Update Semantics for Weak Necessity Modals

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Draft of March 2016

Abstract

This paper develops an update semantics for weak necessity modals (‘ought’, ‘should’). The central idea, defended in greater detail elsewhere (Silk 2012b), is that weak necessity modals suspend the assumption that the necessity of the modal’s prejacent is verified in the evaluation world. Weak necessity modals afford a means of entertaining and planning for hypothetical extensions of the current context in which relevant considerations (norms, preferences, expectations) apply, without needing to settle that those considerations actually do apply. I formalize these ideas within an Update with Centering framework, adapted from Bittner 2011. The conventional meaning of ‘Should ϕ’ is explained, fundamentally, in terms of how its use updates attention toward (semantically unspecified) favored possibilities in which ϕ is necessary. The proposed update semantics for ‘should’ and ‘must’ in root clauses is also extended to deontic conditionals. These analyses capture various contrasting discourse properties of ‘should’ and ‘must’ — e.g. concerning context-sensitivity, entailment, and force — and provide an improved treatment of largely neglected data concerning information-sensitivity (Silk 2013a). I close by briefly considering several alternative static and dynamic implementations of the assumed general account of the weak/strong necessity distinction.
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This paper develops an update semantics for weak necessity modals (‘ought’, ‘should’). The central idea, defended in greater detail elsewhere (Silk 2012b), is that what makes weak necessity modals “weak” is that they suspend the assumption that the prejacent proposition is necessary (deontically, epistemically, etc.) in the evaluation world (§1). Weak necessity modals afford a means of entertaining and planning for hypothetical extensions of the current context in which certain relevant considerations (norms, preferences, expectations) apply, without needing to settle that those considerations actually do apply. I formalize these ideas within an Update with Centering framework, adapted from Bittner 2011 (§2). The conventional meaning of ‘Should $\phi$’ is explained, fundamentally, not in terms of truth-conditions, but in terms of how its use updates attention toward (semantically unspecified) favored possibilities in which $\phi$ is necessary. The proposed update semantics for ‘should’ and ‘must’ in root clauses is also extended to deontic conditionals. These analyses capture various contrasting discourse properties of ‘should’ and ‘must’ — e.g. concerning context-sensitivity, entailment, and force — and provide an improved treatment of largely neglected data concerning information-sensitivity (Silk 2013a). I close by briefly considering several alternative static and dynamic implementations of the general account of the weak/strong necessity distinction from §1 (§3).

1 Weak and strong necessity modals in context

There is robust evidence supporting a distinction in strength among necessity modals.1 For instance, even holding the readings of the modals fixed, ‘Should $\phi$’ can be followed by ‘Must $\phi$’, but not vice versa, as reflected in (1). Similarly, (2a) is consistent in a way that (2b) is not.

(1) a. I should help the poor. In fact, I must.
    b. I must help the poor. #In fact, I should.

(2) a. I should help the poor, but I don’t have to.
    b. #I must help the poor, but it’s not as if I should.

1See, e.g., Sloman 1970, Horn 1972, Wertheimer 1972, Lyons 1977, Williams 1981, Coates 1983, McNamara 1990, Palmer 1990, 2001, Huddleston & Pullum 2002, von Fintel & Iatridou 2008, Rubinstein 2012, Silk 2012b. I use ‘should’ as my representative weak necessity modal, and ‘must’ as my representative strong necessity modal. This is because these modals are typically used “subjectively” (Lyons 1977, 1995), in the sense that they typically present the speaker as endorsing the considerations that would verify the modal claim; non-speaker-endorsing uses (more common with, e.g., ‘have to,’ ‘supposed to’) introduce complications that would be distracting to our discussion here. See Silk 2012b, 2016 for discussion.
There are also important conversational differences. The relative felicity of ‘should’ and ‘must’ depends on standing assumptions in the context. It is this feature of weak and strong necessity modals that I would like to focus on here. (See Rubinstein 2012, Silk 2012a, 2013a for extensive recent discussion; see also Woisetschlaeger 1977: ch. 5, McNamara 1990: ch. 3.)

Start with an epistemic case. Suppose we are working on an art project, and I ask you where the colored pencils are. Normally you put them in the drawer with the crayons, but sometimes you accidentally put them on the shelf. In this scenario it is more appropriate for you to use ‘should’ in responding to my question, as in (3).

(3) Me: Do you know where the colored pencils are?  
You: They should (/?must) be in the drawer with the crayons.

Suppose, alternatively, that we are looking for the colored pencils together, and you indicate that you have seen something that leads you to conclude that they are in the drawer. Perhaps you noticed that they weren’t on the shelf, and this is the only other place you think they could be. In this scenario it is more natural for you to use ‘must’, as in (4).

(4) Me: Do you know where the colored pencils are?  
You: They must (/?should) be in the drawer with the crayons.

It’s following from our knowledge (evidence, information) that the colored pencils are in the drawer depends on today not being one of the atypical days when you accidentally put the colored pencils on the shelf. Using the strong necessity modal ‘must’ is preferred if, and only if, you know that conditions are indeed normal in this way. What is illuminating is that you can use ‘should’ even if you aren’t in a position to judge that they are. Accepting your ‘should’ claim doesn’t require us to presuppose that your evidence is indefeasible.

Similarly, consider a deontic case. Suppose I am considering whether to fight in the Resistance or take care of my ailing mother. I mention that the value of family, which supports my helping my mother over my fighting, is important, and you agree. But the issue is complex, and we haven’t settled whether there might be more important competing values. Sensitive to this, you may find it more appropriate to express your advice that I help my mother by using ‘should’, as in (5).

(5) Me: Family is very important.  
You: I agree. You should (/?must) take care of your mother.

But if we settle that family is of primary importance, as in (6), it can become more
natural to use ‘must’ and for us to accept that I have to help my mother.

(6)  Me:  Family is most important — more important than country.  
You:  I agree. You must take care of your mother.

My having an obligation to help my mother depends on the value of family being more important (or at least not less important) in my situation than any competing value. Using ‘must’ is preferred if it is settled in the conversation that this condition obtains. Parallel to the epistemic case, what is illuminating is that you can felicitously express your advice that I help my mother using ‘should’, advice which I may accept, even if it isn’t common ground that this precondition for my having a genuine obligation is satisfied. Accepting your ‘should’ claim needn’t require us to presuppose that the value of family is more important than other potentially competing values.

