

DYNAMIC THOUGHTS ON IFS AND OUGHTS

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1. The Plot

The received wisdom on Chisholm's (1963) paradox is that we must choose between *factual detachment* and *deontic detachment*:

FACTUAL DETACHMENT: $(\text{If } \phi)(\text{OUGHT } \psi), \phi \models \text{OUGHT } \psi$

DEONTIC DETACHMENT: $(\text{If } \phi)(\text{OUGHT } \psi), \text{OUGHT } \phi \models \text{OUGHT } \psi$

Factual detachment allows for conditional obligations to detach whenever their condition is satisfied, while deontic detachment allows for conditional obligations to detach whenever their condition ought to be satisfied. Endorsing both detachment principles without any restrictions — so the folklore goes — leads to trouble once we try to make sense of contrary-to-duty obligations, that is, conditional obligations telling us what to do in case we neglect our duties so that we make the best of the bad situation to which our misdeeds have led. For consider:

- (1) Jones ought to go to the aid of his neighbors.
- (2) If Jones goes to the aid of his neighbors, then he ought to tell them he is coming.
- (3) If Jones does not go to the aid of his neighbors, then he ought not tell them he is coming.
- (4) Jones does not go to the aid of his neighbors.

The intuition is that (1)–(4) are consistent, yet (1) and (2) entail (5) by deontic detachment while (3) and (4) entail (6) by factual detachment:

- (5) Jones ought to tell his neighbors that he is coming.
- (6) Jones ought not tell his neighbors that he is coming.

But (5) contradicts (6) given the D-axiom of deontic logic, and thus, so the story goes, we need to give at least one of our detachment rules the boot.¹

1. See the discussion by Loewer and Belzer (1983) and references therein; Åqvist (2002), Carmo and Jones (2002), and McNamara (2006) offer more re-

Recent extensive discussions of Chisholm's paradox are rare but its received message looms large in the most prominent possible worlds analyses of deontic conditionals by Lewis (1973) and Kratzer (1991, 2012), who both reject factual detachment and preserve deontic detachment.² On this view, Jones ought to tell his neighbors he is coming since he ought to go help and ought to tell his neighbors he is coming in case he does go help. This remains so regardless of what he actually does and of what he ought to do in case he violates his obligation to help. Arregui (2010), in contrast, preserves factual detachment but rejects deontic detachment. On this view, Jones ought *not* tell his neighbors he is coming since this is what he ought to do in case he does not go help, and as a matter of fact he does not go help. The obligation to tell his neighbors he is coming holds in worlds that are deontically ideal — those in which he does go help — yet such obligations need not be actual obligations since the actual world is anything but deontically ideal. What these proposals share is the dogma that a coherent semantic analysis of deontic conditionals cannot support both detachment rules.

Having to choose between factual and deontic detachment is, to say the least, an unfortunate situation to be in since both detachment principles have intuitive appeal and play a crucial role in everyday reasoning. We often rely on factual detachment to arrive at practical conclusions from hypothetical imperatives; without it, it is hard to see how conditional obligations could have any force in everyday practical reasoning. Deontic detachment is important as well since it allows us

cent discussions of Chisholm's paradox and its implications for the two detachment principles. The labels "factual detachment" and "deontic detachment" go back to Greenspan (1975). Chisholm's original point is that von Wright's (1951) classical deontic logic does not allow for a proper formulation of conditionals articulating contrary-to-duty obligations.

2. In addition to Lewis (1973), see Chellas (1974), Føllesdal and Hilpinen (1971), Hansson (1971), and van Fraassen (1972) for early studies of conditional deontic logics within possible world frameworks. Lewis (1974) offers a useful comparison of these various logics. See Gabbay (2014) for a recent analysis of Chisholm's case, though one that does not rely on possible worlds and differs substantially from the story I am about to tell.

to reason about the combined force of obligations: to wit, it is more than tempting to say that Jones ought to go help and let his neighbors know that he is coming, but saying this on the basis of (1) and (2) just requires that one appeals to deontic detachment. So the best choice would be not to choose at all, and this is especially so if we can show that the need to choose between factual and deontic detachment is illusory.³

My claim is that Chisholm's paradox fails to put us in a spot where we need to make a choice between factual and deontic detachment. *Something* commonly taken for granted about deontic discourse and reasoning needs to go alright, but instead of crippling the inferential potential of *iffy* oughts I say we reject the assumption that deontic discourse and reasoning are monotonic:

MONOTONICITY: If $\phi_1, \dots, \phi_n \models \psi$, then $\phi_1, \dots, \phi_n, \phi_{n+1} \models \psi$

Monotonicity requires that whatever has been established in discourse and reasoning remains established in light of additional information. A commitment to monotonicity, then, does not leave us much choice when it comes to reasoning about what Jones ought to do in Chisholm's scenario: we must either deny that, in light of his primary obligations, Jones ought to tell his neighbors that he is coming, or — the other horn of the dilemma — deny that his contrary-to-duty obligation detaches under the assumption that he does not go help. On the other hand, rejecting monotonicity allows for the possibility that while (1) and (2) entail (5) via deontic detachment, this entailment is *defeated* under the additional assumption that Jones actually does not

3. Loewer and Belzer (1983) suggest that Chisholm's paradox — like so many other deontic puzzles — disappears once we pay close attention to the times of the obligations, and this strategy is also pursued by Åqvist and Hoepelman (1981), van Eck (1982), Feldman (1986, 1990), Loewer and Belzer (1986), and Thomason (1981a, 1981b). I set this option aside since the consensus in the literature now is that considerations about tense will not serve as a silver bullet against all paradoxes deontic. In particular, Prakken and Sergot (1996, 1997) present a "timeless" Chisholm scenario that is not easily solved by considerations about tense. See McNamara (2006) for discussion.

go. Given that Jones ought to go help and let his neighbors know that he will come in case he does go help, he ought to tell his neighbors that he is coming, which is just what deontic detachment predicts. But assume that Jones does not go: then in light of *that* additional information, it is *no longer* the case that he ought to let his neighbors know that he is coming. Rather, he ought not let his neighbors know that he is coming, just as factual detachment together with (3) and (4) predicts. No contradiction arises, but this is *not* so because deontic or factual detachment prove to be invalid, but because the right logic for *ifs* and *oughts* is nonmonotonic.

My proposal is thus sympathetic to those who have advocated for a nonmonotonic perspective on deontic discourse and reasoning. Not all nonmonotonic perspectives are created equal, however, and mine will differ substantially from those advertised before in that it resists the dominant trend of taking the classical nonmonotonic analyses of reasoning with defeasible generalizations (such as “birds fly”) as a source of inspiration.⁴ Instead, I shall argue that the phenomenon of

4. Horty (1994, 1997, 2003, 2007, 2012), whose primary source is Reiter’s (1980) default logic, puts this inspiration to good use in his analysis of prima facie obligations and moral dilemmas. See also Asher and Bonevac (1996, 1997), Belzer (1986), Bonevac (1998), McCarty (1994), Nute (1997), and Ryu and Lee (1997) for similarly inspired frameworks. I leave a detailed discussion of why the path taken here leads to a more comprehensive foundation for a nonmonotonic perspective on deontic logic to another day (see Willer [forthcoming]), but part of the motivation is the simple fact that reasoning with contrary-to-duty obligations can hardly be understood as reasoning with defeasible generalizations: a situation in which a certain norm is violated certainly cannot count as one in which that norm does not apply in the first place (see Prakken and Sergot [1996, 1997]). A notable exception to the general tendency of motivating a nonmonotonic perspective on deontic discourse and reasoning on the basis of considerations about defeasible generalizations is the framework suggested by van der Torre and Tan (1998), who think of deontic *ought* dynamically as inducing preferences in an information carrier. The story told here is sympathetic to theirs but differs substantially in motivation, execution, and scope. For instance, van der Torre and Tan do not develop a compositional semantics that makes sense of deontic *ought* under the scope of negation, and they follow von Wright (1956) in analyzing conditional obligations using a primitive conditional connective instead of deriving their interpretation from independently plausible analyses of conditionals and deontic modals (which is what I will do here).

nonmonotonicity arises naturally from a small set of plausible assumptions about ordinary conditionals and deontic modals. Once we make these assumptions precise in a *dynamic* semantic analysis of modals and conditionals, they immediately translate into a nonmonotonic consequence relation for deontic discourse and reasoning. Rejecting monotonicity, while on first sight no less radical than giving up on one of our two detachment principles, comes with a very attractive perspective on how we speak and reason about iffy oughts.

My plan is straightforward. In §2, I introduce the key concepts of the proposal and outline its basic ideas. In §3, I spell out the story in all its relevant details and demonstrate that it resolves Chisholm’s paradox while preserving factual as well as deontic detachment. §4 offers some bonus applications of the proposed semantic analysis: it readily resolves Forrester’s (1984) paradox of gentle murder, and it is flexible enough to handle the recent miners paradox from Kolodny and MacFarlane (2010) without sacrificing any of our two detachment rules. Once this is done, we can see more clearly what is non-negotiable about the story told here and how it compares to alternative reactions to our puzzles about iffy oughts (§5).

2. Outline

The semantics I intend to develop is dynamic in that it understands the meaning of a sentence in terms of its context change potential (CCP).⁵ This section introduces the key concepts of the proposal and outlines its basic ideas. A natural way of motivating a dynamic approach to meaning and communication starts with the familiar truisms about assertion from Stalnaker (1978). Assertions, Stalnaker maintains, express propositions, and since language has context-sensitive expressions, which proposition an assertion expresses often depends on context. But context-content interaction is not a one-way road: assertions

5. Some classical dynamic semantic frameworks: Discourse Representation Theory (Kamp [1981]; Kamp and Reyle [1993]; Kamp et al. [2011]), Dynamic Predicate Logic (Groenendijk and Stokhof [1991]), File Change Semantics (Heim [1982]), Update Semantics (Veltman [1985, 1996]).

in turn affect the context, and they do so by adding whatever proposition is expressed to the common ground.

In Stalnaker's model the context change that assertions induce is always mediated by propositional content, and thus the resulting picture just builds a dynamic pragmatics on top of a classical truth-conditional semantics. But Stalnaker's story about context-content interaction also suggests a change in perspective: instead of being all about truth-conditions, a semantics may ask how an utterance relates an input context (the context in which it is made) to an output context (the context posterior to the utterance). Meanings then become relations between contexts and while *some* context change may very well be mediated by propositional content, there is no commitment to the idea that *all* context change is thus mediated. Whenever this is the case we have content that does not reduce to truth-conditional content.⁶

With so much focus on contexts, it is legitimate to ask what they are supposed to be, and the answer depends on the specific interests of the dynamic proposal. My interest lies with what Ramsey (1931) has to say about the evaluation procedure for conditionals, and so I will think of contexts as information states. Ramsey does not ask what it takes for a conditional to be true at some index of evaluation but rather what it takes for a rational agent to *accept* a conditional given some state of information. The suggestion is that a conditional is accepted given some state of information σ just in case its consequent is (hypothetically) accepted in the derived state of information got by strengthening σ with the assumption of its antecedent. Putting things a bit more precisely:

$$\sigma \models \phi \Rightarrow \psi \text{ just in case } \sigma[\phi] \models \psi$$

Here " \models " denotes the relation of acceptance, " \Rightarrow " represents the Ramsey conditional, and $\sigma[\phi]$ is the result of strengthening σ with the information carried by ϕ . It is uncontroversial that this idea carries more

6. I roughly follow here Dever (2006) and von Stechow and Gillies (2008) in motivating dynamic semantics by moving from a familiar picture about context-content interaction to a purely relational view about semantic values.

than a grain of truth and in fact virtually every semantic analysis of conditionals owes a lot of inspiration to Ramsey's proposal. The dynamic treatment of conditionals that will be relevant here takes the idea of conditionals as tests very seriously — they check whether the information carried by a state has a certain structure; that is, whether the state of information supports the consequent if hypothetically updated with the antecedent.

