inferential modals are acceptable in sentence exclamations.

(42) a. Wow, John must/might be the murderer! *epistemic*  
b. Wow, John must get a permit for his sailboat! *deontic necessity*  
c. Wow, John may have a ferret for a pet! *deontic possibility*  
d. Wow, Sue can dance! *ability*  
e. Wow, Sue will graduate! *future*

So it seems as though we cannot attribute the inferential evidence prohibition in inversion exclamatives to an exclamation-general prohibition against inferential evidence; in other words, the incompatibility of inversion exclamatives and inferential evidence demonstrated in §3.1 does not seem to be categorically incompatible with the illocutionary mood of exclamation. However, the differences between inversion exclamatives and the data above suggest that the prohibition against inference exhibited so strongly in inversion exclamatives might be sensitive to givenness, and the prohibition against inferential modals might be sensitive to discourse prominence.

First, givenness: exclamatives with inferential modals are improved in contexts in which the modal component of the exclamation is already salient in the discourse. For example, (38-b) is acceptable in a context in which it's been established that Sue is allowed to drive a particular car, which turns out to be big (cf. *Sue is allowed to drive one car in the lot. And what a big car she may drive!*). In these contexts, the modal proposition is taken for granted, and the exclamative is used to express surprise about a related or correlating degree.

Second, and related: it seems plausible that inferential modals are more unacceptable in inversion exclamatives because in these constructions the modal is syntactically more prominent than in the other types

of exclamation. In other words, the syntax of the inversion construction might prohibit the hearer from ignoring the role of inference in the speaker’s expression of surprise, something that might be easier in the other types of exclamation. The relative acceptability of the examples in (43) – which contain but are not headed by inferential modals – speak in favor of an explanation along these lines.

- (43) a. Wow, does Mary have some debt she must pay back!  
b. Wow, can John work out who the murderer must be!

If this is right, then it might be possible to consider the prohibition against inferential modals in inversion exclamatives to be the result of a general incompatibility of exclamation and inferential evidence; we might explain the differences within the class of exclamation constructions with some notion of structured content that differentiates between, among other things, the content encoded in an inversion exclamative headed by *must* and the examples in (43). This is an encouraging possibility, but I am unable to offer such a refinement here. I’ll begin the final section by summarizing the arguments so far and offering brief discussion of one potential area for expanding the discussion here: non-specific indefinites.

## 4 Conclusions and extensions

There are a few reasons to look for a semantic kinship between deontic and epistemic modals. First, there are modals in several languages that lexicalize deontic and epistemic interpretations to the exclusion of other modal bases or accessibility relations (Palmer, 1986). And second, epistemic modals have long been argued to carry an evidential restriction – described here as a requirement that the speaker have inferred the prejacent from some set of premises – which several authors have been tempted to encode in lexical entries of e.g. *must* (Stone, 1994; von Stechow and Gillies, 2010). If *must* can receive either an epistemic or deontic interpretation, and if it encodes an inferential requirement, we would expect deontic and epistemic *must* to pattern similarly in at least some semantic respects.

I’ve argued here that deontic and epistemic *must* (and *may*) do have in common an inferential restriction (hence the label ‘inferential modals’). In particular, I’ve argued that sentences with *must* have in common that they require the speaker have inferred the prejacent from some set of (potentially defeasible) premises, in contrast to having arrived at the prejacent from direct or reported evidence. This parallel has its roots in similar parallels drawn in work on moral reasoning (e.g. Lance and Little, 2006) and in those implementing particular logics involving potentially defeasible inference rules or default reasoning (e.g. Horty, 2012). My formal account of this, similar to the proposal in Glass (2013), amounted to a simplified extension of the



treatment of epistemic modality in Stone 1994 to deontic interpretations of modals like *must* as well.