These cases highlight what I regard as the fundamental difference between the class of weak necessity modals and the class of strong necessity modals. It is typical to gloss deontic notions of necessity as concerning what is obligatory, and epistemic notions of necessity as concerning what follows from one’s evidence (knowledge, information). In this sense accepting deontic ‘Should ϕ’ needn’t commit one to accepting that ϕ is deontically necessary, and accepting epistemic ‘Should ϕ’ needn’t commit one to accepting that ϕ is epistemically necessary: we can accept your deontic ‘should’ claim in (5) without settling that family is the most important relevant value, and thus without accepting that I have an actual obligation to help my mother; and we can accept your epistemic ‘should’ claim in (3) without settling that conditions are normal in the relevant respects, and thus without accepting that our evidence actually entails that the colored pencils are in the drawer. ‘Should ϕ’ doesn’t conventionally communicate that ϕ is necessary (deontically, epistemically, etc.) (Silk 2012b).

The following sections develop one way of capturing these points. Informally put, the core of the proposal is this: There is nothing special about the semantics of strong necessity modals. Strong necessity modals are given a usual semantics of necessity: ‘Must ϕ’ says that ϕ is necessary (in the relevant sense, i.e. deontically, epistemically, etc.) and predicates the necessity of ϕ of the actual world (world of evaluation). Accepting ‘Must ϕ’ commits one to accepting that ϕ is necessary. The

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2I will bracket potential complications concerning incomparabilities and irresolvable dilemmas (see Swanson 2011, Silk 2015, ch. 3, 2015, for discussion and references).


4I will often omit this parenthetical in what follows, but it should be understood. Specific notions of necessity (deontic, epistemic, etc.) may be understood informally as suggested above.
apparent weakness of weak necessity modals derives from their bracketing the assumption that the necessity of \( \phi \) is verified in the actual world (world of evaluation). 'Should' expresses necessity on the supposition that certain circumstances relevant to the necessity claim obtain. It needn't be presupposed that these circumstances actually do obtain. ‘Should \( \phi \)’ can be accepted without presupposing that the necessity of \( \phi \) is verified throughout the set of live possibilities (the context set, or set of worlds compatible with what is accepted for purposes of conversation; \textit{Stalnaker} 1978). (We will address what accepting ‘Should \( \phi \) does commit one to shortly.)

Treating weak necessity modals in this way elucidates a crucial role for them in conversation, deliberation, and planning. As we will see in greater detail in the following sections, weak necessity modals afford a means of coordinating on the implications of our values, norms, etc. without having to decisively settle how they apply and weigh against one another in particular circumstances. Recall (5)–(6).

The deontic necessity of my helping my mother — my having an obligation to help her — depends on the value of family is more important in my situation than other potentially competing values (n. 2). So, accepting the ‘must’ claim ‘You must take care of your mother’ would require committing for the future course of the conversation to being in a world in which this condition is satisfied and the applicable norms entail that I help my mother. But in (5), unlike in (6), after my assertion is accepted it still isn't settled whether the value of family does take priority in my situation. So, were you to use ‘must’ you would imply that you are foreclosing certain possibilities that I have left open. Unless you are in a position to do so, your using ‘must’ is dispreferred. By using ‘should’ you can leave open the possibility that the value of family might ultimately be outweighed or defeated. If I accept your ‘should’ claim, we can provisionally proceed as if my helping my mother is required without needing to settle that the value of family is more important than other competing values we accept or may come to accept.

So far I have suggested, following \textit{Silk} 2012b, that what makes weak necessity modals “weak” is that they bracket the assumption that all preconditions for the prejacent to be necessary are satisfied: one can accept ‘Should \( \phi \)’ without accepting that \( \phi \) is necessary (deontically, epistemically, etc.). This feature of weak necessity modals certainly isn't the only dimension along which (necessity) modals can differ (see \textit{Silk} 2012b, 2015 and references therein). However, I claim that it does distinguish the class of weak necessity modals from the class of strong necessity modals. Moreover there will be various ways of implementing the proposal in the formal semantics and pragmatics. Yet even at the present level of abstraction, we can see that the approach to weak necessity in this section differs crucially from the other main approaches in the literature — e.g., comparative possibility/probability approaches.
(e.g., Finlay 2009, 2010, Lassiter 2011) and domain restriction approaches (e.g., von Fintel & Iatridou 2008, Rubinstein 2012). For instance, the latter analyses maintain that accepting ‘Should $\phi$’ requires accepting that $\phi$ is a necessity at the actual world, but treats the domain of ‘should’ as a subset of the domain of ‘must’. The present approach rejects both of these claims (see Silk 2012a,b for detailed discussion). We will return to this below.

2 Update semantics for weak and strong necessity modals

The primary constructive aim in this paper is to develop an update semantics which formalizes the contrasting update potentials of weak and strong necessity modals, as informally described above. For concreteness I develop the semantics within an Update with Centering framework, adapting Bittner 2011 (see also Stone 1999). Alternative implementations are of course possible (more on which in §3). (Hereafter I will couch the discussion primarily in terms of deontic readings, though the points generalize across flavors of modality.)

2.1 $\text{UC}_\omega$ background

Update with Centering (UC) is a dynamic update system that represents how informational and attentional states develop in discourse. Typed discourse referents are ranked to reflect the relative salience of objects under discussion. Update with Modal Centering, $\text{UC}_\omega$, includes discourse referents not only for individuals but also for worlds and propositions. All sentences are treated as introducing a relevant possibility, or modal topic, being talked about. (Hereafter I treat possibilities as propositions.) With assertions of simple indicative sentences the relevant possibility being commented on is the context set, typically the most salient possibility in the discourse. Not all modal topics, however, need be included in the context set. For instance, counterfactual marking cancels the default assumption that the modal topic — the possibility being talked about — is included in the context set. The meanings of sentences are given in terms of how they update contexts, conceived as informational-attentional states.

Contexts are represented with sets of sequences of discourse referents for individuals $\delta$, worlds $\omega$, and propositions $\Omega$ (conceived as sets of worlds $\omega t$). These discourse referents are divided between those that are currently in the center of attention, or topical ($\top$), and those that are currently backgrounded ($\bot$). The bottom list $\bot$ can be utilized in analyzing (e.g.) grammatical centering, tense, negation, ques-
tions, and — I will argue — modal remoteness. The discourse referents in each list, \( T, \bot \), are ranked according to their relative salience or attentional prominence. The column \( \| \) picks out the set of discourse referents from a given list. For instance, \( T\Omega \) is the most salient (leftmost) proposition in the top list, and \( T\omega \| \) is the set of worlds in the most salient world column in the top list. (Hereafter I write \( T\alpha, \bot\alpha \) as short for \( T\alpha_1, \bot\alpha_1 \).) The context set is identified with this set of topical worlds, i.e. the topical proposition \( T\Omega = T\omega \| \). A context is a set of pairs \( \langle T, \bot \rangle \) of subsequences \( T \) and \( \bot \) of ranked discourse referents.