For present purposes there are two important aspects of my favorite story about conditionals that are worth highlighting and will ultimately conspire to deliver what I take to be a plausible and elegant solution to Chisholm's puzzle about iffy oughts. First, it puts the process of updating one's state of information with an additional bit of information at the center stage of a semantics for conditionals: a conditional is acceptable just in case one would (hypothetically) accept its consequent under the supposition of its antecedent. This is important because it highlights the question how what is accepted in discourse and reasoning *changes* in light of additional information. It is a well-worn story that the most natural answer to this question — that adding some bit of information results in a state carrying at least as many doxastic commitments as the prior state — runs into trouble once we consider agents who believe that so-and-so might be the case, epistemically speaking: rational commitments of this kind need to go once the inquiring agent acquires the information that so-and-so is not the case (see Levi [1988], Fuhrmann [1989], and Rott [1989] for seminal discussion). To see what the issue is, notice that, if Mary is either in Chicago or New York but we do not know where, it seems natural to accept both (7) and (8):

- (7) Mary might be in Chicago.
- (8) If Mary is not in Chicago, she must be in New York.

The natural conclusion to draw is that one may accept that Mary might be in Chicago but also accept that Mary must be in New York under the

assumption that she is not in Chicago.⁷ The assumption that Mary is not in Chicago preserves one's commitment to Mary being in Chicago or in New York: this is just what underlies the acceptance of (8) in the case under consideration. But it cannot preserve one's commitment to (7) — while $\sigma \models \text{MIGHT } C$, $\sigma[\neg C] \not\models \text{MIGHT } C$ (where C is short for "Mary is in Chicago") — since otherwise the supposition would put the deliberating agent into the inconsistent state of mind of accepting both that Mary might be in Chicago and that she must be in New York. And of course, all of this is perfectly intuitive: a belief that Mary might be in Chicago is not preserved by the additional information that Mary is not in Chicago, and so we want to say that information aggregation is not guaranteed to preserve rational commitment. As Gillies (2006) details, this observation finds a natural articulation in a dynamic semantics for epistemic modals.

The fact that updating one's state of information is not guaranteed to preserve one's rational commitment to *might* is familiar. The hypothesis that I want to pursue and articulate in a dynamic setting is that information strengthening fails to preserve *deontic* commitments as well. Observe that just as (7) and (8) are co-tenable in the scenario we considered earlier, (9) and (10) from Forrester (1984) are jointly acceptable as well:

- (9) Jones ought not murder Smith.
- (10) If Jones murders Smith, he ought to murder Smith gently.

Notice here that (9) intuitively forbids Jones to murder Smith *gently* or *otherwise* and so contradicts the consequent of (10). But then we want to say that, as in the case of epistemic *might*, additional information may defeat deontic *ought*. If accepting (10) amounts to accepting its consequent under the assumption that Jones murders Smith, the supposition cannot preserve one's rational commitment to the claim that Jones ought not murder Smith gently: otherwise the assumption would

7. I label this conclusion "natural" since it assigns to (8) the obvious logical form on which epistemic *must* takes narrow as opposed to wide scope.

put the deliberating agent into the inconsistent state of endorsing that Jones ought and ought not murder Smith gently. Even without making this story more precise — and we will — there is every reason to think that rational deontic commitments may be defeated in light of additional information.⁸

The first feature of the Ramseyan approach to conditionals that matters here, then, is that the evaluation procedure for conditionals relies on a process of suppositional reasoning that, qua process of strengthening, is not guaranteed to preserve rational commitments. The second important aspect of the Ramseyan approach is that, since the meaning of conditionals is captured in terms of *acceptance*- rather than truth-conditions, rational inference is no longer well understood in the classical fashion as necessary preservation of truth at some point of evaluation. The natural alternative I wish to pursue here is that rational inference is best understood as necessary preservation of rational commitment: an argument is valid just in case any rational agent would be committed to its conclusion under the supposition of its premises.

Thinking of validity as commitment preserving does not only establish a close connection between the role of suppositional reasoning in the evaluation procedure for conditionals and its role in the evaluation procedure for arguments: both proceed by checking whether a certain sentence is accepted given certain assumptions. It also interacts with the earlier observation that strengthening fails to be commitment preserving to arrive at a nonmonotonic perspective on discourse and reasoning. For assume that $\phi_1, \dots, \phi_n \models \psi$, that is, assume that supposing ϕ_1, \dots, ϕ_n brings in its wake a rational commitment to ψ . But this commitment, given what we have seen earlier, need not be preserved by additional assumptions, and so we expect there to be cases in which $\phi_1, \dots, \phi_n \models \psi$ yet $\phi_1, \dots, \phi_n, \phi_{n+1} \not\models \psi$. In other words, combining the observation that strengthening fails to be commitment preserving with

8. This line of reasoning, as so many others, can be resisted by someone who believes that the deontic modals in (9) and (10) differ in meaning. I set this option aside since part of the exercise here is to demonstrate that there is simply no need to postulate ambiguities to handle the paradoxes under consideration.

a conception of validity as necessary preservation of rational commitment naturally leads to a nonmonotonic conception of logical consequence.

What I have done so far is to argue that if we take the Ramseyan test conception of conditionals seriously, we have every reason to expect that a logic for conditionals — deontic conditionals, in particular — fails to be monotonic. It remains to be seen, of course, that the resulting perspective on deontic discourse and reasoning can be elaborated so that it fails to be nonmonotonic in the right way and preserves factual and deontic detachment. The purpose of the next sections is to demonstrate that this is indeed the case.

3. Details

The immediate goal of this section is to present a dynamic semantics for a propositional language extended with the conditional connective and the epistemic modals *might* and *must* (§3.1). The point of this exercise is to demonstrate that given very limited semantic assumptions, the logical consequence relation for this language already fails to be monotonic; moreover, there is a simple semantic feature observable in some natural language modals that grounds the observed nonmonotonic effects. §3.2 shows that deontic *ought* exhibits this very same semantic feature, and so we have independent reason to believe that the logical consequence relation for a deontic language is nonmonotonic. It is then straightforward to verify how the resulting semantic proposal resolves Chisholm's paradox while preserving factual and deontic detachment. §3.3 summarizes the discussion and addresses a few remaining issues.

3.1 Basics

Start with defining a basic language, which for our purposes is a standard propositional language extended with the epistemic modals *might* and *must* as well as the binary conditional connective:

Definition 1 (Basic Language) \mathcal{L} is the smallest set that contains a set of sentential atoms $\mathcal{A} = \{p, q, \dots\}$ and is closed under negation (\neg), conjunction (\wedge), the epistemic modal *might* (\diamond_e), and the binary conditional connective (\Rightarrow). \mathcal{L}_0 is defined as the propositional fragment of \mathcal{L} . Disjunction (\vee), the material conditional (\supset), the biconditional (\equiv), and the epistemic modal *must* (\square_e) are defined in the usual way.

At a later stage, \mathcal{L} will be extended with a modal operator representing deontic *ought*, which is similar to epistemic *must* in that it is interpreted as a universal quantifier over a set of possible worlds.

The suggestion is to model the meaning of elements of \mathcal{L} in terms of their update potential on states of information. Here it will suffice to work with a simple model of an information state as a set of possible worlds, that is — the set of possible worlds compatible with the information carried by that state.

Definition 2 (Possible Worlds, States) w is a *possible world* iff $w: \mathcal{A} \mapsto \{0, 1\}$. W is the set of such worlds, $\mathcal{P}(W)$ is the powerset of W . σ is a *state of information* iff $\sigma \subseteq W$. Σ is the set of such states of information. The *absurd* state is identical to \emptyset .

For each $\phi \in \mathcal{L}_0$, we can define a set of indices $\llbracket \phi \rrbracket$ at which ϕ is true:

Definition 3 (Propositions) Define a function $\llbracket \cdot \rrbracket: \mathcal{L}_0 \mapsto \mathcal{P}(W)$ that assigns to each element of \mathcal{L}_0 a *proposition* according to the following recipe:

- (1) $\llbracket p \rrbracket = \{w \in W: w(p) = 1\}$
- (2) $\llbracket \neg \phi \rrbracket = W \setminus \llbracket \phi \rrbracket$
- (3) $\llbracket \phi \wedge \psi \rrbracket = \llbracket \phi \rrbracket \cap \llbracket \psi \rrbracket$

Such sets of indices will not play their classical role as carriers of meaning, but they will prove to be useful at a later stage.

Define now for each $\phi \in \mathcal{L}$ an update rule according to the following recipe (for inspiration, see Veltman [1985, 1996] and Gillies [2004]):

Definition 4 (Basic Update Rules) Associate with each $\phi \in \mathcal{L}$ a state change rule $[\phi]: \Sigma \mapsto \Sigma$ as follows:

- (1) $\sigma[p] = \{w \in \sigma: w(p) = 1\}$
- (2) $\sigma[\neg\phi] = \sigma \setminus \sigma[\phi]$
- (3) $\sigma[\phi \wedge \psi] = \sigma[\phi][\psi]$
- (4) $\sigma[\diamond_e \phi] = \{w \in \sigma: \sigma[\phi] \neq \emptyset\}$
- (5) $\sigma[\phi \Rightarrow \psi] = \{w \in \sigma: \sigma[\phi][\psi] = \sigma[\phi]\}$

The clause in (1) requires that updating σ with an atom p eliminates all possible worlds from σ in which p is false. According to clause (2), updating σ with $\neg\phi$ comes down to leaving everything in σ that gets eliminated by an update with ϕ . To update with a conjunction, update with the first conjunct and then update the result with the second conjunct (cf. [3]). Clause (4) captures a *test*-conception of claims of epistemic modality. Updating σ with a formula of the form $\diamond_e \phi$ is to run a test: if updating σ with ϕ does not return the empty set, then σ passes the test. Otherwise, we get back the empty set and the test is rejected. For example, updating σ with $\diamond_e p$ returns σ if there is at least one p -world in σ , and returns the empty set otherwise. This is, in effect, to model the semantics of epistemic *might* in terms of its acceptance-conditions; and a corresponding approach also makes sense of conditional constructions. Ramsey, remember, specifies conditions under which a conditional is acceptable given some state of information. And intuitively, ϕ is accepted in σ just in case updating σ with ϕ idles, that is, just in case the information carried by ϕ is already carried by σ . The simple proposal in (5) is then that a conditional tests whether updating with its consequent idles — the consequent is accepted — once we have updated the input state with the conditional's antecedent. If the test is passed, the conditional is accepted; otherwise, the conditional is rejected.

The final step is to define the notion of logical consequence for the language under consideration. As I suggested earlier, we will think of validity as necessary preservation of commitment: any state of information that is updated with the premises accepts the conclusion.

To facilitate the discussion, we also define what it takes for a sequence of sentences to be consistent.

Definition 5 (Acceptance, Entailment, Consistency) Take any $\phi_1, \dots, \phi_n, \psi \in \mathcal{L}$ and $\sigma \in \Sigma$:

1. $\sigma \models \phi$, σ accepts ϕ , iff $\sigma[\phi] = \sigma$
2. ϕ_1, \dots, ϕ_n entails ψ , $\phi_1, \dots, \phi_n \models \psi$, iff for all $\sigma \in \Sigma$: $\sigma[\phi_1] \dots [\phi_n] \models \psi$
3. ϕ_1, \dots, ϕ_n is consistent iff for some $\sigma \in \Sigma$: $\sigma[\phi_1] \dots [\phi_n] \neq \emptyset$

A state of information σ accepts ϕ just in case updating σ with ϕ idles. An argument is valid just in case any state accepts its conclusion once updated with the premises of that argument. Finally, for a sequence of sentences to be consistent there must be at least one carrier of information that can be updated with that sequence without resulting in the absurd state.

It is straightforward to observe that the suggested framework predicts that (7) and (8) are consistent (repeated):

- (7) Mary might be in Chicago.
- (8) If Mary is not in Chicago, she must be in New York.

To see this, suppose that Mary is in Chicago (C) at w_1 and in New York (NY) at w_2 , and consider $\sigma = \{w_1, w_2\}$: then $\sigma \models \diamond_e C$ but $\sigma[\neg C] \models \square_e NY$ and thus $\sigma \models \neg C \Rightarrow \square_e NY$. The underlying observation is that a state may accept (7) but *no longer* accept it if strengthened with an additional bit of information. In particular, strengthening σ with $\neg C$ does *not* result in a state of information accepting both “Mary might be in Chicago” and “Mary must be in New York” — only the latter, and not the former, is accepted. The underlying fact is that epistemic *might* fails to be persistent in the following sense:

Definition 6 (Persistence) A sentence ϕ is *persistent* with respect to \models iff for all states of information σ and τ : if $\sigma \models \phi$ and $\tau \subseteq \sigma$, then $\tau \models \phi$.

