

# Deontic Logic and Natural Language Semantics

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`<http://mit.edu/fintel/roskilde-slides.pdf>`

## Overview

- Natural Language Semantics and Its Friends
- A Short Tour of Deontic Modality in Natural Language
- Iffy Oughts: Deontic Modals and *if*

## Different Concerns

- Deontic logic: perspicuous/idealized syntax, axioms, and semantics
- Philosophy/Cognitive Science: understanding human preference systems
- AI: realistic modeling of preference systems
- Natural language semantics: analyzing natural language expressions of deontic modality

## Parting Ways

Natural language semantics of deontic modality . . .

- May not need full “access” to the richness of preference systems
- Needs to be compositional: what are the parts of natural language deontic modal constructions (syntax/morphology), what are the meanings of these parts, and how do those meanings combine to give the overall meaning of the deontic modal construction
- Needs to be able to account for cross-linguistic patterns
- Needs to understand diachronic developments of deontic modals
- Is understaffed

# Kinds of Meanings

The Nature of Deontic Modal Meanings:

- expressivism
- dynamic meanings
- boring old static truth-conditional semantics

## Context-Dependency I

- (1) [Father to Son]:
  - a. You may leave the table.
  - b. You have to take out the garbage.
  - c. You ought to call your grandma.
  
- (2) [Grad school handbook]:
  - a. You may take up to two undergraduate courses in other fields.
  - b. You have to finish your thesis within 5 years.
  - c. You ought to form your dissertation committee in your fourth year.

Note: the same modals are used in both contexts; no specialization.

## Context-Dependency II

Many modals are usable in many kinds of modal meanings.

**epistemic** *Given all those wet umbrellas, it **has to** be raining.*

**deontic** *According to the hospital regulations, visitors **have to** leave by six pm.*

**bouletic** *According to my wishes as your father, you **have to** go to bed in ten minutes.*

**circumstantial** *Excuse me. *Given the current state of my nose, I **have to** sneeze.**

**teleological** *Given the choices of modes of transportation and their speeds, to get home in time, you **have to** take a taxi.*

## Kratzer

- Modals are context-dependent: they depend on the context to supply a modal base about which they are then making claims of necessity/possibility etc.
- Specialized modals (German *dürfen*, English *might*, etc.) impose restrictions on the kind of modal base they can accept.
- Additional fact (not discussed by Kratzer): multi-functional modals usually develop diachronically out of more specialized modals; in particular, epistemic uses of modals often only become available late, after a period where the modal can only be used deontically

## Necessity

$$\llbracket \textit{have to } \phi \rrbracket^P = P \subseteq \llbracket \phi \rrbracket$$

$P$ : A particular, contextually supplied set of ideal worlds

Note: modal takes a sentence as its argument (prejacent)

## Contingency/Iterability

$$\llbracket \textit{have to } \phi \rrbracket^{w,P} = P(w) \subseteq \llbracket \phi \rrbracket$$

$P$ : A particular, contextually supplied function from evaluation worlds to set of ideal worlds

Why? Iteration, uncertainty:

- (3) You might have to leave at 10 (I don't know what the dorm rules say exactly).

## Factual Background

$$\llbracket \textit{have to } \phi \rrbracket^{w,f,P} = P(w)(f(w)) \subseteq \llbracket \phi \rrbracket \quad [\textit{cf. } O_f \phi \textit{ or } O(\phi/f)]$$

$f$ : A particular, contextually supplied function from evaluation worlds  $w$  to sets of worlds (those where the relevant circumstances are the same as in  $w$ ), i.e. a circumstantial accessibility function — Kratzer's *modal base*

$P$ : A particular, contextually supplied function from evaluation worlds to functions from sets of worlds to set of “ideal” worlds (ideal in the sense that *given* the factual background they couldn't be better) — a subset selection function

Why? Contrary-to-Duty/Good Samaritan scenarios:

(4) [A tourist has been mugged] We have to help the victim.

## Or: Ordering

$\llbracket \textit{have to } \phi \rrbracket^{w,f,P} =$

$$\forall w' \in f(w): (\neg \exists w'' \in f(w): w'' \leq_{P,w} w') \rightarrow \llbracket \phi \rrbracket (w')$$

$f$ : A particular, contextually supplied function from evaluation worlds  $w$  to sets of worlds (those where the relevant circumstances are the same as in  $w$ )

$P$ : A particular, contextually supplied function from evaluation worlds  $w$  to partial orderings of worlds according to how close they get to the ideal as it is in  $w$  — Kratzer's *ordering source*.

Many slight variants depending on one's assumptions about the ordering (simplest if one makes the Limit Assumption)

## Ordered Orderings?

(5) Everyone ought to wash their hands; employees have to.

[Kai von Fintel and Sabine Iatridou. 2006. “How to Say *Ought* in Foreign: The Composition of Weak Necessity Modals”. URL <http://mit.edu/fintel/ought.pdf>, ms, MIT, to appear in Jacqueline Guéron and Jacqueline Lecarme (eds), *Time and Modality*, Studies in Natural Language and Linguistic Theory, Springer.]