Start with a simple indicative declarative sentence such as [7]. Modifying Bit-TNER 2011, I propose the UC\(_w\) representation of [7] in [8].

(7) Alice is generous.

(8) \[ \top[x | x = \text{Alice}]; [w | \text{generous}_w(T\delta)]; [p | p = \bot\omega \| ]; \]
\[ [w | w = \bot\omega]; [\bot\omega \epsilon T\omega \| ]; [T\omega = \bot\omega]; [p | p = T\omega] \]

Asserting [7] involves seven updates, as reflected in [9], where the output context (set of \( T\bot\)-lists) is given below each update. Boxes with variables, \( \top[d \ldots d \ldots] \) or \( [d \ldots d \ldots] \), are recentering updates which introduce a discourse referent satisfying ‘\ldots d\ldots’ into the most prominent spot in the center of attention or background, respectively. Boxes without variables, \( \ldots \), are information updates, or tests, which eliminate sequences in the context that don’t satisfy the constraint ‘\ldots’. Suppose that our model contains three worlds \( w_0, w_1, w_2 \); Alice is generous in \( w_1 \) and \( w_2 \) but not in \( w_0 \); and the input context \( c_0 \) consists of two \( T\bot \)-lists each of which includes a discourse referent for the initial context set \( p_0 \) and a topic world \( w_0, w_1 \) in \( p_0 \).

(9) \[ \top[x | x = \text{Alice}]; [w | \text{generous}_w(T\delta)]; [p | p = \bot\omega \| ]; \]
\[ c_0 \]
\[ \langle\{w_0, p_0\}, \{\}\rangle \]
\[ \langle\{a, w_0, p_0\}, \{\}\rangle \]
\[ \langle\{a, w_0, p_0\}, \{w_1\}\rangle \]
\[ \langle\{a, w_0, p_0\}, \{w_2\}\rangle \]
\[ \langle\{a, w_0, p_0\}, \{q, w_1\}\rangle \]
\[ \langle\{a, w_0, p_0\}, \{q, w_2\}\rangle \]
\[ c_1 \]
\[ \langle\{w_0, p_0\}, \{\}\rangle \]
\[ \langle\{a, w_1, p_0\}, \{\}\rangle \]
\[ \langle\{a, w_1, p_0\}, \{w_1\}\rangle \]
\[ \langle\{a, w_1, p_0\}, \{w_2\}\rangle \]
\[ \langle\{a, w_1, p_0\}, \{q, w_1\}\rangle \]
\[ \langle\{a, w_1, p_0\}, \{q, w_2\}\rangle \]
\[ c_2 \]
\[ \langle\{w_1, p_0\}, \{\}\rangle \]
\[ \langle\{a, w_1, p_0\}, \{\}\rangle \]
\[ \langle\{a, w_1, p_0\}, \{w_1\}\rangle \]
\[ \langle\{a, w_1, p_0\}, \{w_2\}\rangle \]
\[ \langle\{a, w_1, p_0\}, \{q, w_1\}\rangle \]
\[ \langle\{a, w_1, p_0\}, \{q, w_2\}\rangle \]
\[ c_3 \]
\[ \top[x | x = \text{Alice}]; [w | \text{generous}_w(T\delta)]; [p | p = \bot\omega \| ]; \]
\[ [w | w = \bot\omega]; [\bot\omega \epsilon T\omega \| ]; [T\omega = \bot\omega]; [p | p = T\omega] \]

\[ ^5 \text{I bracket complications concerning tense. For relevant definitions and abbreviations, see Bit-TNER 2011; cf. also Stone 1999.} \]
Like Bittner 2011 I use the top sequence in representing the context set. However, following Murray 2014, I use the bottom sequence to keep track of possibilities we are considering but aren't currently committed to. The first update introduces into each top sequence \( \top \) an individual discourse referent \( a \) for Alice, yielding \( c_1 \). The second update introduces the worlds where Alice is generous, \( w_1 \) and \( w_2 \), into the bottom sequence, yielding \( c_2 \). The worlds added to the bottom sequence at this step needn’t be in the current context set. The third update introduces a propositional discourse referent \( q \) for this set of most prominent worlds in the bottom sequence \( \bot \omega | = \{ \{ w_1, w_2 \} \} \), yielding \( c_3 \). (The superscript \( \{ \} \) indicates the characteristic set.) However, the context set isn’t yet restricted; the update is a pure attention update. The fourth update represents a commitment to this possibility, by reintroducing the worlds in which it is true into the bottom sequence, yielding \( c_4 \). The fifth update represents the proposal to update with the proposition that Alice is generous, by restricting the set of worlds introduced in the fourth update to the worlds in the context set, yielding \( c_5 \). The sixth update represents the acceptance of the assertion, by checking for each world \( \top \omega \) in the context set that it is identical to the most prominent world \( \bot \omega \) in its row. The first sequence is ruled out and the context set is restricted to \( \{ w_1 \} \), yielding \( c_6 \). The final update recenters attention on the new context set by introducing into the top sequence a propositional discourse referent \( p_1 \) for it, yielding the final output context \( c_7 \). This possibility \( \top \omega | = \{ p_1 \} = \{ w_1 \} \) constitutes the default modal topic for the interpretation of subsequent indicative assertions.

The main features of this sequence of updates are these: First, the bottom sequence keeps track of the possibility that Alice is generous and puts it on the conversational table, as reflected in updates 1–3. By \( c_3 \) the proposed possibility is registered as being under consideration, but it hasn’t yet been committed to. Second, although the commitment update in \( c_4 \) may seem trivial in this example, it will become im-
important in distinguishing uses of weak vs. strong necessity modals. This update is distinctive of the version of UC developed here. Third, updates 5–6 occur with the assertion of any declarative sentence (cf. Murray 2014). The proposal update in $c_5$ reflects how in ordinary indicative assertions the worlds being talked about are the live possibilities in the conversation. The success of the assertion registers a specific attitude toward the proposed possibility — acceptance that it is true — and restricts the context set accordingly. Asserting $[7]$ thus provides both an informational and attentional update: it updates information, reflected in the reduction of the context set, and also attention, reflected in the introduction of a new modal referent as the primary topic.