It is then straightforward to verify that epistemic *might* lacks the persistence property whenever its prejacent is contingent:

Fact 1 Consider arbitrary contingent ϕ in \mathcal{L}_0 : $\diamond_e\phi$ fails to be persistent.

If ϕ is persistent, a commitment to ϕ never gets defeated through strengthening and is thus guaranteed to be preserved by the process of updating, the underlying fact being that our update function is eliminative in the sense that for all σ and ϕ , $\sigma[\phi] \subseteq \sigma$. Epistemic *might* fails to be persistent since its acceptance condition is sensitive to a global feature of a state of information — the property of leaving a certain possibility open — that is not guaranteed to be preserved under information strengthening.

The persistence-failures we observed do not only account for the co-tenability of (7) and (8) in a Ramseyan approach to conditionals. They also underlie the observation that our logic for \mathcal{L} fails to be monotonic:

Fact 2 The logical consequence relation \models for \mathcal{L} is nonmonotonic.

To see this, simply observe that $\diamond_e p \models \diamond_e p$ yet $\diamond_e p, \neg p \not\models \diamond_e p$ since a commitment to a claim such as “Mary might be in Chicago” fails to be preserved by the process of strengthening a state with the information that Mary is not in Chicago. If logical consequence is at its heart all about commitment preservation, nonmonotonicity is just what we expect since strengthening is not guaranteed to preserve rational commitment.

This is all that needs to be said about the semantics of conditionals and epistemic modals. The purpose of this exercise was to make the two intuitions precise that I articulated earlier. First, a Ramseyan approach to conditionals highlights the role of suppositional reasoning in evaluating a conditional, and we have independent reason to believe that suppositional reasoning is not guaranteed to preserve existing rational commitments. Second, a Ramseyan analysis of the meaning of conditionals in terms of their acceptance- rather than truth-conditions

highlights the role of logical consequence as guaranteed preservation of rational commitment, and we have independent reason to believe that this notion of logical consequence fails to be monotonic. The two intuitions are related: our notion of logical consequence fails to be monotonic *because* information strengthening fails to preserve rational commitment, and we now have a criterion ready at hand — lack of persistence — that explains *why* certain (modal) commitments fail to be thus preserved. The next step is to extend the proposal to deontic *ought*.

3.2 Deontic Ought

The goal of this section is to extend the semantics so that it covers formulas of the language \mathcal{L}^+ , which is just the result of extending \mathcal{L} with the deontic modal *ought* (\square_d). For ease of exposition, I will first present a simple dynamic analysis of deontic *ought* and explain how it offers a straightforward solution to Chisholm’s paradox while preserving factual and deontic detachment (§3.2.1). The final proposal — which is slightly more complex but in return avoids a few shortcomings of the basic story — is presented in §3.2.2.

3.2.1 Basic Proposal

I shall assume here that deontic *ought* recommends propositions rather than tests and thus scopes over elements of \mathcal{L}_0 (the propositional fragment of \mathcal{L}). Precisely:

Definition 7 (Full Language) \mathcal{L}^+ is the smallest set that contains $\mathcal{L}_0 \cup \{\square_d\phi : \phi \in \mathcal{L}_0\}$ and is closed under negation (\neg), conjunction (\wedge), *might* (\diamond_e), and the conditional connective (\Rightarrow). Disjunction (\vee), the material conditional (\supset), the biconditional (\equiv), and the epistemic modal *must* (\square_e) are defined in the usual way.

Everything said so far remains valid, and so all we need to do is to give a reasonable update rule for the the new operator.

Earlier I modeled the semantics of epistemic modals and conditionals in terms of their acceptance-conditions, and there is no need to depart from this fine tradition once we consider deontic *ought*. Classical semantic analyses interpret deontic modals as quantifiers over a contextually restricted set of possible worlds — intuitively, the set of possible worlds that are deontically ideal in light of the relevant context. In general, we may thus think of deontic *ought* as interpreted with respect to a context that determines, for each state of information, which set of possible worlds are deontically ideal in light of that information.⁹ Deontic *ought* is then similar to epistemic *must* in that it is accepted in σ just in case its prejacent is entailed by a certain carrier of information — that is, the set of possible worlds that are deontically ideal in light of σ and some relevant deontic context.

Definition 8 (Deontic Contexts) A deontic context d determines for each $\sigma \in \Sigma$ a set of deontically ideal worlds σ_d in accordance with the following principles:

- SUCCESS: $\sigma_d \subseteq \sigma$
 CONSISTENCY: If $\sigma \neq \emptyset$, then $\sigma_d \neq \emptyset$.
 UNIFORMITY: If $\sigma_d \subseteq \tau$ and $\tau_d \subseteq \sigma$, then $\sigma_d = (\sigma \cup \tau)_d = \tau_d$.

The guiding idea here is that the acceptance-conditions for deontic *ought* are sensitive to the information taken for granted in discourse and reasoning, and the principles of SUCCESS, CONSISTENCY, and UNIFORMITY say a bit more about the scope of this sensitivity.

According to SUCCESS, what is taken for granted always matters for what is considered to be deontically ideal, in the sense that the deontically ideal worlds are required to be epistemically possible. This in effect enforces a deliberative interpretation of deontic *ought* — the

9. Epistemic *must* (and its dual epistemic *might*) can be interpreted in context as well, though the resulting notion of an epistemic context simply amounts to the identity function and so does not add anything to what I have said earlier.

question is what ought to be done taking the facts as given — and we will later see how to make sense of non-deliberative interpretations on which the facts themselves may be subject to evaluation (the distinction goes back to Thomason [1981a]). CONSISTENCY simply enforces the D-axiom of deontic logic. Finally, UNIFORMITY requires that whenever some $s \in \mathcal{P}(\sigma)$ is selected as deontically ideal over some other $s' \in \mathcal{P}(\sigma)$, then s must be selected over s' in light of any state τ such that $s, s' \in \mathcal{P}(\tau)$. Moreover, whenever s is selected over two alternatives s' and s'' , then it is also selected over the union of s' and s'' . In words, how regions of logical space compare in terms of their deontic ideality remains fixed in discourse and reasoning given some fixed deontic context, and if one region dominates two alternatives it also dominates the choice between those alternatives.

What I am about to say here does not rely on a *specific* hypothesis about how exactly deontic contexts determine what is deontically ideal, as long as they do so in accordance with the intuitive constraints just described. This is a plus, but for sake of concreteness, it will often be helpful to think of deontic contexts in a classical fashion as fixing a set of propositions that induces an ordering on the set of possible worlds compatible with the body of information under consideration.

Definition 9 (Classical Deontic Contexts) A deontic context d is *classical* iff d fixes an *ordering source* $o \subseteq \mathcal{P}(W)$ — that is, a set of propositions. o_d is the ordering source provided by d . $w <_d w'$ iff (i) for all $[\phi] \in o_d$: if $w' \in [\phi]$, then $w \in [\phi]$ and (ii) for some $[\phi] \in o_d$: $w \in [\phi]$ and $w' \notin [\phi]$. w is *minimal* in σ given d iff $w \in \sigma$ and $\neg \exists w' \in \sigma$: $w' <_d w$. σ_d is then just the set of possible worlds that are minimal in σ given d . An obligation is *violated* in σ given d iff for some $[\phi] \in o_d$: $\sigma \cap [\phi] = \emptyset$.¹⁰

10. Deontic contexts must be consistent and hence this definition makes the LIMIT ASSUMPTION: the ordering $<_d$ induced by a classical deontic context d is well-founded. See Lewis (1973) for seminal discussion and also Herzberger (1979), Pollock (1976), Stalnaker (1984), and Warmbröd (1982); here, it is technical convenience that simplifies the semantics and immediately guarantees that classical deontic contexts also satisfy SUCCESS and UNIFORMITY.

Earlier I observed that epistemic *might* fails to be persistent since its acceptance condition is sensitive to a global feature of a carrier of information — the property of leaving a certain kind of possibility open — that is not preserved under information aggregation. The simple but nonetheless crucial observation is that what worlds are minimal is a global feature of a state of information that is not guaranteed to be preserved under strengthening either. Trivially, if $w \in \sigma_d$ but $w \notin \sigma'$, then $w \notin \sigma'_d$ even if $\sigma' \subseteq \sigma$. Relatedly, since strengthening may eliminate all elements of σ_d it can happen that $w \notin \sigma_d$ yet $w \in \sigma'_d$ for some $\sigma' \subseteq \sigma$. And of course, this is not just a formal result but also makes good intuitive sense: a non-ideal way the world could be may very well emerge as the best one once its ideal alternatives have been ruled out, that is, once we assume that a certain obligation is violated. The obvious proposal is then to make the acceptance condition of deontic *ought* sensitive to what worlds are minimal in the state of information under consideration. In light of what was said before, persistence and thus monotonicity failures are just what we will expect.

We define the state change rules for \mathcal{L}^+ by extending our rules for \mathcal{L} with an update rule for deontic *ought* (subject to a refinement in §3.2.2):

Definition 10 (Extended Update Rules) Associate with each $\phi \in \mathcal{L}^+$ a state change rule $[\phi]: \Sigma \mapsto \Sigma$ by adding the following entry to the update rules for \mathcal{L} :

$$(6) \sigma[\Box_d \phi] = \{w \in \sigma: \sigma_d \models \phi\}$$

The proposal is that ' $\Box_d \phi$ ' is accepted in σ given d just in case its prejacent is accepted by the state of information got by focussing on the set of worlds that are deontically ideal in light of σ and d . Note that since $\phi \in \mathcal{L}_0$, $\sigma \models \Box_d \phi$ just in case $\sigma_d \subseteq \llbracket \phi \rrbracket$ — that is, just in case $\sigma_d \subseteq \sigma[\phi]$.

We are now in a position to verify that the semantics provides the advertised response to Chisholm's paradox. The first step is to show that factual as well as deontic detachment are valid:

Fact 3 $\phi \Rightarrow \Box_d \psi, \phi \models \Box_d \psi$

In light of the advocated conception of logical consequence as commitment preserving, we need to show that for all σ , $\sigma[\phi \Rightarrow \Box_d \psi][\phi] \models \Box_d \psi$. This holds trivially in case $\sigma[\phi \Rightarrow \Box_d \psi] = \emptyset$. If $\sigma[\phi \Rightarrow \Box_d \psi] = \sigma$, then $\sigma[\phi] \models \Box_d \psi$, which is all that is needed to prove the point.

It is just as straightforward to demonstrate that the framework developed here delivers the validity of deontic detachment. It will be helpful to establish the following point as a preparation:

Fact 4 If $\sigma_d \subseteq \tau$ and $\tau \subseteq \sigma$, then $\sigma_d = \tau_d$.

This follows immediately from the definition of a deontic context since SUCCESS requires that $\tau_d \subseteq \tau$ and so whenever $\tau \subseteq \sigma$, $\tau_d \subseteq \sigma$. And if $\sigma_d \subseteq \tau$ and $\tau_d \subseteq \sigma$, then $\sigma_d = \tau_d$ because of UNIFORMITY.

It is now easy to establish the validity of deontic detachment:

Fact 5 $\phi \Rightarrow \Box_d \psi, \Box_d \phi \models \Box_d \psi$

Consider any σ such that $\sigma[\phi \Rightarrow \Box_d \psi][\Box_d \phi] = \sigma$ (again, the proof is trivial otherwise). Since $\sigma \models \Box_d \phi$, $\sigma_d \subseteq \sigma[\phi]$. Since $\sigma[\phi] \subseteq \sigma$, it follows by Fact 4 that $\sigma_d = \sigma[\phi]_d$. But since $\sigma \models \phi \Rightarrow \Box_d \psi$, we know that $\sigma[\phi] \models \Box_d \psi$ and so that $\sigma[\phi]_d \subseteq \llbracket \psi \rrbracket$. Accordingly, $\sigma_d \subseteq \llbracket \psi \rrbracket$ and thus $\sigma \models \Box_d \psi$, as required.

All of this, and yet there is no paradox. A logic for *ifs* and *oughts* fails to be monotonic, and not by *fiat* but in virtue of the fact that information strengthening fails to preserve prior deontic commitments. To see this fact in action, assume that the deontic context relevant for Chisholm's paradox fixes the following ordering source:

$$o_d = \{\llbracket \text{GO} \rrbracket, \llbracket \text{GO} \supset \text{TELL} \rrbracket, \llbracket \neg \text{GO} \supset \neg \text{TELL} \rrbracket\}$$

It does not take much to verify that the consequence of (1) and (2) from Chisholm's paradox — that Jones ought to tell his neighbors he is coming — fails to be persistent:

Fact 6 Consider d as fixed for Chisholm's paradox: $\Box_d \text{TELL}$ fails to be persistent.