If deontic and epistemic modality have in common an inferential requirement, we would predict that modals across languages either could or could not lexicalize this requirement. When they do, as with English *must* and *may*, the modal is consequently restricted to only deontic and epistemic interpretations (and the epistemic interpretation would have an evidential restriction like the one observed in §2.2). If they do not, like English *can*, the modal might impose neither a restriction on the type of interpretation it can receive (the modal ‘flavor’) nor an evidential restriction. They could, alternatively, lexicalize other things; Matthewson (2010) argues that while modals in English lexicalize modal force but not flavor, modals in St’át’imcets (a Salish language spoken in Western North America) lexicalize modal flavor but not force. There is still a significant amount of cross-linguistic work to be done on this topic.

§3 explored a way in which this difference between deontic and epistemic modals on the one hand and other modal flavors on the other – which I’m claiming amounts to the difference between inferential and non-inferential modals – could be tested for explicitly. I’ve argued that inversion exclamatives are unacceptable in situations in which the speaker has only inferential evidence for the content of the exclamation. This correctly predicts that inferential modals cannot head inversion exclamatives, despite the fact that they do not differ from other modal auxiliaries in their scalarity or compatibility with non-assertoric illocutionary force, etc. But there is clearly more to be said on the topic of inferential evidence and exclamation generally: only possibility inferential modals are prohibited from *wh*-exclamatives, and all inferential modals are acceptable in sentence exclamations.

Nevertheless, the fact that deontic and epistemic modals form a natural class in their unacceptability in inversion exclamatives is an encouraging fact for those looking for a semantic corollary to the lexical kinship of deontic and epistemic modality. Especially in the absence of a better explanation, the fact that both epistemic modals and exclamations are picky about the sort of evidence the speaker has for the relevant proposition supports a connection between the two (and its extension to deontic modality).

Curiously, in addition to inferential modals, inversion exclamatives are incompatible with non-specific indefinites (McCawley, 1973). (To quote Farkas (2002), “The notion of specificity in linguistics is notoriously non-specific.” I will follow Groenendijk and Stokhof (1980) and Jayez and Tovena (2006) in characterizing an indefinite as specific when it is used in a context in which the speaker can identify its referent, and as non-specific otherwise. I’ll refer to this property as ‘speaker identifiability’.) I consider this prohibition to be at least plausibly related to the prohibition against inferential modals, and will end by discussing a possible theoretical parallel.

Original accounts of indefinites treated them as existential quantifiers, similar to DPs headed by the quantifier *some* (Russell, 1905; Ludlow and Neale, 1991); in contrast, Strawson (1952) proposed that indefinites are referring expressions. These accounts both failed to differentiate between specific and non-specific indefinites. Recent theories tend to blend these proposals, analyzing non-specific indefinites as existential quantifiers and specific indefinites as referring expressions. Many such approaches (Kamp, 1981; Fodor and Sag, 1982; Heim, 1982; Abusch, 1994) treat indefinites as denoting (restricted) variables either valued by an assignment function (for specific indefinites) or bound by a quantifier, existential (for non-specific indefinites) or other. This is true even for dynamic treatments, e.g. Groenendijk and Stokhof (1991), which employ multiple variable assignments to model the indeterminacy associated with non-specific indefinites.

The English determiners *some* and *a* can receive specific or non-specific interpretations, depending on context. The word *certain* can generally be used to bring out specific interpretations of indefinites; non-specific interpretations can be brought out by context or by explicit claims of ignorance ((44)).

- (44) a. Mary met a certain man for dinner. *specific*  
 b. Mary met a man for dinner and I need to know who. *non-specific*

Imagine a scenario in which Mary learns that Joe Schmo will win an extremely valuable jackpot in the lottery, and that he is from New York. In this context, Mary can felicitously utter (45) to exclaim about the amount of money Joe will win.

- (45) (Wow,) Will someone from New York win the lottery!

In contrast, imagine Mary learns that New York's lottery has hit a particularly high jackpot, and that the winning ticket will be chosen tonight. In this scenario – in which all Mary knows about the lottery is that the jackpot is exceptionally high, and that it will go to someone in New York – it is infelicitous to utter (45) to exclaim about the amount of money that was won.<sup>15</sup>

This contrast between specific and non-specific indefinites is more stark in exclamatives formed with unambiguous versions of the indefinites, as the contrast between (46) and (47) shows.