2.2 Root clauses

Now consider [10] with the strong necessity modal ‘must’.

(10) Alice must be generous.

I follow standard premise semantics/ordering semantics for modals in treating modals as contributing a semantic object $\lessdot$ — a preorder frame, or function from worlds to preorders — where the resolution of $?$ is tied to the reading of the modal (e.g., Lewis 1973, 1981, Kratzer 1981, 1991). The function $\text{min}$ selects the $\lessdot$-minimal elements of an anaphoric modal base $Q (\top , \bot)$, i.e. the set of worlds in $Q$ that aren’t $\lessdot$-bettered by any world in $Q$. For instance, $\text{min}(Q, \lessdot d w)$ is the set of worlds in $Q$ that best satisfy the relevant norms in $w$.

Like with [7], the meaning of [10] is given in terms of how it updates the default modal topic, or context set. The distinctive dynamic contribution of the modal is that it itself introduces a topical possibility — here, the possibility that Alice is generous — and then comments on it (cf. Stone 1999). I propose the following UC representation of [10] in [11].

(11) $\top[\{x | x = \text{Alice}\} ; [w | \text{generous}_w(\top , \delta) ; [w | \text{min}\{\top , \bot\} ; [p | p = \top \} ; [w | w = \top \} ; [\top \}\

$6The world-indexed preorder $\lessdot$ could be determined from a premise set (Kratzerian ordering source) in the usual way: for any worlds $u, v$ and premise frame $P$, $u \lessdot_{P(w)} v := \forall p \in P(w) ; v \in p \Rightarrow u \in p$. For simplicity I make the limit assumption (Lewis 1973: 19–20) and assume that $\text{min}$ is well-defined.

$7$Interestingly, it has been argued that a principle use in the development of modals diachronically involves encouraging the hearer to “focus mentally” on the embedded proposition (Van Linden 2012 chs. 6, 8).
As above, assume an input context $c_0$ with an initial context set $\{p_0 = \{w_0, w_1\}\}$. And assume a model with three worlds $w_0, w_1, w_2$, such that Alice is generous only in $w_1$ and $w_2$, and Alice’s being generous is deontically necessary only at $w_0$ and $w_2$. As the reader can verify, the input and output updates for (11) are as follows (the superscript $\chi$ indicates the characteristic function):

(12) \[c_0 := \chi\{(w_0, p_0), \langle\rangle\}, \quad c_8 := \chi\{(p_1, a, w_0, p_0), (w_0, q, w_0, w_1)\},\]
\[\{(w_1, p_0), \langle\rangle\}\} \quad \{(p_1, a, w_0, p_0), (w_0, q, w_0, w_2)\}\}

As with (8), the first update in (12) introduces into each top sequence an individual discourse referent $a$ for Alice, and the second update introduces into each bottom sequence the worlds where the topical individual $\top \delta$ (=Alice) is generous, i.e. $w_1$ and $w_2$. The third update reflects the modal’s evaluation of this possibility $\bot \omega\{w_1, w_2\}$. The update introduces into the bottom sequence the worlds $w$ such that every $\leq^d w$-minimal world in the topical modality ($\top \delta$ (=the context set $\top \omega\{\}$) is a world where Alice is generous — i.e., $w_0$ and $w_2$. The fourth update introduces a propositional discourse referent $q$ for this set of worlds, $\bot \omega\{q = \{w_0, w_2\}\}$. This attentional update represents the necessity claim being put on the conversational table. The fifth update represents the speaker’s commitment to this possibility, and the sixth update represents the proposal to update the context set with it. The seventh update represents the acceptance of the necessity claim and success of the assertion. This update eliminates the sequences in which $w_i$ is the (local) topical world, restricting the context set $\top \omega\{\}$ to $\{w_0\}$. The final update recenters attention on the new context set by introducing a propositional discourse referent $p_1 = \chi\{w_0\}$, yielding $c_8$.

There are two features of this example that I would like to highlight. First, as in (8), the update $[w \mid w = \bot \omega]$ represents a commitment to the proposition which has been placed on the conversational table — here, the deontic necessity claim. So, accepting (10) requires accepting that the deontic necessity of Alice’s being generous is verified throughout the set of live possibilities. Successfully asserting (10) again both updates information, reflected in the reduction of the context set, and updates attention, reflected in the introduction of the modal referent $p_1$ as the primary modal topic. Second, note that with ‘must’ the modal base for the relevant norms is resolved to the topical modality $\top \omega\{\}$. This reflects the indicative presupposition that the worlds being talked about are in the context set. We will return to this feature of the analysis below.

In §1 I argued that weak necessity modals bracket the assumption that the necessity claim is verified in the actual world. One way of implementing this idea in the
The present framework is to treat 'should' as having an ordinary semantics of necessity, but as canceling the assumption associated with ordinary indicative assertions that the speaker is committed to the at-issue proposition. I propose \[14\] as a first-pass semantic representation of \[13\] in UC.  

\[13\] Alice should be generous.  
\[14\] \(\top[x \mid x = \text{Alice}]\) \(\downarrow w \mid \text{generous}_w(\top \delta)\) \(\downarrow w \mid \text{min}\{w \mid \text{\leq}_w \subseteq \bot\} \uparrow \mid p \uparrow p = \bot\} \uparrow \downarrow w = \top\omega \} \downarrow \bot \omega \in \top\omega \} \downarrow [\top\omega = \bot\omega] \downarrow \top[p \uparrow p = \top\omega]\)  

The first four updates are the same as in \[11\]: the deontic necessity claim is placed on the conversational table, as represented by the introduction of a propositional discourse referent \(q\) for this possibility into the bottom sequence. The crucial contrast is in the fifth update: it is the worlds in the context set, rather than the worlds in the at-issue proposition \(q\), that are introduced into the bottom sequence. The update recommits to the topical modality \(\top\omega\), rather than to the necessity claim \(q\). The subsequent updates, which are associated with any assertion, have no effect: there is no restriction of the context set to worlds where it is deontically necessary that Alice is generous, and the output context set \(p_2\) is \(\chi\{w_0, w_1\} = p_0\), as reflected in \[15\].  