Consider the following distribution of truth-values across possible worlds:

	GO	TELL
w_1	T	T
w_2	T	F
w_3	F	T
w_4	F	F

If $\sigma = \{w_1, w_2, w_3, w_4\}$, then $\sigma_d = \{w_1\}$ and so $\sigma \models \Box_d \text{TELL}$. But consider $\sigma[-\text{GO}] = \{w_3, w_4\}$: then $\sigma[-\text{GO}] \subseteq \sigma$ but $\sigma[-\text{GO}]_d = \{w_4\}$ and so $\sigma[-\text{GO}] \not\models \Box_d \text{TELL}$ — in fact, $\sigma[-\text{GO}] \models \Box_d \neg \text{TELL}$, as required by factual detachment.

The observed persistence failures immediately translate into nonmonotonic effects given the proposed dynamic perspective on discourse and reasoning:

Fact 7 Consider d as fixed for Chisholm's paradox:

1. $\Box_d \text{GO}, \text{GO} \Rightarrow \Box_d \text{TELL} \models \Box_d \text{TELL}$
2. $\Box_d \text{GO}, \text{GO} \Rightarrow \Box_d \text{TELL}, \neg \text{GO} \Rightarrow \Box_d \neg \text{TELL}, \neg \text{GO} \not\models \Box_d \text{TELL}$

Ideally Jones tells his neighbors he is coming, for sure, just as deontic detachment predicts. But assume that Jones does not go: then in light of *that* information, Jones ought not tell his neighbors he is coming, just as factual detachment predicts. We do not have a paradox here since the very same bit of information that licenses factual detachment

defeats one's prior commitment to a conclusion licensed by deontic detachment.

A dynamic semantics for *ifs* and *oughts* dissolves the dogma that Chisholm's paradox enforces an unhappy choice between factual and deontic detachment. Factual and deontic detachment may be preserved if we drop the classical conception of logical consequence as monotonic by design. And this is not an empty formal result but a consequence of Ramsey's insights into the semantics of conditionals, articulated in a dynamic setting. As we will see momentarily, the proposal also has something useful to say in response to a few more puzzles about iff-y oughts. Before that, let me put some finishing touches on the framework so that it fulfills a few additional desiderata.

3.2.2 Refined Proposal

One often hears it that the premises of Chisholm's paradox (1)–(4) are not only consistent but also *independent* in the sense that none of them entails any other one (see, e.g., Loewer and Belzer [1983]). In the framework developed so far, (4) entails (2) and in general $\neg\phi \models \phi \Rightarrow \psi$ for arbitrary ϕ and ψ of \mathcal{L}^+ . This is a notoriously problematic inference rule that may be avoided by some tinkering with the logical consequence relation, but here I choose a more general approach that distinguishes between the validity of an inference rule and its actual ability to license an inference in context. The initial observation is that, unlike (11b), (11a) is marked:

- (11) a. # Mary is not in New York. If she is in New York, she will meet Alex.
- b. Mary is not in New York. If she were in New York, she would meet Alex.

The familiar explanation is that conditionals in the indicative mood presuppose that their antecedent is compatible with the input context (see Stalnaker [1975] for the basic idea and von Stechow [1998], Gillies [2009, 2010], and Starr [forthcoming], among others, for elaborations).

It is straightforward to capture this hypothesis by adding the following idea to the current framework:

Definition 11 (Presupposition) $\sigma[\phi \Rightarrow \psi]$ is defined iff $\sigma[\phi] \neq \emptyset$.

I follow Heim (1982) in her treatment of presupposition as an additional definedness condition on the update function. Accordingly, $\sigma[\neg\text{GO}][\text{GO} \Rightarrow \text{TELL}]$ is undefined because of presupposition failure. Notice, furthermore, that whenever updating with ' $\phi \Rightarrow \psi$ ' is undefined, so is updating with any complex formula containing it.

The possibility of presupposition failure motivates a refinement of the notion of logical consequence. Adopting a familiar idea from the literature (see Starr [forthcoming], and von Stechow [1999] and Beaver [2001] for related proposals) we say that validity remains guaranteed preservation of rational commitment, but in evaluating an argument for validity we ignore those states for which updating with the premises and then with the conclusion is undefined. The following definition makes this idea more precise and articulates a corresponding notion of consistency.

Definition 12 (Entailment and Consistency with Presupposition)

Take any $\phi_1, \dots, \phi_n, \psi \in \mathcal{L}^+$ and $\sigma \in \Sigma$:

1. $\phi_1, \dots, \phi_n \models \psi$ iff for all σ : if $\sigma[\phi_1] \dots [\phi_n][\psi]$ is defined, then $\sigma[\phi_1] \dots [\phi_n] \models \psi$
2. ϕ_1, \dots, ϕ_n is *consistent* iff for some $\sigma \in \Sigma$: $\sigma[\phi_1] \dots [\phi_n]$ is defined and non-absurd
3. ϕ_1, \dots, ϕ_n *presupposes* ψ iff for all σ : if $\sigma[\phi_1] \dots [\phi_n]$ is defined, then $\sigma \models \psi$

This proposal delivers the validity of the inference of (1) from (4) for the plain reason that $\sigma[\neg\phi][\phi \Rightarrow \psi]$ fails to be defined by design. But it is plausible to say that any inference in context — even if valid — requires that its presuppositions be met in that context, and clearly no non-absurd context can satisfy this condition when it comes to the

inference of ' $\phi \Rightarrow \psi$ ' from ' $\neg\phi$ '. That is just to say that even though $\neg\phi \models \phi \Rightarrow \psi$ holds, this inference rule is *guaranteed* to have no purchase in discourse and reasoning and I submit that it is this feature that gives the premise and its conclusion the air of independence.¹¹

The general idea behind my response to the issue of independence — that an inference may be valid but fail to be licensed in certain contexts — also connects with the role of deontic detachment in Chisholm's paradox. Deontic detachment, I have said, is valid but the inference of "Jones ought to tell his neighbors he is coming" from "Jones ought to go to the aid of his neighbors" and "If Jones goes to the aid of his neighbors, he ought to tell them he is coming" is defeated in Chisholm's scenario under the assumption that Jones does not go. The more specific suggestion now is that this assumption creates a context that *no longer* licenses the inference since the latter carries a presupposition in virtue of its conditional premise — the presupposition that Jones might actually go — that is outright violated by any $\sigma[\neg\text{GO}]$.¹² The validity of factual and deontic detachment lives happily with the consistency of Chisholm's scenario since the premise that triggers factual detachment creates a context in which the conflicting rule of deontic detachment has no purchase.

Another crucial concern starts with the observation that, according to the framework developed so far, the factual information in Chisholm's paradox — that Jones does not go — does not only defeat the inference that was initially licensed by deontic detachment,

11. To see why this is not the *only* possible response, simply observe that we could have defined a notion of logical consequence that just ignores cases in which updating with the *premises* of the argument is undefined for the input context. On this proposal, $\phi_1, \dots, \phi_n \models \psi$ iff for all σ : if $\sigma[\phi_1] \dots [\phi_n]$ is defined, then $\sigma[\phi_1] \dots [\phi_n] \models \psi$. The inference of ' $\phi \Rightarrow \psi$ ' from ' $\neg\phi$ ' then turns out to be invalid. While this approach requires a more radical rethinking of the logic for conditionals than the strategy I have proposed, it lives happily with everything else I am about to say in the remainder of this paper.

12. The fact that this presupposition is satisfied by contexts other than the absurd one marks the crucial difference between deontic detachment and the previously discussed rule that permits the move from ' $\neg\phi$ ' to ' $\phi \Rightarrow \psi$ ': unlike the latter, the former actually does license felicitous inferences in some contexts.

that Jones ought to tell his neighbors he is coming. It also predicts that this bit of information defeats the first premise of Chisholm's paradox, that Jones ought to go help his neighbors, and in fact it predicts that (1)–(4) entail that Jones ought not go. What underlies this unfortunate result is that the deontic modal is interpreted as a quantifier ranging over the possible worlds compatible with the information carried by the input state. While it is reasonable to think that utterances of deontic *ought* conversationally imply that the prejacent is a possibility in epistemic space (see Sinnott-Armstrong [1984]), a statement such as the following is fine:

(12) Mary is in New York, but she ought to be in Chicago instead.

All of this suggests that deontic *ought* may sometimes reach outside the input state — in other words, it allows for non-deliberative interpretations in the sense of Thomason (1981a) on which the facts taken for granted may be subject to evaluation — and so a refinement of the existing proposal is in order. The good news is that the required steps are fairly straightforward and well-motivated. Let me explain.

I rely here on the familiar hypothesis, going back to Frank's (1997) discussion, that deontic *ought* is to be evaluated with respect to a state that is "non-trivial" in the sense that it leaves room for the prejacent as well as its negation to be a possibility, the underlying intuition being that $\lceil \Box_d \phi \rceil$ recommends ϕ over $\lceil \neg \phi \rceil$ and thus should not be accepted or rejected in σ simply *because* the facts taken for granted already settle the question in one way or another.¹³ This condition

13. Cf. the discussions by Arregui (2010) and Condoravdi (2002), among others, who prefer the label "diversity." Another source of motivation for the upcoming proposal starts with the observation that deontic *ought* differs from its deontic cousins *must* and *have to* in that it patterns with modals in the counterfactual mood, the perhaps most striking observation being that in many languages, what English expresses by the use of deontic *ought* is expressed by combining a strong necessity modal (corresponding to English *must* and *have to*) with counterfactual morphology (see Palmer [2001] and von Stechow and Iatridou [2008]). Stalnaker (1975) suggests that counterfactual morphology is a conventional device used for indicating that presuppositions are being suspended — this is why (11b) is fine while (11a) is marked — and Starr (forth-

coming) offers a dynamic interpretation of counterfactual mood as expanding the input information carrier. All of this neatly connects with the observation that unlike (12), a sentence such as "Mary is in New York, but she must/has to be in Chicago instead" is marked (see, e.g., Ninan [2005], Palmer [2001], Portner [2009], Werner [2003] for related observations). The hypothesis would then be that deontic *must* and *have to* are restricted to possibilities in the input state while the additional counterfactual dimension carried by deontic *ought* in effect cancels this requirement by allowing the input context to expand. A complicating factor, however, is that at least for some speakers, combinations of $\lceil \neg \phi \rceil$ and $\lceil \text{MUST } \phi \rceil / \lceil \text{HAVE TO } \phi \rceil$ are sometimes acceptable. A comprehensive discussion of these issues is beyond the scope of this paper. I refer the reader to Silk (2014b) for a discussion of how such cases may be handled by a theory that grounds the difference between *ought* and *must/have to* in the presence or absence of counterfactual marking (though Silk's approach differs in detail from the strategy outlined here).

14. The underlying fact is that whenever we have two states σ and τ such that $\sigma_d = \tau_d$, then $\sigma_d \subseteq \tau$ and $\tau_d \subseteq \sigma$ because of SUCCESS, and so $\sigma_d = (\sigma \cup \tau)_d = \tau_d$ because of UNIFORMITY. It follows that for any two states that agree on the set of deontically ideal worlds, there is a unique superset treating exactly those worlds as deontically ideal.

or closeness between worlds. A set of possible worlds σ can then be associated with a system of spheres as well, where each S_n of σ is such that $S_n(\sigma) = \{\bigcup S_n(w) : w \in \sigma\}$ (notice that $S(\sigma)$ is thus centered on σ).¹⁵ Against this background, it is possible to define a downdating operation on carriers of information.

Definition 13 (Downdating) Consider arbitrary $\sigma \in \Sigma$, $\phi \in \mathcal{L}_0$, and deontic context d : $S(\sigma) \circ \phi = \{\sigma' \in S(\sigma) : \sigma' \not\models \phi\}$. $|\sigma| \in \Sigma$ is such that $|\sigma|_d = \sigma_d$ and for all $\tau \in \Sigma$: if $\tau_d = \sigma_d$, then $\tau \subseteq |\sigma|$. The result of *downdating* σ with ϕ , $\sigma \downarrow \phi$, is the minimal element of $S(|\sigma|) \circ \phi$ in case $S(|\sigma|) \circ \phi \neq \emptyset$, and σ otherwise.