Idea: ordered orderings; after the first ordering has determined what is strongly necessary, the second ordering determines what ought to happen.

## A Cross-Linguistic Puzzle

(6) everyone ought to wash their hands

(7) *Tout le monde devrait se laver les mains*  
everybody **must/COND** REFL wash the hands

Many languages express *ought* by putting counterfactual marking on a strong necessity modal (*must, have to*).

von Stechow and Iatridou: counterfactual marking signals “ordering source promotion”: if the secondary ordering source were to be given primary status, then it would be strongly necessary that everyone washes their hands

## Alternatives

Jackson (1985), anticipated by Sloman (1970):

deontic modals evaluate alternatives to the prejacent

Jackson's version: *ought*  $\phi$  wrt a comparison set  $C$  says that the way  $\phi$  would happen (given the factual background) is preferred over the way that any of the alternatives would happen

to make this work, the factual background can't just be a set of worlds but needs to be rich enough to support counterfactual assessments (for example, a Lewis system of spheres, or a Stalnakerian selection function)

## Personal Modalities

So far, we have treated deontic modals as sentential operators.  
How does that relate to their syntax?

(8) There have to be 50 chairs in the living room by 5pm.

(9) John has to put 50 chairs in the living room by 5pm.

If both (8) and (9) have the same logical form where the modal takes a full sentence as its argument, then they involve *Raising* of the embedded subject to the surface subject position.

## Ought to be vs. Ought to do

John in (10) is naturally interpreted as the person that the onus is being put on. (But cf. (11))

(10) John has to put 50 chairs in the living room by 5pm.

(11) [To the babysitter:] John has to be in bed by 7:30pm.

This has long been recognized as a separate *ought to do* reading of the deontic modal, contrasting with the *ought to be* reading of deontic modals, where there is no specific person carrying the onus. (Humberstone 1971, Feldman 1986, Brennan 1993)

Should this be analyzed by giving (10) a different logical form, where the surface subject is a separate argument of the modal? This would make this a *Control* construction.

Yes: Perlmutter 1970, Jackendoff 1971, Brennan 1993

No: Bhatt 1997, Wurmbrand 1999

## Some More History

Modal expressions often start as exclusively control/*ought to do* deontics, then acquire the raising/*ought to be* deontic use, and then acquire the epistemic use.

## Epistemics under Deontics?

- (12) If there might have been a mistake in the calculations, the editor ought to commission a second review.

[Imagine that a Mafia boss talks about framing Miller for a murder:]

- (13) The evidence ought to point in Miller's direction.  
(14) Miller ought to be the prime suspect.  
(15) #Miller ought to have to be the murderer.

## Iffy Oughts

(16) If that tourist was mugged, we have to help him.

Wide-spread consensus in deontic logic: the *if*-clause modifies the factual background of the “dyadic” deontic operator.

McNamara’s complaint: “a bit of a puzzle about why this apparent composite of a conditional and a deontic operator is actually some sort of primitive idiom involving a modal notion” (SEP 2006)

## Lewis on Restrictive *If*-Clauses

- (17) This dog almost always/usually/sometimes/never bites if he is approached.

“The *if* of our restrictive *if*-clauses should not be regarded as a sentential connective. It has no meaning apart from the adverb it restricts. The *if* in *always if . . . , . . . , sometimes if . . . , . . .*, and the rest is on a par with the non-connective *and* in *between . . . and . . .*, with the non-connective *or* in *whether . . . or . . .*, or with the non-connective *if* in *the probability that . . . if . . .*. It serves merely to mark an argument-place in a polyadic construction.” (Lewis “Adverbs of Quantification”, 1975)

## Kratzer's Thesis

Lewis wasn't just right about adverbial quantification. His analysis is right about other occurrences of *if*.

“The history of the conditional is the story of a syntactic mistake. There is no two-place *if . . . then* connective in the logical forms of natural languages. *If*-clauses are devices for restricting the domains of various operators.” (Kratzer “Conditionals”, 1986)

In other words: there are no conditionals, just constructions involving an *if*-clause and an operator that the *if*-clause restricts.

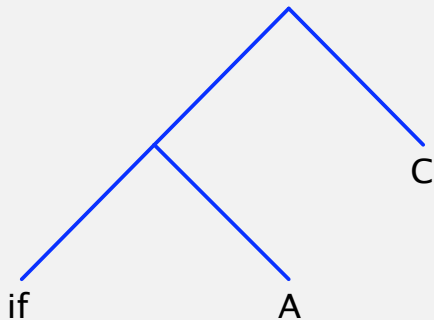
# Tripartite Structures

Heim's dissertation:

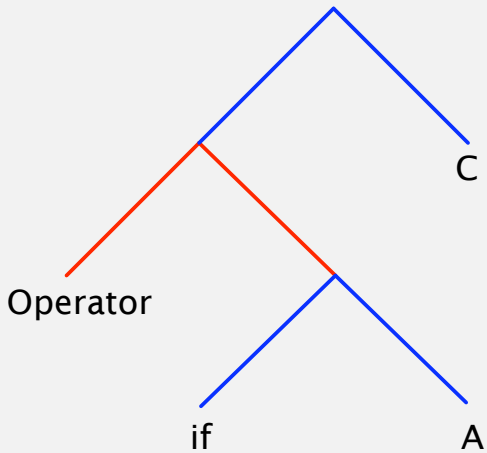
## **Quantifier/Operator [Restriction] [(Nuclear) Scope]**

Heim achieved a solution to the problem of donkey anaphora, which ensured that the Lewis/Kratzer/Heim view of the partition of “conditionals” into Operator + *if*-clause + consequent became the received view in linguistic semantics.

Before Lewis, Kratzer, Heim



After Lewis, Kratzer, Heim



## 'If' Restricting Various Operators

- (18) If we are on Rte. 195, we **must/might** be in Mansfield.  
*if* restricts epistemic *must/might*
- (19) If it rains tomorrow, the game **will** be cancelled.  
*if* restricts future modal *will*
- (20) If it had rained, the game **would** have been cancelled.  
*if* restricts subjunctive modal *would*
- (21) If that tourist was mugged, we **ought** to help him.  
*if* restricts *ought*

## Restricting Deontics

$$\llbracket \textit{if } \phi, \textit{have to } \psi \rrbracket^{w,f,P} = \llbracket \textit{have to } \psi \rrbracket^{w,f^+,P}$$

where  $f^+ = \lambda w.f(w) \cap \llbracket \phi \rrbracket$

Note that *if* is not the same as *given*, which would indicate that  $\phi$  is in fact true, rather than just being added to the factual background for the assessment of the deontic modal

## A Problematic Prediction

(22) If  $\phi$ , have to  $\phi$ .

is predicted to be a tautology.

## Zvolenszky's Complaint

“outlandish sentences like those under (23) come out true.”

- (23)
- a. If teenagers drink then teenagers must drink.  
(deontic reading invoking, say, U.S. laws)
  - b. If teenagers drink then teenagers may drink.
  - c. If I file my taxes, then I must file my taxes.  
(bouletic reading invoking my desires)
  - d. If children don't eat spinach then children shouldn't eat spinach.  
(deontic reading invoking, say, considerations of health)

## The Flipside

- (24)
- a. If The Dalai Lama is mad, then he should be mad.  
(deontic reading evoking considerations about reasonable reactions)  
'If The Dalai Lama is mad, then (given his even temper) he must have his reasons.'
  - b. If Yogi Bear works then he has to work/is obliged work.  
(bouletic reading evoking Yellowstone ranger John Smith's demands)
  - c. If Bart Simpson listens to Bartók, then he must/is to obliged to do so.  
(bouletic reading evoking, say, Marge's demands)

## Two Desiderata

- 1 Explain the reading under which *if  $\phi$ , must  $\phi$*  makes a contingent claim
- 2 Explain why we do not perceive the tautological reading

## Bare Conditionals

(25) If this dog is approached, he bites.

(26) If John was here on time, he left Cambridge at noon.

Kratzer:

- covert operator restricted by *if*-clause
- covert frequency adverb in (25) ( $\approx$  “always”)
- covert epistemic necessity modal in (26) ( $\approx$  “must”)

## Predicted Ambiguity

- *if*-clause restricting (covert) epistemic modal under which the deontic modal is embedded
- *if*-clause restricting the deontic modal directly

(27) If Caspar vacuums on Saturday, then Chris has to cook dinner on Sunday. [Sarah Moss]

(28) If Caspar vacuums on Saturday, then Chris must have to cook dinner on Sunday.

## But Why No Tautology?

Two ideas:

- when there is a contingent reading for a sentence, we do not perceive a non-contingent reading, even if the grammar generates it
- modals that employ an ordering source presuppose/implicate that the prejacent is not already trivial wrt the factual background (i.e. there are prejacent and non-prejacent worlds in the factual background)

Keep in mind that in (29), we do perceive a tautological reading:

(29) If he's here, he's here.

## To Do List

- Anette Frank's claim in her 1996 thesis: "There are in fact no truly *deontically modalized if*-conditionals. Instead, we assume conditionals with a deontic modal operator in the consequent clause to be analyzed throughout in terms of an implicit or explicit epistemically (or circumstantially) based modal operator. The deontic modal adverb is then to be analyzed within the scope of the 'higher' epistemic modal operator."
- Investigate alternative implementations of Kratzer's Thesis about *if*: von Fintel's return to Belnap's conditional and Gillies' dynamic iffiness proposal.
- Other proposals that iffy oughts involve an *ought* embedded under a "normal" conditional: Chellas, Bonevac, Horty, . . . .
- Connect to discussion in meta-ethics about narrow scope vs. wide scope of *ought* in iffy oughts.