\[15\] \(c_8 := \chi\{\{(p_2, a, w_0, p_0), \{w_0, q, w_0, w_1\}\},
\{(p_2, a, w_0, p_0), \{w_0, q, w_2, w_1\}\},
\{(p_2, a, w_0, p_0), \{w_0, q, w_0, w_2\}\},
\{(p_2, a, w_0, p_0), \{w_0, q, w_2, w_2\}\},
\{(p_2, a, w_1, p_0), \{w_1, q, w_0, w_1\}\},
\{(p_2, a, w_1, p_0), \{w_1, q, w_2, w_1\}\},
\{(p_2, a, w_1, p_0), \{w_1, q, w_0, w_2\}\},
\{(p_2, a, w_1, p_0), \{w_1, q, w_2, w_2\}\}\}  

Although the updates in \[14\] don't directly restrict the context set, they don't have no conversational import. Both \[11\] and \[14\] introduce a modal topic for consideration — the possibility \(q\) that Alice's being generous is deontically necessary. Updating with \[11\], for 'must', would require committing to this possibility; it would require settling that norms of generosity take priority in Alice's situation over other potentially competing considerations. We might not be prepared to restrict the future course of the conversation in this way. Nevertheless we may take some ways of extending the current conversation and addressing the proposed issue to be more likely or better than others. Using 'should' allows us to consider the necessity of \(\phi\)
as holding in a preferred (most likely, normal, desirable) continuation or minimal revision of the current context, whatever that might turn out to be. Updating with (14) centers attention on the set of worlds at which Alice’s being generous is deontically necessary, but doesn’t explicitly require committing that the actual world is among them. The conventional role of weak necessity modals, on this semantics, isn’t to update information. It is to place a necessity claim on the conversational table and center attention on it.⁸ We can capture a role for ‘should’ claims in discourse without treating them as directly placing constraints on the set of live possibilities. This analysis gives precise expression to the informal intuition that ‘should’ is weaker and more tentative than ‘must’. In uttering ‘Should φ’ the speaker introduces a claim about the necessity of φ but fails to mark her utterance as being about worlds that are candidates for actuality. Yet, as Stalnaker notes, “normally a speaker is concerned only with possible worlds within the context set, since this set is defined as the set of possible worlds among which the speaker wishes to distinguish” (1975:69). So, using ‘should’ implicates that one isn’t in a position to commit to the prejacent’s being necessary throughout the set of live possibilities. This suggests that the basis of the scale between ‘should’ and ‘must’ isn’t one of quantification — as per domain restriction accounts of weak necessity (e.g., von Fintel & Iatridou 2008, Rubin-stein 2012) — but of epistemic strength.⁹ Since ‘should’ is weaker than ‘must’ in this way, Grice’s first quantity maxim — “Make your contribution as informative as is required” (Grice 1989:26) — can be exploited to generate a familiar upper-bounding implicature (Horn 1972). Using ‘should’ implicates that for all one knows — or, better, for all one is willing to presuppose in the conversation — ‘Must φ’ is false. This implicature has the usual properties of implicatures. For instance, it is cancelable and reinforceable, as in (1a) and (2a), respectively. In (1a) ‘I should help the poor; in fact, I must’, the speaker first merely places the deontic necessity claim on the conversational table (with ‘should’), and then positively commits to it (with ‘must’). The tentativeness of ‘should’ can thus be assimilated to the tentativeness of modal past forms (Palmer 2001) more generally, as in (16b) or “future less vivid” subjunctive conditionals like (17).

(16) a. May/Can I comment on your proposal?
   b. Might/Could I comment on your proposal?

⁸This contrasts with non-assertive discourse moves, like questions, which also introduce propositional discourse referents into the bottom sequence but don’t restrict the context set. Whereas questions introduce propositional discourse referents for each of their answers (Juttner 2011), thereby inducing a partition on the information state, the same doesn’t hold for uses of weak necessity modals.⁹Cf. Verstraete 2009, Van Linden & Verstraete 2008.
If you came to our party tomorrow — and I’m not saying you will — you would have a great time.

I noted above that the modal base for the strong necessity modal ‘must’ is resolved to the topical modality $\top\omega\mid$, reflecting the indicative presupposition that the worlds being commented on are included in the context set. Weak necessity modals lack this restriction, as reflected in the semantically unspecified modal base $\omega\mid$ in (14). Distinguishing the modal bases in this way helps capture another well-attested contrast between ‘should’ and ‘must’ in entailingsness (veridicality). Uttering ‘Should $\phi$’ (on any reading) is compatible with denying $\phi$, as in (18). Indeed when used with the perfect, ‘should’ implicates the negation of the prejacent, as in (19).

(18) a. Alice should be here by now, but she isn’t.
    b. You should help your mother, but you won’t (/but I know you won’t).

(19) We should have given to Oxfam. (Implicates: we didn’t)

Utterances of ‘Must $\phi$ and $\neg\phi$’, by contrast, are generally anomalous. There is robust descriptive linguistic evidence that this holds not only with epistemic readings, as in (20a), but also, surprisingly, with deontic readings, as in (20b).

(20) a. #Alice must be here by now, but she isn’t.
    b. ??You must help your mother, but you won’t (/but I know you won’t).

Of course obligations can go unfulfilled. What is interesting is that speakers appear to assume otherwise, at least for purposes of conversation, when expressing obligations with ‘must’. The analyses in (11) and (14) reflect this: (11) requires that there be some worlds in the context set where Alice is generous (vacuous updates aside); (14) does not.

We can clarify these points about (non-)entailingness by examining the role of truth in the present framework. One way of adapting common definitions of truth in dynamic semantics for UC $\omega$ is as follows:

**Definition 1.** (truth, $v_1$). For a model $M$ and ($st$) $st$ term $K$:

\[ \tau_{M,v} K = \{ (\tau j) \mid j \in D_1 \cap \forall g : j \in \{ K \}(c) \} \]

---

For any world $w$, let $C_w$ be the set of contexts $c_w$ such that $\top \omega_1 \models = \{ w \}$.