Downdating σ with ϕ , observe, is *shifty* in the sense that it considers the information state carrying no more epistemic commitments than necessary to preserve what is deontically ideal in σ , that is, it operates on $|\sigma|$. The idea that downdating removes any commitment to ϕ from $|\sigma|$ is implemented formally by thinking of the operation as one that weakens $|\sigma|$ to its minimal revision that is no longer committed to ϕ . Note that downdating does not affect what is deontically ideal whenever $|\sigma|$ already fails to be committed to ϕ : in that case, the operation returns $|\sigma|$, whose set of deontically ideal worlds is identical to σ_d .

The modified proposal then is that deontic *ought* is a universal quantifier over the set of possible worlds that are minimal in light of a carrier of information that leaves room for the prejacent as well as its negation to be a possibility. Downdating on the state that

15. The set of sets of possible worlds around σ , intuitively, captures a fallback relation that determines how σ would need to be weakened in the course of giving up on an existing rational commitment. An alternative to the path pursued here would have contexts directly assign to each $\sigma \subseteq W$ a set of sets of possible worlds around σ (a “hyperproposition” in the sense of Fuhrmann [1999]; see also Grove [1988]). Notice, furthermore, that instead of assigning to each world w a system of spheres, we may assign to each w a set of propositions determining such a system of spheres (see Lewis [1981] for discussion and also Kratzer [1981, 1989] as well as Veltman [1976, 2005]) and determine the system of spheres around a set of possible worlds on that basis. The subtle differences between these approaches need not detain us here.

carries no more epistemic commitments than necessary to preserve the deontically relevant commitments of the input state σ guarantees that we consider an appropriate carrier of information whenever the prejacent is contingent. Precisely:

Definition 14 (Extended Update Rules, v.2) Associate with each $\phi \in \mathcal{L}^+$ a state change rule $[\phi] : \Sigma \mapsto \Sigma$ by adding the following entry to the update rules for \mathcal{L} :

$$(6) \sigma[\Box_d \phi] = \{w \in \sigma : (\sigma \downarrow \phi \downarrow \neg \phi)_d \models \phi\}$$

The downdating operation preserves what is deontically ideal whenever $|\sigma|$ is committed to neither ϕ nor its negation. In that case, even if σ resolves the question in one or way another, this is irrelevant to the issue whether ϕ or $\neg \phi$ is deontically ideal and so it is harmless to evaluate the prejacent in light of σ_d . And of course, it should be just as harmless to do so in case σ is already agnostic about ϕ , and this is just what we predict since whenever σ is agnostic about ϕ , so is $|\sigma|$.

It is straightforward to verify that the refined proposal preserves factual and deontic detachment. The argument for factual detachment proceeds as before: we now need to show that for all σ , it holds that $\sigma[\phi \Rightarrow \Box_d \psi][\phi] \models \Box_d \psi$ whenever $\sigma[\phi \Rightarrow \Box_d \psi][\phi]$ is defined. Again, this holds trivially in case $\sigma[\phi \Rightarrow \Box_d \psi] = \emptyset$. If $\sigma[\phi \Rightarrow \Box_d \psi] = \sigma$, then $\sigma[\phi] \models \Box_d \psi$, which is once again all that is needed to prove the point.

To see why deontic detachment remains valid, observe the following immediate consequence of the previous definitions:

Fact 8 For all σ and τ : if $\sigma_d = \tau_d$, then $|\sigma| = |\tau|$ and so $\sigma \downarrow \phi = \tau \downarrow \phi$ for all $\phi \in \mathcal{L}_0$.

This is just to say that whenever two states agree on what is deontically ideal, so do their downdated states. The proof of deontic detachment is then straightforward.

Consider any σ so that $\sigma[\phi \Rightarrow \Box_d \psi][\Box_d \phi][\Box_d \psi]$ is defined, and assume furthermore that $\sigma[\phi \Rightarrow \Box_d \psi][\Box_d \phi] = \sigma$ (again, the proof

is trivial otherwise). Since $\sigma \models \Box_d \phi$ and $\phi \in \mathcal{L}_0$, we know that $(\sigma \downarrow \phi \downarrow \neg \phi)_d \subseteq \llbracket \phi \rrbracket$. Since $\sigma[\phi \Rightarrow \Box_d \psi]$ is defined, $\sigma[\phi] \neq \emptyset$ and so $\sigma \not\models \neg \phi$. Accordingly, $|\sigma| \not\models \neg \phi$ and hence $\sigma \downarrow \phi \downarrow \neg \phi = \sigma \downarrow \phi$. We can now distinguish between two cases. Suppose that (i) $\sigma \downarrow \phi \neq |\sigma|$: then $|\sigma| \models \phi$, hence $\sigma \models \phi$ and so $\sigma[\phi] = \sigma$. But since $\sigma[\phi \Rightarrow \Box_d \psi] = \sigma$ by assumption, we know that $\sigma[\phi] \models \Box_d \psi$ and so $\sigma \models \Box_d \psi$, as required. Now suppose that (ii) $\sigma \downarrow \phi = |\sigma|$: then $|\sigma|_d \subseteq \llbracket \phi \rrbracket$ and so $\sigma_d \subseteq \llbracket \phi \rrbracket$ by definition. The proof of deontic detachment now basically proceeds as in §3.2.1. Since $\sigma_d \subseteq \llbracket \phi \rrbracket$, $\sigma_d \subseteq \sigma[\phi]$ and of course $\sigma[\phi] \subseteq \sigma$, hence by Fact 5 $\sigma_d = \sigma[\phi]_d$. It follows that $\sigma \downarrow \psi \downarrow \neg \psi = \sigma[\phi] \downarrow \psi \downarrow \neg \psi$ by Fact 8. Since $\sigma \models \phi \Rightarrow \Box_d \psi$ by assumption, we know that $\sigma[\phi] \models \Box_d \psi$ and so it follows that $(\sigma[\phi] \downarrow \psi \downarrow \neg \psi)_d \subseteq \llbracket \psi \rrbracket$. Accordingly, $(\sigma \downarrow \psi \downarrow \neg \psi)_d \subseteq \llbracket \psi \rrbracket$ and thus $\sigma \models \Box_d \psi$, as required.

In addition to preserving factual and deontic detachment, the refined proposal also avoids the unfortunate result that the premises of Chisholm's paradox entail that Jones ought not go. For consider again the distribution of truth-values across possible worlds from §3.2.1, let $\sigma = \{w_1, w_2, w_3, w_4\}$ and remember that $\sigma[\neg \text{GO}] = \{w_3, w_4\}$. Observe that $|\sigma[\neg \text{GO}]| = \sigma[\neg \text{GO}]$ since all supersets of $\sigma[\neg \text{GO}]$ differ on what counts as deontically ideal. Downdating on $\sigma[\neg \text{GO}]$ with the prejacent of $\Box_d \text{TELL}$ or $\Box_d \neg \text{TELL}$ does not affect what is deontically ideal — simply observe that $\sigma[\neg \text{GO}] \not\models \text{TELL}$ and $\sigma[\neg \text{GO}] \not\models \neg \text{TELL}$ — and so $\sigma[\neg \text{GO}] \models \Box_d \neg \text{TELL}$, as predicted by factual detachment. But downdating with the prejacent of $\Box_d \text{GO}$ or $\Box_d \neg \text{GO}$ *does* re-introduce some possible worlds at which Jones goes to the help of his neighbors since $\sigma[\neg \text{GO}] \models \neg \text{GO}$. In particular, observe that on the standard conception of similarity between worlds, $\sigma[\neg \text{GO}] \downarrow \text{GO} = \sigma$ and thus $(\sigma[\neg \text{GO}] \downarrow \text{GO} \downarrow \neg \text{GO})_d = \{w_1\}$. Given minimal assumptions about the fallback relation that figures in downdating, we can thus predict that — assuming that Jones does not go — he ought not tell his neighbors that he is coming, but he (still) ought to go.

The last result may not strike the reader as fully convincing since it is — at least on first sight — strange to conclude from Chisholm's paradox that Jones ought to go help his neighbors but ought not tell

his neighbors that he is coming (see Prakken and Sergot [1996]). In response, it is a familiar observation that modals are sometimes interpreted in light of a salient set of possible worlds other than those compatible with the input state. Consider the following case:

- (13) (a) Mary did not buy a book. (b) If she had bought one, she would have finished it by now. (c) It would have been a crime novel.

The anaphoric element *it* in (13c) requires that the sentence is evaluated against a context in which Mary bought a book, but because of (13a) this cannot be the set of possible worlds compatible with what is taken for granted. This is the phenomenon of *modal subordination* (see Roberts [1987, 1989]), and it is natural to say that it may also be in play when it comes to the interpretation of deontic modals. The specific suggestion is that evaluating “Jones ought to go help his neighbors” in $\sigma[\neg \text{GO}]$ raises to salience a region of logical space outside of $\sigma[\neg \text{GO}]$ — one that leaves room for the possibility that Jones might go — and of course if *that* possibility is open, Jones also ought to tell his neighbors that he is coming. The observation that an utterance of “Jones ought not tell his neighbors that he is coming” sounds marked after uttering “Jones ought to go help his neighbors” is then not surprising since the former is naturally interpreted in light of the possibilities brought into view by the latter.

Filling in the details of the story sketched in the previous paragraph would require a complex model of information structure and how it develops in discourse and reasoning.¹⁶ But here we only need to say that downdating has the potential to create temporary contexts in which

16. While the assumptions may be integrated in a complex dynamic framework that takes the structure of information and discourse into account — more complex than the story I have told here — it arguably has a pragmatic flavor and so it is fair to ask what pragmatic mechanisms a classical, monotonic semantic perspective on *ifs* and *oughts* could exploit to tell a satisfying story about Chisholm's paradox. I address this question in §5.

subsequent discourse is interpreted by default (see Starr [forthcoming], who elaborates on a proposal by Kaufmann [2000]). This is why an utterance of “Jones ought to tell his neighbors that he is coming,” rather than of its alternative “Jones ought not tell his neighbors that he is coming,” is the natural continuation of an occurrence of “Jones ought to go help his neighbors” in discourse even if it is settled that Jones does not go. The suggestion that we are dealing with a *default* is supported by the fact that a sentence like the following is perfectly fine:

- (14) Jones ought to go help his neighbors, but since he won’t go, he ought not tell them he is coming.

Here, it is indicated that that the second deontic modal is to be interpreted in light of the original (rather than the downdated) carrier of information, and indeed (14) strikes the ear as exactly the right thing to say in light of the information provided by the premises of Chisholm’s paradox. The fact that the assumptions required to deliver this result derive from well-established principles about the dynamics of reasoning and conversation should give us confidence that the dynamic proposal developed here is on the right track.

3.3 Summary and Outlook

Let me briefly summarize the framework developed so far and outline how to address a few additional issues of interest. The trouble with Chisholm’s case, remember, is that (1)–(4) appear consistent yet (1) and (2) entail (5) by deontic detachment while (3) and (4) entail (6) by factual detachment (repeated):

- (1) Jones ought to go to the aid of his neighbors.
- (2) If Jones goes to the aid of his neighbors, then he ought to tell them he is coming.
- (3) If Jones does not go to the aid of his neighbors, then he ought not tell them he is coming.
- (4) Jones does not go to the aid of his neighbors.

- (5) Jones ought to tell his neighbors that he is coming.
- (6) Jones ought not tell his neighbors that he is coming.

The basic nonmonotonic proposal predicts that (1)–(4) are consistent because (1) and (2) entail (5) by deontic detachment, but no longer do so if strengthened with the information carried by (3) and (4). Even though (3) and (4) entail (6) by factual detachment, no contradiction arises.