- (46) a. (Boy,) Can a certain someone bake a cake! (*after eating a slice of cake Mary baked*)  
 b. (Man,) Did a certain someone win the lottery! Joe will be rolling in dough!  
 (47) a. \*(Boy,) Can someone or other bake a cake! (*after eating a slice of cake at a restaurant*)  
 b. \*(Man,) Did someone or other win the lottery!

It's worthwhile noting that the specific indefinite exclamatives in (46) – in contrast to versions with proper

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<sup>15</sup>Although Nate Charlow (p.c.) points out that, in this context, the free relative *Wow, is whoever purchased that ticket going to win the lottery!* is acceptable. This is a compelling observation, although at least one prominent analysis of *-ever* free relatives (von Stechow, 2000) characterizes the contribution of *ever* in terms of uncertainty rather than non-specificity.

names – are most natural in situations in which the speaker has reason to obscure the identity of his intended referent (e.g., the speaker in (46-a) knows Mary baked the cake, but does not want to reveal that he knows).

This intolerance of non-specific indefinites is a property of exclamatives generally, as the *wh*-exclamatives in (48) and ?? demonstrate (I use § to mark ‘specific interpretation only’). Imagine a context in which Sue overhears a concerta played in an elevator, but does not know who wrote it. In this context, she cannot utter the sentences in (48) to express surprise at how talented its composer is.

- (48) a. §(Wow,) What a composer someone is!  
b. §(Wow,) How very talented someone is!

Like the examples in (50), these exclamatives are only acceptable in a situation in which it’s clear that Sue knows who the composer or talented individual is.

A typical example of the specific/non-specific contrast is in (49), from Von Heusinger (2002).

- (49) A student in Syntax 1 cheated on the exam.  
a. His name is John. *specific*  
b. We are all trying to figure out who it was. *non-specific*

Assuming, following Groenendijk and Stokhof 1980; Jayez and Tovenà 2006, that non-specific indefinites lack the property of speaker identifiability (that is, that an indefinite is non-specific iff the speaker cannot identify the individual that satisfies the description), then non-specific indefinites are licensed only when the speaker has inferred the existence of an individual that satisfies the description. In other words, if speaker identifiability is the right way to characterize non-specificity, we might be able to cash out non-specificity in terms of inferential evidence.

The non-specific interpretation of (49) requires a context in which the speaker has evidence that is informative enough to tell them someone cheated, but not so informative that they can tell who, for example, a context in which the professor’s answer key was discovered stolen. In such a context, the speaker must infer from this indirect evidence that someone has cheated. It is an inference based on descriptive generalizations about other worlds in which answer keys are stolen; it comes about neither from direct evidence nor from reported evidence.

The non-specific interpretation of the indefinite in (45), repeated below, involved a similar pattern of inference.

- (50) §(Boy,) Will someone from New York win the lottery!

The non-specific interpretation was natural in a context in which the speaker knew only that New York’s

lottery had hit a particularly high jackpot. The leap from this knowledge to the claim in (50) involves the premise that someone will buy the winning ticket, and that that person will be from New York. This, too, represents a (defeasible) inference based on descriptive generalizations about the world or model of evaluation.

I have not done this topic or these data enough justice to make a strong claim; I only mention them in passing as another phenomenon, inexplicably barred from inversion exclamatives, to which considerations of inferential evidence could be brought to bear. If non-specific indefinites denote existential individual quantifiers that carry an indirectness requirement, they are clear counterparts to deontic and epistemic modals, and we are closer to understanding their unacceptability in inversion exclamatives. The plausibility of this comparison is, I believe, bolstered to some small degree by work in Rullmann et al. (2008), in which St'át'imcets (Lillooet Salish) modals are argued to be “akin to specific indefinites in the nominal domain” (p.317) and are analyzed accordingly with choice functions. If language encodes an inferential restriction in one domain, it's reasonable to expect that it might mark inference in another domain.

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