1. $K$ is true at $w$ (relative to $M$) iff $\exists p \in D_{\omega_1} : \top \omega_1 \cap K = \{ p \} \land p = \chi \{ w \}$
2. $K$ is false at $w$ (relative to $M$) iff $\exists p \in D_{\omega_1} : \top \omega_1 \cap K = \{ p \} \land p = \emptyset$

This says that $K$ is true at $w$ iff given perfect information about $w$ — i.e., an initial context set $\{ w \}$ — updating with $K$ doesn’t lead to the empty information state (cf., e.g., van Benthem et al., 1997: 594). This definition predicts the inconsistency of ‘Must $\phi$, and $\neg \phi$’. There is no $\neg \phi$-world at which ‘Must $\phi$’ is true, and hence no world at which ‘Must $\phi$, and $\neg \phi$’ is true. Although Definition 1 doesn’t assign a truth value to (14) (since (14) doesn’t recenter the primary modal topic), we could extend the definition of truth to assign truth values to terms that update the primary backgrounded item $(j)_1$ to a specific proposition.

Definition 2. (truth, v2).

1. $\bot M_c K = \{ (j)_1 \mid j \in D_{\omega_1} \cap \forall g : j \in \{ } [K] g (c) \}$
2. $\bot M_c K = \{ (j)_1 \mid j \in D_{\omega_1} \cap \forall g : j \in \{ } [K] g (c) \}$
3. $\bot M_c K = \{ (j)_1 \mid j \in D_{\omega_1} \cap \forall g : j \in \{ } [K] g (c) \}$
4. $\bot M_c K = \{ (j)_1 \mid j \in D_{\omega_1} \cap \forall g : j \in \{ } [K] g (c) \}$

This definition predicts the consistency of ‘Should $\phi$, and $\neg \phi$’.

This brief discussion of truth in UC highlights the essentially dynamic nature of weak and strong necessity modals on the present semantics. Updating with this limited role for truth is familiar among dynamic semantic accounts: the primary notion in representing linguistic meaning isn’t truth but how expressions conventionally update context. (More on this in §3.)

2.3 Conditionals and information-sensitivity

This section describes one way of extending the above semantics for ‘should’ and ‘must’ in root clauses to deontic conditionals. The resulting account sheds light on observed, but little discussed, differences in information-sensitivity between ‘should’ and ‘must’ conditionals.

All sentences in UC are treated as introducing a modal topic under discussion. Simple indicative sentences comment on the topical modality $\top \Omega$, identified with the input context set. ‘If’-clauses in indicative conditionals introduce a subdomain of this modality — i.e. the set of worlds in the context set in which the supposition is realized. This topical subdomain is commented on by the consequence clause. I propose (22) as a first-pass analysis of a simple indicative conditional such as (21) ($K^T$; $K'$ is a topic-comment sequence).
If Alice has a job, she will be generous.

(22) \( \langle [x | x = \text{Alice}] ; [w | \text{job}_w(\tau \delta)] ; [\omega \in \omega \mid \omega \mid] ; [p | p = \omega \mid \omega \mid] \rangle \)
\( \vdash ([\text{generous}_w(\tau \delta)] ; [\omega | \text{MIN}(\omega, \omega) \leq \omega \mid \omega \mid] ; [w | w = \omega \mid \omega \mid] ; [\omega \mid \omega = \omega \mid \omega \mid] ; [\omega \mid \omega = \omega \mid \omega \mid] \)

The ‘if’-clause introduces a propositional discourse referent into the bottom sequence for the set of worlds in the context set \( \omega \mid \omega \mid \) in which Alice has a job, as reflected in the first line of (22). This topical subdomain \( \omega \mid \omega \mid \) forms the modal base of an expectation modal comment in the consequent clause, as reflected in the second line: the first update in the second line restricts the topical subdomain to worlds in which Alice is generous (modal anaphora via \( \omega \mid \omega \mid \)), and the next update introduces the set of worlds \( w \) in which the most \( w \)-expected (\( \omega \mid \omega \mid \)-minimal) worlds in the modal base \( \omega \mid \omega \mid \) are worlds in which this possibility \( \omega \mid \omega \mid \) is realized. The now-familiar updates in the third line represent commitment to this possibility \( \omega \mid \omega \mid \), the proposal to update with it, the acceptance of this proposal, and the recentering of attention on the new topical modality \( \tau \mid \omega \mid \).

Our analyses of ‘should’ and ‘must’ in root clauses can be straightforwardly integrated into this general treatment of indicative conditionals:

If Alice has a job, she must be generous.

(23) \( \langle [x | x = \text{Alice}] ; [w | \text{job}_w(\tau \delta)] ; [\omega \in \omega \mid \omega \mid] ; [p | p = \omega \mid \omega \mid] \rangle \)
\( \vdash ([\text{generous}_w(\tau \delta)] ; [\omega | \text{MIN}(\omega, \omega) \leq \omega \mid \omega \mid] ; [w | w = \omega \mid \omega \mid] ; [\omega \mid \omega = \omega \mid \omega \mid] ; [\omega \mid \omega = \omega \mid \omega \mid] \)

If Alice has a job, she should be generous.

(24) \( \langle [x | x = \text{Alice}] ; [w | \text{job}_w(\tau \delta)] ; [\omega \in \omega \mid \omega \mid] ; [p | p = \omega \mid \omega \mid] \rangle \)
\( \vdash ([\text{generous}_w(\tau \delta)] ; [\omega | \text{MIN}(\omega, \omega) \leq \omega \mid \omega \mid] ; [w | w = \omega \mid \omega \mid] ; [\omega \mid \omega = \omega \mid \omega \mid] ; [\omega \mid \omega = \omega \mid \omega \mid] \)

(25) \( \langle [x | x = \text{Alice}] ; [w | \text{job}_w(\tau \delta)] ; [\omega \in \omega \mid \omega \mid] ; [p | p = \omega \mid \omega \mid] \rangle \)
\( \vdash ([\text{generous}_w(\tau \delta)] ; [\omega | \text{MIN}(\omega, \omega) \leq \omega \mid \omega \mid] ; [w | w = \omega \mid \omega \mid] ; [\omega \mid \omega = \omega \mid \omega \mid] ; [\omega \mid \omega = \omega \mid \omega \mid] \)

As with (21), the ‘if’-clauses in the deontic conditionals (23)/(25) introduce a topical subdomain of the context set — i.e. the set of worlds in \( \omega \mid \omega \mid \) in which Alice has a job — which is commented on by the consequent clause. In both (24) and (26), this subdomain is further restricted to worlds in which Alice’s being generous is deontically necessary (modal anaphora via \( \omega \mid \omega \mid \)). The comment is that these latter worlds are the most expected worlds in the subdomain \( \omega \mid \omega \mid \). That is, the proposition “that the most expected worlds in the context set where Alice has a job are worlds in which Alice’s being generous is deontically necessary” is introduced into the bottom sequence as being under consideration. As in the case of root clauses, the crucial con-
trast between the ‘should’ and ‘must’ conditionals concerns what attitude is taken toward this possibility, as reflected in the first update of the third line. Updating with (26) simply places on the conversational table the possibility that Alice’s being generous is deontically necessary, conditional on her having a job. Commitment to the conditional necessity claim isn’t required simply by the conventional meaning of (25).