Adding a nontriviality constraint to the acceptance conditions for deontic *ought* guarantees that a commitment to (1) is preserved by an update with (4). The inference licensed by deontic detachment is defeated because the information carried by (4) defeats the commitment to the conditional obligation articulated by (2). Deontic detachment is valid but has no purchase under the assumption that Jones does not go. This follows immediately from the presuppositional analysis of the Ramsey conditional and a corresponding refinement of the notion of logical consequence.¹⁷

Let me briefly say a bit more about two issues that arise in connection with the framework developed so far. The extension of classical update semantics for epistemic *might* with a semantics for deontic *ought* raises the question how these two operators interact. The non-triviality constraint that comes with deontic *ought* raises the

17. One consequence of the framework is that the consistency of Chisholm’s premises is order sensitive: while (1)–(4) are perfectly fine in that order, any sequence in which (4) precedes (2) is undefined and thus inconsistent. This strikes me as an acceptable result given the data presented in (11), but it is not essential to the framework developed here. Specifically, and taking some inspiration from van der Torre and Tan (1998), we may define dynamic notions of entailment and consistency that consider the admissible *permutations* of a given sequence of premises, where a permutation is admissible just in case it preserves the order of premises for which updating is defined for some carrier of information. An argument is valid just in case its conclusion is a dynamic consequence of every such admissible permutation for which updating is defined; a sequence is consistent just in case one of its permutations is dynamically consistent. This proposal would preserve everything that has been said about Chisholm’s paradox but — in addition — predict that its premises are consistent regardless of order.

question what the framework has to say about the problem cases for a possible worlds analysis of deontic modality discussed by Zvolenszky (2002, 2006). I will address these issues in turn.

3.3.1 Deontic Ought and Epistemic Might

As it stands, the framework developed so far has not much of interest to say about the result of embedding deontic modals under epistemic modals. In English, deontic *ought* does not easily embed under epistemic *might* and *must*, but *have to* is less resistant and the following are not equivalent:

- (15) a. Jones might have to go to the aid of his neighbors.
 b. Jones must have to go to the aid of his neighbors.

The problem is that combining a test semantics for epistemic modals with a test semantics for deontic modals collapses epistemic possibility and necessity: for all σ and $\phi \in \mathcal{L}_0$, $\sigma[\diamond_e \Box_d \phi] = \sigma[\Box_e \Box_d \phi]$, the underlying observation being that $\sigma[\Box_d \phi] \neq \emptyset$ just in case $\sigma[\Box_d \phi] = \sigma$.

This is not the place to offer a comprehensive discussion of the interaction between epistemic and deontic modals, not least because doing so would require a more complex story about epistemic *might* and *must* (see Willer [2013] for such a story). Here, let me just outline why collapsing epistemic possibility and necessity is a superficial feature of the framework that may be overcome by a slightly more complex analysis. So far I have assumed that a deontic context fixes unambiguously what is deontically ideal by providing a unique ordering source, but we may lift this assumption and leave room for *ambiguous* deontic contexts, the basic idea being that it may not always be settled in discourse and reasoning what is deontically ideal. So instead of working with a single deontic context d , we can work with a (non-empty) *set* of deontic contexts $D = \{d_1, \dots, d_n\}$, where each element of D corresponds to a possible sharpening of an ambiguous context. To show why this matters for the issue that interests us here, we now explicitly assign to each element of \mathcal{L}^+ a CCP relative to a set of deontic contexts D and

decide that a sentence of the form ' $\Box_d \phi$ ' is accepted in light of D just in case ϕ is deontically ideal in light of each of its disambiguations. Epistemic *might*, remember, was originally understood as testing whether its prejacent is compatible with the input context, and so it now makes sense to say that it tests whether the prejacent it is compatible with the information carried by σ given *some* possible disambiguation of D .

For our purposes, it is not necessary to go through all the (straightforward) modifications of what has been said earlier. It is good enough to highlight the revised semantic entries for our modal and conditional formulas of \mathcal{L}^+ (as before, I treat epistemic *might* and *must* as duals):

- (4') $\sigma[\diamond_e \phi]_D = \{w \in \sigma : \exists d \in D. \sigma[\phi]_{\{d\}} \neq \emptyset\}$
 (5') $\sigma[\phi \Rightarrow \psi]_D = \{w \in \sigma : \sigma[\phi]_D[\psi]_D = \sigma[\psi]_D\}$
 (6') $\sigma[\Box_d \phi]_D = \{w \in \sigma : \forall d \in D. (\sigma \downarrow \phi \downarrow \neg \phi)_d \models \phi\}$

It follows immediately that (15a) and (15b) are not equivalent assuming the classical treatment of *might* and *must* as duals. For consider some non-absurd σ and let $D = \{d_1, d_2\}$ be such that $o_{d_1} = \{\llbracket \text{GO} \rrbracket\}$ and $o_{d_2} = \{\llbracket \neg \text{GO} \rrbracket\}$ — that is, assume that the deontic context is ambiguous between Jones having to go and Jones having not to go. Then clearly there is some $d \in D$ — the one that comes with $\{\llbracket \text{GO} \rrbracket\}$ as its ordering source — such that $(\sigma \downarrow \text{GO} \downarrow \neg \text{GO})_d \models \text{GO}$, and so $\sigma \models \diamond_e \Box_d \text{GO}$. But since $d_2 \in D$ and $(\sigma \downarrow \text{GO} \downarrow \neg \text{GO})_{d_2} \not\models \text{GO}$, it follows that $\sigma \not\models \Box_e \Box_d \text{GO}$, as desired. Notice, furthermore, that we preserve the familiar entailment relation between epistemic *must* and epistemic *might* as well as the dynamic entailment relations between epistemic *must* and its prejacent, which is just to say that all we have here is fairly conservative modification of the previous framework.

3.3.2 Zvolenszky on Deontic Ought

With some additional twists, leaving room for ambiguous deontic contexts also allows us to say something useful in response to Zvolenszky's worry about any possible worlds analysis of deontic modals. The point of the nontriviality constraint and the resulting appeal to a

downdating operation, remember, was to avoid the problematic prediction that ϕ entails $\Box_d \phi$ and, accordingly, that any conditional of the form $\phi \Rightarrow \Box_d \phi$ turns out to be a plain tautology (for arbitrary $\phi \in \mathcal{L}_0$). Zvolenszky worries that a downdating approach faces a “flipside problem,” namely the inability to predict the acceptability of conditionals such as:

(16) If the Dalai Lama is angry, he ought to be angry.

The intuition here is that (16) is acceptable under the background assumption that the Dalai Lama, given his mild manners, does not get angry unless he has a reason for doing so. In fact, (16) may be interpreted as communicating (17):

(17) If the Dalai Lama is angry, he has a reason to be angry.

While the story told so far does not make this subtle prediction, some plausible additional modifications will do the trick.¹⁸ Let me explain.

Zvolenszky’s examples — it is reasonable to say — highlight the possibility that factual information sometimes removes insecurity about what is deontically ideal. To leave room for this, we may ground the ambiguity of deontic contexts in epistemic uncertainty by associating, with each possible world compatible with what is taken for granted, a possible deontic context and then define the contextually relevant D on that basis. Precisely, we let δ be a function associating with each $w \in W$ a deontic context d and now say that $\delta(\sigma) = \{\delta(w) : w \in \sigma\}$.¹⁹ To keep the notation tidy, we then define an update function $+$ relative

18. Geurts (2004) and Carr (forthcoming) offer alternative reactions (see also Kratzer [2012, ch. 4]). Discussing the virtues and vices of these proposals — or of the moral that Zvolenszky prefers to draw from the flipside problem — is a valuable exercise but not one that can be efficiently executed here.

19. In accordance with the previous discussion, δ is required to obey certain minimal constraints that jointly enforce, among other desiderata, the validity of deontic detachment. Specifically, say that $\sigma_\delta = \{w \in \sigma_d : \exists d \in \delta(\sigma)\}$. We then require that given arbitrary carriers of information σ and τ , σ_δ and τ_δ obey the principles of SUCCESS, CONSISTENCY, and UNIFORMITY familiar from §3.2. Notice that σ_δ is guaranteed to be consistent as long as σ is consistent.

to some δ on top of the update function that was introduced in the previous discussion. Since the required modifications are once again straightforward, let me just highlight one more time the revised semantic entries for our modal and conditional formulas of \mathcal{L}^+ :

$$\begin{aligned} (4'') \quad \sigma +_\delta \Diamond_e \phi &= \{w \in \sigma : \exists d \in \delta(\sigma). \sigma[\phi]_{\{d\}} \neq \emptyset\} \\ (5'') \quad \sigma +_\delta \phi \Rightarrow \psi &= \{w \in \sigma : \sigma +_\delta \phi +_\delta \psi = \sigma +_\delta \phi\} \\ (6'') \quad \sigma +_\delta \Box_d \phi &= \{w \in \sigma : \forall d \in \delta(\sigma). (\sigma \downarrow \phi \downarrow \neg\phi)_d \models \phi\} \end{aligned}$$

The crucial observation here is that conditional antecedents may restrict the set of possible worlds in light of which the consequent is evaluated. Since deontic contexts are now sensitive to the possibilities that are open in discourse, it follows that the evaluation procedure for conditionals leaves room for dynamic developments of such contexts.

To see this proposal in action, consider the following distribution of truth-values across possible worlds that also keeps track of the ordering source associated with each world:

	ANGRY	REASON	$o_{\delta(w)}$
w_1	T	T	$\{\llbracket \text{ANGRY} \rrbracket\}$
w_2	T	F	$\{\llbracket \neg \text{ANGRY} \rrbracket\}$
w_3	F	T	$\{\llbracket \text{ANGRY} \rrbracket\}$
w_4	F	F	$\{\llbracket \neg \text{ANGRY} \rrbracket\}$

Here, the intuition is that there is a requirement for the Dalai Lama to be angry just in case he has a reason to be angry. Take it as a background assumption that the Dalai Lama does not get angry unless he has a reason for doing so — that is, let $\sigma = \{w_1, w_3, w_4\}$. Then $\sigma +_\delta \text{ANGRY} = \{w_1\}$ and of course for all $d \in \delta(\{w_1\})$, $o_d = \{\llbracket \text{ANGRY} \rrbracket\}$ and so for all $d \in \delta(\{w_1\})$, $(\{w_1\} \downarrow \text{ANGRY} \downarrow \neg \text{ANGRY})_d \models \text{ANGRY}$. It follows immediately that $\sigma \models \text{ANGRY} \Rightarrow \Box_d \text{ANGRY}$, as desired.²⁰

20. An important observation here is that the downdating operation only affects the set of possible worlds to be ranked but not the ordering sources to be taken into consideration when doing so: in evaluating $\sigma +_\delta \Box_d \phi$, we ask how

Observe, furthermore, that without the background assumption that the Dalai Lama does not get angry unless he has a reason for doing so, (16) fails to be accepted. Specifically, if $\sigma = \{w_1, w_2, w_3, w_4\}$, then $\sigma +_\delta \text{ANGRY} = \{w_1, w_2\}$. It follows that for some $d \in \delta(\{w_1, w_2\})$, $o_d = \{\llbracket \neg \text{ANGRY} \rrbracket\}$ and, accordingly, that for some $d \in \delta(\{w_1, w_2\})$, $(\{w_1, w_2\} \downarrow \text{ANGRY} \downarrow \neg \text{ANGRY})_d \neq \text{ANGRY}$. Clearly, then, $\sigma \not\models \text{ANGRY} \Rightarrow \Box_d \text{ANGRY}$. (16) and (17) thus entail each other in the following sense:

Fact 9 Consider δ as fixed for Zvolenzsky's scenario:

1. $\text{ANGRY} \Rightarrow \text{REASON} \models \text{ANGRY} \Rightarrow \Box_d \text{ANGRY}$
2. $\text{ANGRY} \Rightarrow \Box_d \text{ANGRY} \models \text{ANGRY} \Rightarrow \text{REASON}$

Zvolenzsky holds that any possible worlds analysis of deontic *ought* faces a dilemma. On the one hand, it needs to find some way to block the problematic inference of ' $\Box_d \phi$ ' from ϕ since, for instance, the fact that Mary is in Chicago is not sufficient for it being the case that Mary ought to be in Chicago. At the same time, responding to the problem by adopting a nontriviality constraint threatens to undercut our ability to accommodate the acceptability of conditionals such as (16): given suitable background assumptions, the fact that the Dalai Lama is angry does suffice for it being the case that the Dalai Lama ought to be angry. All of this sounds right but the framework developed here can make perfect sense of why this is so: deontic ideals, so the story goes, need not always be settled in deontic discourse and in fact this kind of deontic uncertainty may very well be grounded in epistemic uncertainty. Whenever this is so we leave room for an update with ϕ to have nontrivial effects for the acceptability of ' $\Box_d \phi$ ' even if we sign up for

the worlds in $\sigma \downarrow \phi \downarrow \neg \phi$ compare in light of the ordering sources in $\delta(\sigma)$ — as opposed to those in $\delta(\sigma \downarrow \phi \downarrow \neg \phi)$. So when we consider $\{w_1\} +_\delta \Box_d \text{ANGRY}$, we rank worlds in $\{w_1\} \downarrow \text{ANGRY} \downarrow \neg \text{ANGRY}$ in light of $o_d = \{\llbracket \text{ANGRY} \rrbracket\}$ since $\delta(\{w_1\}) = \{\llbracket \text{ANGRY} \rrbracket\}$. Accordingly, even though the downdating operation introduces some worlds at which the Dalai Lama is not angry, such worlds are guaranteed to be ranked below worlds at which the Dalai Lama is angry.

a nontriviality constraint. While there is plenty of room for exploring these ideas in more detail, what I have said here should give us good reason to believe that a possible worlds semantics of modality — or at least of deontic modality — is possible after all.

