Deontic Modals and Probabilities: One Theory to Rule Them All? (Abstract)

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1. Synopsis. I defend and develop a probabilistic premise semantics for deontic modals. The probabilistic component is motivated by considering embeddings of deontic modals in conditionals with probabilistic antecedents. To make room for probabilities, premises are treated as properties of alternatives (and not of individual worlds). The theory can be shown to be importantly different from the scalar semantic theories that have gathered attention in recent literature.

2. An Argument for a Probabilistic Semantics. There are embeddings of deontic modals in conditionals with probabilistic antecedents (Yalcin 2012).

(1) If it is likely that your opponents will attack your team on the right flank, you should concentrate your defense on the right side.

(2) If it is not likely that your opponents will attack your team on the right flank, you should not concentrate your defense on the right side.

In treating these cases, I make two assumptions: (i) expressions like 'it's likely' constrain probabilistic information states (Swanson 2011, Yalcin 2010, 2012, Lassiter 2011) and (ii) conditionals with probabilistic antecedents shift the relevant information state (as opposed to restricting the modal base for the *should*). Under these assumptions, explaining the meaning of these complex embeddings requires us to explain how the compositional semantic value of the deontic consequents is sensitive to the shift introduced by the probabilistic antecedents.

Furthermore, these kinds of embeddings give rise to distinctive entailments, such as:

(3) If rain is likely, you should wear a coat. Strong winds are likely. Rain is at least as likely as strong winds. *Therefore:* You should wear a coat.

Inferences like (3) must be validated by a joint account of probabilistic and deontic language.

3. Scalar Theories. According to scalar theories (e.g., Lassiter 2011), unembedded deontic claims express comparisons of expected values between the prejacent and the alternatives. Deontic claims in consequents of conditionals express comparisons of expected value between the prejacent and the alternatives in the local context created by evaluating the antecedents.

Applying these ideas to (1)-(2) easily explains how probabilistic shifts affect deontic claims and also accounts for (3) and other interactions between probability operators and deontic modals.

Scalar theories run into trouble with ascriptions of propositional attitudes to non-Bayesian agents. Suppose that John thinks that everyone should follow an unorthodox decision rule such as *Maximin* (the rule that requires agents to choose based on the outcome of each choice in the worst case scenario). Consider (4) as uttered in a context in which (i) I flip a coin that is heavily (but not perfectly) biased towards heads and (ii) you can choose between betting on the outcome at even odds or refrain from betting.

(4) John thinks that you should not bet on heads.

For the scalar theorist, (4) is acceptable iff for every pair $\langle Pr, v\rangle$ of probability and value function compatible with John's state, the expected value (calculated according to Pr and v) of betting on heads is higher than that of the alternatives. This does not seem to be correct representation of the content of (4): John might think the deontic claim is true, even though the expected value of betting on heads is greater than that of the alternatives (note that alternative scalar theories that are built on non-Bayesian rules face similar problems with the attitudes of Bayesian agents). I argue that attempts to address this problem by pushing John's risk-aversion in the value function produce unsatisfactory results in more complicated examples and undermine the motivation for scalar theories.

4. Probabilistic Premise Semantics. The central idea of my approach is to build deontic semantics on an ordering of alternatives (i.e. propositions), rather than an ordering of worlds. Probabilities enter the picture because this ordering is determined by premises that may be probabilistic in character (e.g., "given alternative A in state S, it is likely that you will win the game"). Conditional antecedents (including probabilistic antecedents) update the state S, and hence may affect which ordering source members apply to which alternatives.

The technical implementation of this idea requires three parameters: (i) a *fine-grained state*, i.e. a pair $\langle I, Pr\rangle$ with I a set of worlds, and Pr a probability function (ii) an *alternative set* Alt and (iii) an *elevated ordering source* O—that is, a set of sets of propositions (these parameters can be made to depend on the world of evaluation, but I ignore this complication here). As in Kratzer's (1981) semantics, I define a preorder by inclusion. Where α and β are propositions:

(5) $\alpha \succeq_{I,Pr,O} \beta$ iff $\{\pi \in O \mid (\alpha \cap I) \in \pi\} \supseteq \{\pi \in O \mid (\beta \cap I) \in \pi\}$

Informally, α is at least as good as β (relative to I) if and only if every premise that applies to $\beta \cap I$ applies to $\alpha \cap I$. Since the ranking of α is only affected by $\alpha \cap I$, this preorder is sensitive to updates to the fine-grained state. Given an analogue of the limit assumption, the ordering in (5) can be used to define a quantificational domain:

(6) $\mathit{Domain}(I, Pr, O, \mathit{Alt}) = \{v \in I \mid \exists\beta \in \mathit{Alt}[\sim \exists\alpha \in \mathit{Alt}(\alpha \succ_{I,Pr,O} \beta \;\&\; v \in \beta)\}$

(7) $[\![\mathsf{SHOULD}(\phi)]\!]^{I,Pr,O,Alt,w} = T$ iff $\forall w' \in \mathit{Domain}(I, Pr, O, \mathit{Alt}), [\![\phi]\!]^{I,Pr,O,Alt,w'} = T$

This approach is easily extended to other modal auxiliaries and deontic comparatives. As mentioned, I assume that antecedents of the form $\ulcorner$if it's likely that $\phi\urcorner$ operate on these points of evaluation partly by shifting Pr.

5. Accounts of the Data. Despite the superficial similarities, this theory is fundamentally different from Kratzer's classical premise semantics. On the present theory, 'SHOULD' is *information sensitive* (in the sense characterized by Kolodny and MacFarlane, 2010 to solve the *miners paradox*; see also Charlow 2013). Crucially for current purposes, the interpretation of deontics is sensitive to probabilistic updates. Suppose, for instance, that the elevated ordering source for (1)-(2) includes the premise $\{\alpha|$ given α, it is likely that you will win$\}$ and suppose it's common ground that it's likely you will win if and only if you match defense to your opponent's offense. Then, in the local context created by the antecedent of (1), concentrating the defense on the right satisfies the premise. In the context created by the antecedent of (2), it does not. Hence, the semantics can capture the interaction between probability claims and deontics. Furthermore, given any standard definition of validity, this semantics validates the inference in (3) and others like it.

Like the scalar semantics, the probabilistic premise semantics can handle the interaction between probabilities and deontic modalities. However, the present theory also easily handles ascriptions of attitudes to non-Bayesian agents: (4) is acceptable iff for every I, Pr, O, w compatible with John's state, $[\![$you should bet on heads$]\!]^{I,Pr,O,Alt,w} = F$. This delivers the expected verdicts if we suppose, among other things, that a premise set compatible with John's state will feature premises that represent John's risk-aversion, like $\{\alpha|$ given α, you are guaranteed to win$\}$.

References. Charlow (2013) *What We Know and What to Do* ■ Kolodny and MacFarlane (2010) *Ifs and Oughts* ■ Kratzer (1981) *The Notional Category of Modality* ■ Lassiter (2011) *Measurement and Modality* ■ Swanson (2011) *How Not to Theorize about the Language of Subjective Uncertainty* ■ Yalcin (2010), *Probability Operators* ■ Yalcin (2012) *Bayesian Expressivism*.