This account of deontic conditionals helps capture an apparent contrast between ‘should’ and ‘must’ conditionals in information-sensitivity. Consider the Miners Puzzle:

Ten miners are trapped either in shaft A or in shaft B, but we do not know which. Flood waters threaten to flood the shafts. We have enough sandbags to block one shaft, but not both. If we block one shaft, all the water will go into the other shaft, killing any miners inside it. If we block neither shaft, both shafts will fill halfway with water, and just one miner, the lowest in the shaft, will be killed. (Kolodny & MacFarlane 2010: 115–116)

As has been extensively discussed in the literature, there are readings of (27)–(29) on which they appear jointly consistent.

(27) We should block neither shaft.
(28) If the miners are in shaft A, we should block shaft A.
(29) If the miners are in shaft B, we should block shaft B.

(27) seems true, since we don’t know which shaft the miners are in, and the consequences will be disastrous if we choose the wrong shaft. The conditionals in (28)–(29) are also natural to accept, since, given that the miners are in shaft A (shaft B), blocking shaft A (shaft B) will save all the miners.

A wrinkle in the discussions of information-sensitivity is that nearly all examples use weak necessity modals, and little if any attention is paid to how context affects speakers’ judgments. Several authors have observed, first, that using ‘must’ in the conditionals, as in (30)–(31), is generally dispreferred (Charlow 2013: 2305–2306; Silk 2013a).

(30) If the miners are in shaft A, we must block shaft A.
(31) If the miners are in shaft B, we must block shaft B.
Intuitively, the ‘should’ conditionals in (28)–(29) say what is best on a condition: given that the miners are in shaft A (/shaft B), our blocking shaft A (/shaft B) is the expectably best action. (28)–(29) don’t impose obligations on us conditional on how the world happens to be, unbeknownst to us. By contrast, (30)–(31) do seem to impose such an obligation. This is likely part of why many speakers find using ‘must’ in the conditionals to be dispreferred to using ‘should’. However, second, the relative felicity of ‘should’ and ‘must’ can vary with context. Consider a context in which it is particularly urgent that no miners be lost. Suppose our rescue team has a longstanding record of never losing anyone on the job, and we intend to keep that record intact. After all, people's lives are at stake! Getting into this frame of mind can improve the felicity of (30)–(31). Further, speakers report that insofar as they can imagine being in an urgent context where (30)–(31) are acceptable, (27) no longer seems true. Alice's response in (32) is marked.

(32) Alice: People's lives are at stake! If they're in A, we must block A. And if they're in B, we must block B.
Bert: So what should we do?
Alice: #We should (/may) block neither shaft.

The ‘must’ conditionals don’t seem to give rise to the same apparent modus ponens violations as the ‘should’ conditionals.

Elsewhere I have argued that deontic ‘may’ conditionals pattern with deontic ‘must’ conditionals in these respects, and that existing accounts of the Miners Puzzle make incorrect predictions about the broader spectrum of examples (Silk 2013a). Though many have appealed to cases like the Miners Case to motivate claims about the interpretation of modals and conditionals in general,\textsuperscript{11} examples with ‘must’ and ‘may’ suggest that the puzzles raised by such cases turn on features peculiar to weak necessity modals. For reasons of space I won't press these points here. My only point for the moment is that the account of ‘should’ and ‘must’ conditionals in this section sheds light on the broader data concerning information-sensitivity.

In short: As with (23), updating with the ‘must’ conditional in (e.g.) (30) requires committing (roughly) that our blocking shaft A is deontically necessary at every world in the context set in which the miners are in shaft A. However, some of these worlds are worlds where we don’t know that the miners are in shaft A. Hence updating with (30) requires accepting (roughly) that we have an obligation to block shaft A conditional on the miners being in shaft A — hence, accepting either that

the obligation holds independent of our knowledge, or accepting that we will learn where the miners are. Though perhaps one could imagine accepting this in a particularly urgent context (at least for purposes of conversation), doing so would typically be inapt — hence the general anomalousness of (30) (likewise for (31)).

Accepting the ‘should’ conditionals in (28)–(29), by contrast, requires no such commitments. As we have seen, ‘should’ centers attention on a deontic necessity claim without conventionally committing to it. Suppose we accept information-dependent norms which obligate us to block shaft A iff we learn that the miners are in shaft A. On the one hand, updating with the simple ‘should’ sentence in (27) allows us to entertain the possibility that we won’t learn where the miners are and hence will have an obligation to block neither shaft. By using ‘should’, we can plan for this likely scenario without explicitly settling that we won’t end up learning where the miners are, as we would need to do if we accepted (33) with ‘must’.

(33) We must block neither shaft.

On the other hand, updating with the ‘should’ conditionals in (28)–(29) places on the conversational table the possibility that we will be obligated to block shaft A/B conditional on the miners’ being in shaft A/B, and hence — given the information-dependent norms we accept — the possibility that we learn that the miners are in shaft A/B. (28)–(29) allow us to plan for the (possibly remote but still live) possibility in which we learn where the miners are. We can capture this without treating the conditional antecedents as explicitly reinterpreted as ‘if the miners are in shaft A/B and we learn it’ (as in von Fintel 2012), or introducing general revisions to the semantics of modalized conditionals (e.g. information-dependent preorder frames, selection functions, etc.; cf. Kolodny & MacFarlane 2010, Cariani et al. 2013, Charlow 2013, Silk 2014).

In sum, the present account correctly predicts that (27)–(29) can be jointly be accepted. By accepting (27) we can coordinate on a plan to block neither shaft, but without needing to settle decisively that we won’t get new evidence about the miners’ location. Remaining open to the possibility, however slight, that we might learn which shaft the miners are in, we can also plan for this contingency by accepting (28)–(29). It is weak necessity modals like ‘should’, unlike ‘must’ or ‘may’, that play this complex role in conversation, deliberation, and planning (see Silk 2013a for further discussion and developments).
3 Alternatives: Static and dynamic

One might worry that the account of the consistency of [27]–[29] in §2.3 is a symptom of a more general defect in the semantics: that it places no constraints on acceptance of seemingly conflicting modal claims expressed with 'should'. If updating with a 'should' sentence only places the necessity claim on the conversational table, why can't any set of 'should' sentences be jointly accepted? In this section I would like to briefly mention several strategies of reply. Though I won't be able to adjudicate among these options here, I hope the following discussion may provide a framework for further theorizing about them.