4. Bonus

The dynamic framework developed so far offers a solution to Chisholm's paradox that avoids an unhappy choice between factual and deontic detachment and can be easily embellished so that it delivers a few additional desiderata. It also has useful things to say about some other puzzles involving *iffy oughts*: Forrester's gentle murder paradox (§4.1) and Kolodny and MacFarlane's miners paradox (§4.2). To streamline the upcoming discussion, I will set the modifications of the framework that arise from the possibility of ambiguous deontic contexts aside for the remainder of this paper.

4.1 Forrester's Paradox

Forrester (1984) observes that (9) and (10) are jointly consistent (repeated):

- (9) Jones ought not murder Smith.
- (10) If Jones murders Smith, he ought to murder Smith gently.

Intuitively, (9) and (10) are not only jointly consistent but also compatible with the possibility that Jones in fact murders Smith. But suppose that

- (18) Jones murders Smith.

Given factual detachment, (10) and (18) entail:

- (19) Jones ought to murder Smith gently.

But the INHERITANCE principle that *ought* is closed under logical entailment licenses the derivation of (20) from (19):

- (20) Jones ought to murder Smith,

since even the gentlest of murders must count as a murder. And (20) once again contradicts (9) given the D-axiom of deontic logic — where did we go wrong?

Like Forrester, I suggest that INHERITANCE is mistaken and so (19) does not entail (20).²¹ This is a very intuitive response since ordinary speakers have no inclination whatsoever to actually draw the inference leading to all the trouble, but the case is a bit more complex. As I have already said earlier, (9) intuitively forbids Jones to murder Smith *gently* or *otherwise*, and so it is more than tempting to think that (9) entails:

(21) Jones ought not murder Smith gently,

which no less stands in conflict with (19) than (20) clashes with (9).

To see how the framework handles Forrester's case, choose the deontic context for the scenario in the obvious way:

$$o_d = \{[\neg\text{MURDER}], [\text{MURDER} \supset \text{GENTLY}]\}$$

The basic observation is that INHERITANCE holds whenever ϕ and ψ are open questions in the input state. The following captures the fact succinctly:

Fact 10 Consider arbitrary ϕ and $\psi \in \mathcal{L}_0$: if $\phi \models \psi$, then $\Box_d\phi, \Diamond_e\phi, \Diamond_e\neg\psi \models \Box_d\psi$.²²

As a consequence, a prohibition to murder entails a prohibition to murder gently whenever certain global epistemic conditions are satisfied, and in particular (9) licenses (21) in any out-of-the-blue context. The inference is predicted to be defeated, however, by the supposition that Jones murders Smith. This seems to be the right result since it is natural

21. Castañeda (1985, 1986) and Sinnott-Armstrong (1985) point to ambiguities in the logical structure of (19) to block the inference of (20) while retaining INHERITANCE. Goble (1991) argues, convincingly I think, that their strategy does not generalize to cover variants of the gentle murder paradox, and endorses Forrester's solution.

22. Observe that since $\phi \models \psi$, $\Diamond_e\phi \models \Diamond_e\psi$ and $\Diamond_e\neg\psi \models \Diamond_e\neg\phi$.

to draw the following conclusion from the information in Forrester's scenario:

(22) Jones ought not murder Smith, but since he will do it anyway, he (at least) ought do it gently.

On the other hand, we are only willing to accept that Jones ought to murder Smith gently in a context in which Jones' not murdering Smith fails to be an epistemic possibility. But this is just a case in which INHERITANCE is not predicted to hold in the first place, and thus we expect that the inference of (20) from (19) lacks any intuitive appeal. The following summarizes the most important predictions of the framework:

Fact 11 Consider d as fixed for Forrester's paradox and the definition of dynamic logical consequence (with or without presupposition):

1. $\Box_d\neg\text{MURDER}, \Diamond_e\neg\text{MURDER} \models \Box_d\neg\text{GENTLY}$
2. $\Box_d\text{GENTLY}, \Diamond_e\text{GENTLY} \not\models \Box_d\text{MURDER}$
3. $\Box_d\neg\text{MURDER}, \text{MURDER} \Rightarrow \Box_d\text{GENTLY}, \text{MURDER} \models \Box_d\neg\text{MURDER}$
4. $\Box_d\neg\text{MURDER}, \text{MURDER} \Rightarrow \Box_d\text{GENTLY}, \text{MURDER} \models \Box_d\text{GENTLY}$

The contribution made by the framework developed here is thus twofold. First, it accounts for the observation that an inference of (21) from (9) has some appeal, while there is hardly any tendency to infer (20) from (19): the former inference holds in out-of-the-blue contexts, while the latter fails to hold in any context given intuitive constraints on the ordering source for Forrester's scenario. Second, it predicts that factual detachment is compatible with the derivability of (21) from (9) in out-of-the-blue contexts: the derivation is defeated by the very same piece of information that triggers factual detachment.²³

23. Cariani (2013) argues that INHERITANCE failures are more radical than predicted by my favorite story about deontic *ought*. I leave it to another day to discuss how the framework developed here may tackle the issues that Cariani raises.

4.2 *The Miners Paradox*

Kolodny and MacFarlane (2010) consider the following scenario.²⁴ Ten miners are trapped either in shaft *A* or in shaft *B*, but we do not know which one. Water threatens to flood the shafts. We only have enough sandbags to block one shaft but not both. If one shaft is blocked, all of the water will go into the other shaft, killing every miner inside. If we block neither shaft, both will be partially flooded, killing one miner.

Action	if miners in <i>A</i>	if miners in <i>B</i>
Block <i>A</i>	All saved	All drowned
Block <i>B</i>	All drowned	All saved
Block neither shaft	One drowned	One drowned

Lacking any information about the miners' exact whereabouts, it seems right to say that

- (23) We ought to block neither shaft.

However, we also accept that

- (24) If the miners are in shaft *A*, we ought to block shaft *A*.
 (25) If the miners are in shaft *B*, we ought to block shaft *B*.

But we also know that

- (26) Either the miners are in shaft *A* or they are in shaft *B*.

And (24)–(26) seem to entail (27), which contradicts (23):

- (27) Either we ought to block shaft *A* or we ought to block shaft *B*.

This paradox has received a lot of attention in the recent literature. Here, I am interested in the question whether the miners paradox

24. See also the discussion by Parfit (1988, 2011), who credits Reagan (1980). A similar puzzle involving “better” instead of “ought” is discussed by Dreier (2009).

undermines my previous claim that a coherent semantics for *ifs* and *oughts* may preserve factual and deontic detachment.²⁵

Some authors have suggested that the deontic modals are interpreted in light of different ordering sources in (23) and (24)/(25), respectively (see Dowell [2012] and von Fintel [2012]). If this suggestion is correct, there is no need to embellish the story told so far to handle the miners paradox. But if it is incorrect — see, for instance, the detailed criticism by Silk (2014a) — the case becomes more complex. The arguments to the conclusion that a single contextually provided ordering source understood as a set of propositions is not flexible enough to predict the consistency of (23)–(25) are familiar and need not be repeated here. Simply observe that a single deontic context will not do the trick whenever it is stable in the following sense (the label “stability” goes back to Charlow [2013]):

Definition 15 (Stability) A deontic context d is *stable* iff for all σ , τ , and w : if $\tau \subseteq \sigma$, $w \in \sigma_d$, and $w \in \tau$, then $w \in \tau_d$.

Stability makes the consistency of (23) and (24) a bit of a puzzler: worlds at which we block neither shaft are predicted to remain deontically ideal even under the assumption that the miners are in shaft *A* (and likewise for the consistency of [23] and [25]). It follows that a single deontic context does not leave room for our intuitions about the miners case to be correct whenever it is classical:

Fact 12 If a deontic context d is classical, then d is stable.

To see this, suppose that d is classical and assume for reductio that $\tau \subseteq \sigma$, $w \in \sigma_d$, $w \in \tau$, but $w \notin \tau_d$. Since $w \in \tau$, $\tau_d \neq \emptyset$ due to CONSISTENCY

25. Kolodny and MacFarlane argue that an adequate response to the puzzle must reject modus ponens and thus factual detachment. In Willer (2012), I show how a solution to the miners paradox may preserve modus ponens, though the story told there remains silent on deontic detachment and differs in its details from what I am about to say here.

and so there must be some $w' \in \tau$ so that $w' <_d w$. But since $\tau \subseteq \sigma$, $w' \in \sigma$ as well. Since $w' <_d w$, $w \notin \sigma_d$ — contradiction.

All of this shows that a deontic context may not always be best understood as determining what is deontically ideal by providing an ordering source understood as a set of propositions. Notice, however, that stability failures are compatible with the joint satisfaction of SUCCESS, CENTERING, and UNIFORMITY (repeated) and thus with the general definition of a deontic context.

SUCCESS: $\sigma_d \subseteq \sigma$

CONSISTENCY: If $\sigma \neq \emptyset$, then $\sigma_d \neq \emptyset$.

UNIFORMITY: If $\sigma_d \subseteq \tau$ and $\tau_d \subseteq \sigma$, then $\sigma_d = (\sigma \cup \tau)_d = \tau_d$.

In particular, observe that Fact 5 — whenever $\sigma_d \subseteq \tau$ and $\tau \subseteq \sigma$, then $\tau_d = \sigma_d$ — does not commit the existing framework to the claim that every deontic context is stable.²⁶

The proposal made here can thus live happily with the facts about the miners paradox. The question is not so much whether factual and deontic detachment can be preserved but how deontic contexts fix what is deontically ideal. One reaction to the limitations of the classical perspective on deontic contexts — not the only one but certainly congenial to the story told so far — is to make such contexts information-sensitive in the sense that they rank worlds depending on the information carried by a given state. Given our information about the miners whereabouts, worlds at which we block neither shaft are ranked best. But add to this the information that the miners are in shaft *A*: given *that* information, worlds at which we block shaft *A* are ranked best. An easy way to implement this idea is to allow for a deontic context to fix what is deontically ideal by providing a set of

CCPs rather than a set of propositions.

Definition 16 (Dynamic Deontic Contexts) A deontic context d is *dynamic* iff d fixes an ordering source $o \subseteq \Sigma^\Sigma$ — that is, a set of CCPs. o_d is the ordering source provided by d . Given some $\sigma \in \Sigma$, $w <_d^\sigma w'$ iff $w, w' \in \sigma$ and (i) for all $[\phi] \in o_d$: if $w' \in \sigma[\phi]$, then $w \in \sigma[\phi]$ and (ii) for some $[\phi] \in o_d$: $w \in \sigma[\phi]$ and $w' \notin \sigma[\phi]$. w is *minimal* in σ given d iff $\neg \exists w': w' <_d^\sigma w$. σ_d is then just the set of possible worlds that are minimal in σ given d . An obligation is *violated* in σ given d iff for some $[\phi] \in o_d$: $\sigma[\phi] = \emptyset$.²⁷

Whenever a dynamic deontic context articulates its ordering sources using only elements of \mathcal{L}_0 , there is no interesting innovation over the classical perspective.²⁸ But we may now formulate ordering sources according to which a certain way the world could be is deontically ideal just in case a certain global epistemic condition is satisfied.

To see this new possibility in action, fix the ordering source for the miners scenario as follows:

$$o_d = \{[\text{BLA} \equiv \square_e \text{INA}], [\text{BLB} \equiv \square_e \text{INB}], [\neg(\text{BLA} \vee \text{BLB}) \equiv (\diamond_e \text{INA} \wedge \diamond_e \text{INB})]\}$$

Let σ be the information we have about the miners whereabouts. Then $\sigma \models \diamond_e \text{INA} \wedge \diamond_e \text{INB}$ and accordingly $\sigma \models \neg \square_e \text{INA}$ and $\sigma \models \neg \square_e \text{INB}$. It

27. Once again, the CONSISTENCY constraint leads to some version of the LIMIT ASSUMPTION: for any $\sigma \in \Sigma$, the ordering $<_d^\sigma$ induced by a dynamic deontic context d must be well-founded. While any such context is guaranteed to satisfy SUCCESS, UNIFORMITY does not immediately follow but amounts to a separate restriction on what counts as an admissible ordering source (unlike in the classical case). Dynamic contexts of the kind we postulate for the miners paradox — those that recommend different actions depending on a set of mutually exclusive set of epistemic conditions that may be articulated using (conjunctions of) epistemically modalized formulas — live happily with the UNIFORMITY constraint.

28. The underlying fact here is that updating with any $\phi \in \mathcal{L}_0$ is not only eliminative but also *distributive*: for all σ , $\sigma[\phi] = \bigcup_{w \in \sigma} \{w\}[\phi]$. As a consequence, an update with ϕ is mediated by the proposition expressed by ϕ (see van Benthem [1986]) and adopting a dynamic perspective on ordering sources does not go beyond the classical setup.

26. Another way of putting the point: the framework developed so far requires that the comparison between regions of logical space remains fixed in discourse due to UNIFORMITY but not — as STABILITY requests — that the comparison between elements of those spaces (possible worlds) remains thus fixed.

follows that the minimal worlds in σ are those at which we block neither shaft. But consider $\sigma' = \sigma[\text{INA}]$: then $\sigma' \models \Box_e \text{INA}$ and accordingly, the minimal worlds in σ' are those at which we block shaft A . For parallel reasons, the minimal worlds in the result of strengthening σ with the information that the miners are in shaft B are those at which we block shaft B . We can summarize the output of the proposal as follows:

Fact 13 Consider d as fixed for the miners paradox and let σ be the information we have about the miners' whereabouts:

1. $\sigma \models \Box_d \neg(\text{BLA} \vee \text{BLB})$
2. $\sigma \models \text{INA} \Rightarrow \Box_d \text{BLA}$
3. $\sigma \models \text{INB} \Rightarrow \Box_d \text{BLB}$
4. $\sigma \models \text{INA} \vee \text{INB}$

The framework thus accounts for our intuitions about the miners scenario in light of a single deontic context. Moreover, it does so while avoiding the problematic inference of (27) from (24)–(26). The underlying fact is that proof by cases is invalid given the dynamic conception of logical consequence (with or without presupposition):

Fact 14 $\phi \vee \psi, \phi \Rightarrow \chi, \psi \Rightarrow \chi \not\models \chi$

Notice that failure of proof by cases is not a peculiarity of the semantic proposal for iffy oughts but is already attested by a dynamic semantic interpretation of a language containing conditionals and epistemic modals.

For current purposes, there is no need to discuss how the proposal made here compares to alternative treatments of the miners paradox within a single deontic context.²⁹ The goal of this exercise was to

29. See the discussions by Cariani et al. (2013), Carr (2013), Charlow (2013), Gabbay (2014), and Katz et al. (2013). Carr observes that our intuitions about the miners scenario are sensitive to probabilistic considerations. It is possible to extend the proposal so that dynamic ordering sources can be stated using probability operators using, e.g., Yalcin's (2012) work as a source of inspiration.

demonstrate that the data about the miners paradox are compatible with the validity of factual and deontic detachment. Even if one sets aside the possibility of appealing to different deontic contexts in interpreting the data, one may find deontic contexts that account for our intuitions about the miners scenario. Such a context cannot be classical, but it may very well be dynamic and articulate obligations whose force depends on the satisfaction of global epistemic conditions by the input carrier of information.

5. Dynamics?

The goal of this paper has been to look for a semantic analysis of iffy oughts that preserves factual and deontic detachment while avoiding Chisholm's paradox. As we have seen, the resulting proposal is general enough so that it also addresses Forrester's gentle murder paradox as well as Kolodny and MacFarlane's miners paradox. I have nothing to add to my earlier contention that dodging the choice between factual and deontic detachment is of theoretical significance, and that a non-monotonic perspective on deontic discourse and reasoning offers an attractive strategy for doing so that arises naturally once we articulate some simple lessons from the Ramsey test for conditionals in a dynamic setting. However, some readers may be willing to grant all this and still wonder to what extent, if any, doing so requires buying into the semantic details of the story told here. Let me make a few concluding remarks about this issue.

The story told here models the semantics of conditionals dynamically in terms of their acceptance conditions: the question is whether the consequent is accepted once the input state is strengthened with the antecedent. Correspondingly, logical consequence is modeled in terms of preservation of acceptance: the question is whether the conclusion is accepted once the input state is strengthened with the premises. One may insist, however, that the dynamic phenomena I have put into the semantics are better reserved for our pragmatic story about language and communication, just as Stalnaker (1978) originally proposed. The easiest way to sketch such an alternative —

easiest because it does not require a separate semantic setup but can be quickly stated on the basis of what I said earlier — starts with deriving static truth-conditions from dynamic state change rules and then defines logical consequence as guaranteed preservation of truth given some world and carrier of information (a Stalnakerian context).

Definition 17 (Staticness) Consider arbitrary $\phi \in \mathcal{L}^+$ and deontic context d : $\llbracket \phi \rrbracket^{w,\sigma} = 1$ iff $w \in \sigma[\phi]$.³⁰ An argument $\phi_1, \dots, \phi_n \models \psi$ is valid iff for all w and σ : if $\llbracket \phi_1 \rrbracket^{w,\sigma} = 1$ and ... and $\llbracket \phi_n \rrbracket^{w,\sigma} = 1$, then $\llbracket \psi \rrbracket^{w,\sigma} = 1$.

On this proposal, deontic detachment is semantically valid while its factual cousin is semantically invalid. However, we may still treat factual detachment as a *reasonable* inference since factual information — for instance the information that Jones does not go help his neighbors — pragmatically shifts the context in a dynamic fashion, and we already know that factual detachment is dynamically valid. Dynamic logical consequence has a role to play alright, but its role is better captured by a pragmatic story about discourse and reasoning.³¹ And obviously, this way of looking at things also goes well together with the established semantic frameworks proposed by Lewis (1973) and Kratzer (1991, 2012). Why, then, tell the story just in the way I have done?

The initial response to the question raised here is that several aspects of my story are worth telling regardless of where one wants to

30. The noteworthy limitation of this definition is that a sentence will be false at any index of evaluation $\langle w, \sigma \rangle$ such that $w \notin \sigma$. A stern defender of a static perspective may also be reluctant to derive his or her favorite semantics from dynamic context change rules. These reservations do not affect the purpose of this exercise, that is, to convey the general spirit of the alternative proposal that I am about to discuss.

31. The notion of a reasonable inference goes back to Stalnaker (1975) and has recently been appealed to by Silk (2014a, 2014c) in his story about deontic conditionals.

locate the undeniable dynamics of discourse and reasoning. The crucial observation is that reasonable inference — be it a semantic or a pragmatic notion — is best understood as nonmonotonic, and that this feature gives rise to an attractive solution to one of the more stubborn paradoxes about deontic discourse and reasoning. Moreover, monotonicity failures thus understood follow from independently plausible assumptions about the interplay between information aggregation and commitment preservation. If others are willing to work on integrating these dynamic insights into their preferred, semantically more static analyses of modals and conditionals, all the power to them.

But there is also something to be said in favor of telling the story just in the way I did. The first observation is that, on a closer look, the alternative static proposal does not completely resolve the question about factual and deontic detachment. The issue is not only to explain why both detachment principles appear to be valid — this job may perhaps be distributed among different notions of logical consequence. The question is also how the joint validity of these principles may be upheld in light of the troubles stirred up by Chisholm's paradox. And at this point, having two notions of logical consequence in the game, the semantic one being monotonic by design, does more harm than it does any good. On the alternative static proposal, the premises of Chisholm's paradox *semantically* entail that Jones ought to tell his neighbors that he is coming in a monotonic fashion, yet they also license the *reasonable* inference that Jones ought not tell his neighbors that he is coming. And this just reproduces the original problem for upholding both factual and deontic detachment. Suppose that Jones does not go but tells his neighbors he is coming: is he, or is he not, to blame for telling his neighbors that he is coming? The answer provided by the static semantic notion of entailment conflicts with the one given by the dynamic pragmatic notion of reasonable inference.

It is unclear how the static proposal can solve this problem in a satisfying manner. The most promising strategy is to suggest that deontic detachment is pragmatically defeated by the information that Jones does not go. Specifically, one may just take the presuppositional anal-

ysis of conditionals that I adopted in §3.2.2 as a source of inspiration and say that “If Jones goes to the aid of his neighbors, then he ought to tell them he is coming” becomes — as a matter of pragmatics — undefined once the information that Jones does not go is added to the common ground: the additional information licensing the reasonable inference that Jones ought not tell his neighbors that he is coming creates a context in which deontic detachment has no purchase. But regardless of how *exactly* one wants to justify the pragmatic defeat of deontic detachment, it remains that all the explanatory work is once again done by the dynamic consequence relation (even if it now comes with a pragmatic gloss), and it is unclear what role truth preservation plays in accounting for how we reason with iffy oughts. Staticness may, of course, play *some* role in our best theory of discourse and reasoning but it drops entirely out of the picture when it comes to the issues that matter here and needs to be justified by some other means. And even if this can be done, we need to explain why an inference that is explicitly maintained to be semantically valid — specifically, the inference of “Jones ought to tell his neighbors that he is coming” from the premises of Chisholm’s paradox that is licensed by deontic detachment — can at the same time be utterly unreasonable. A monotonic semantic notion of validity does not live happily with what I have argued to be the driver behind the co-tenability of factual and deontic detachment — that is, the nonmonotonicity of deontic discourse and reasoning.

The general lesson behind the first observation is that the well-entrenched tradition of explaining the appeal of certain inference rules at the pragmatic rather than at the semantic level only goes so far. It works well if all one wants to do is to account for certain inference rules *in addition* to those that are licensed by one’s favorite semantics. But a semantics cannot simply be supplemented with a pragmatic notion of validity whose appeal stems in part from the fact that it *avoids* certain inference patterns that the semantics itself licenses. At a minimum, we now need to answer non-trivial questions about how to referee potential clashes between the predictions made by the various notions of inference in play. It is, then, because the dynamic story told here is

neither strictly stronger nor strictly weaker than its static alternative — in addition to deontic detachment, it licenses factual detachment, but at the same time it rejects monotonicity — that it cannot be demoted to a pragmatic afterthought to the classical semantic analyses of iffy oughts.

The second observation is that every modal semantics for conditionals worth its salt *already* appeals to the dynamic effects that I suggested putting at the center of our semantic conception of logical consequence. This is most obvious in the analysis of conditionals by Kratzer (1991, 2012), where conditional antecedents strengthen the context in light of which the consequent is evaluated, but also in the ones by Stalnaker (1968) and Lewis (1973) where conditional antecedents trigger a shift of the indices at which the consequent is evaluated. Insofar as these dynamic effects in the evaluation procedure for conditionals are supposed to model the role of supposition in conditional reasoning, and insofar as there is an important match between the evaluation procedure for conditionals and the one for logical arguments — both proceed by checking the acceptability of a sentence under certain assumptions — we have every reason to think of logical consequence as dynamic as well. In short: there is simply no good reason to postulate an internally dynamic *semantic* evaluation procedure for conditionals and at the same time ban the corresponding dynamic effects from playing a role in the semantic evaluation procedure for arguments in discourse and reasoning.

In contrast to its static alternative, the proposal made here involves a dynamic model of discourse and reasoning that matches the intuitive evaluation procedure for conditionals, and it is this connection that makes a well-motivated nonmonotonic perspective on deontic discourse and reasoning possible. The resulting framework offers an attractive solution to one of the most notorious puzzles about deontic reasoning while preserving intuitive rules of inference for iffy oughts. Another notable feature of the framework presented here is that it has something useful to say about Forrester’s paradox and is flexible enough to leave room for a dynamic conception of a deontic

context that accounts for the data about the miners paradox without sacrificing deontic and factual detachment. To my knowledge, no other account has an equally impressive track record. Given the current momentum of the field, it would be premature to conclude that no alternative strategy may be developed that delivers all the goodies. But given the attractiveness of a dynamic analysis of iffy oughts and the difficulties of integrating its insights into a static framework on the cheap, I conclude that the story told here compares very favorably to its alternatives currently on the market.

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