One option is to maintain the proposed update semantics for weak necessity modals, and capture apparent rationality constraints on deontic modal claims in the pragmatics. Though 'Should φ' doesn't conventionally express a specific attitude about the necessity of φ, this doesn't imply that no attitude is expressed. 'Should φ' conventionally places the possibility that φ is necessary on the conversational table, and centers attention on this possibility. We can capture ideas about the logic of 'should' sentences in an extra-semantic account of rationality constraints on this kind of discourse move. Indeed we can view work in deontic logic on prima facie obligations, weights and priorities among norms, resolvable and irresolvable dilemmas, etc. as addressing precisely this issue. Settling on controversial issues about the logic and metaethics — e.g., concerning the possibility of irresolvable moral dilemmas, the proper order in which to apply defaults, etc. — arguably isn't required for semantic competence with modals. These points suggest an attractive way of situating respective work in logic and natural language semantics in an overall theory of modality and modal language.

An alternative response is to weaken the proposition placed on the conversational table with 'Should φ', but treat the updates as restricting the context set. One might treat 'Should φ' as predicating the necessity of φ of a set of closest worlds that satisfy some possibly counterfactual condition, or a set of worlds that are "preferred" in some other contextually relevant sense (cf. Silk 2012a, 2012b: defn. 2), as in [34], where pref_w specifies a set of minimal worlds relative to w (for some relevant, lexically unspecified notion of minimality, e.g. most desirable, normal, likely, etc.).

\[
\begin{align*}
\text{(34)} & \quad T[x \mid x = \text{Alice}]; [w \mid \text{generous}_w(\top \delta)]; [w \mid \text{MIN}\{?\omega\mid \leq w\} \subseteq \bot \omega]; \\
& \quad [w \mid \text{pref}_w \subseteq \bot \omega]; [p \mid p = \bot \omega]; \\
& \quad [w \mid w = \bot \omega]; [1\omega \in \top \omega]; [\top \omega = 1\omega]; [T \omega = 1\omega]; T[p \mid p = T \omega]
\end{align*}
\]

\textsuperscript{12}\textsuperscript{For further discussion of related methodological issues, see Forrester 1989: chs. 2, 13, Silk 2013b, 2016.}
This sequence of updates doesn’t restrict the context set to worlds in which Alice’s being generous is deontically necessary; it restricts the context set to worlds \( w \) such that the relevant \( w \)-accessible worlds \( w' \) — which may not themselves be in the context set — are worlds at which Alice’s being generous is deontically necessary.

(34) explicitly represents an additional attitudinal comment (concerning preference, probability, etc.) in the semantics of ‘should’ sentences. However, we shouldn’t dismiss out of hand an alternative conversational strategy which derives the apparent sensitivity to a set of “preferred” worlds from general principles of pragmatic reasoning. Further investigation of potential grammatical reflexes of this kind of sensitivity — as concerning comparatives, interactions with quantifiers, polarity effects, and neg-raising — would be helpful in adjudicating among these options.

Although the update semantics developed in §2 is essentially dynamic, considering an alternative such as (34) raises the question of to what extent the informal ideas from §§1–2 about the conversational role of ‘should’ call for a dynamic implementation. (34) treats assertions with ‘should’ as updating context in the same kind of way as any other assertion. This kind of analysis could be implemented in a static framework, as in (35) (for modal base function \( f \)).

\[
\text{[Should } \phi \text{]}^{c:w} = 1 \text{ iff } \forall w' \in \text{pref}_w: \min(f(w'), \lesssim_{w'}) \subseteq [\phi]^c
\]

Insofar as the evaluation world \( w \) needn’t be in the set of worlds \( \text{pref}_w \) at which the necessity of \( \phi \) is evaluated, (35) would capture the idea from §1 that ‘Should \( \phi \)’ brackets whether \( \phi \) is actually necessary (epistemically, deontically, etc.). However, even if informal ideas about the discourse function of weak necessity modals could be implemented in both static or dynamic frameworks, this leaves open whether these ideas are best explained in terms of truth. Thorough empirical examination of the grammatical and discourse differences among necessity modals is certainly required. Yet I suspect that philosophical reflections on the theoretical significance and explanatory power of alternative static vs. dynamic implementations may ultimately prove more important (cf. Starr 2010).

4 Conclusion

Let’s recap. Following Silk 2012a,b, I have argued that the common semantic core of weak necessity modals is that they bracket whether the prejacent is necessary (deontically, epistemically, etc.) in the actual world (world of evaluation). This analysis

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carves out an important role for expressions of weak necessity in conversation, delibera-
tion, and planning. Weak necessity modals allow us to entertain and plan for hypo-
thetical extensions of the current context. They afford a means of coordinating our values, expectations, etc. while remaining open to new evidence about how the relevant considerations (norms, preferences, expectations, etc.) apply. To capture these ideas I developed an update semantics for weak and strong necessity modals. An account of deontic conditionals was also developed and integrated into a more general update semantics for conditionals.

The discourse differences between ‘should’ and ‘must’ here certainly aren’t the only data that must be explained by an overall theory. Elsewhere I argue that the proposed treatment of the weak/strong necessity distinction also captures the morphosyntactic properties of expressions of weak necessity cross-linguistically (von Fin-
tel & Iatridou 2008), and the contrasting performative properties of weak and strong necessity modals (see Silk 2012a,b). There are also contrasts in, e.g., polarity effects and interactions with quantifiers and negation (n. 13). And though I focused on what distinguishes the respective classes of weak vs. strong necessity modals, I bracketed differences among weak necessity modals and among strong necessity modals (see Silk 2012b, 2015 and references therein). Moreover our discussion has highlighted how phenomena with weak and strong necessity modals interact with more general issues concerning context-sensitivity, counterfactuality, assertion, the roles of truth and discourse function in explaining linguistic meaning and use, and the relations among logic, semantics, and pragmatics in an overall theory of modality. These connections afford rich possibilities for future research. I welcome alternative ways of systematizing the data with which the present account may be compared.

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