Semantics in the coal mine

Kai von Fintel (MIT)

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The meaning of deontic modals

(1) You { must / have to / should / ought to / may / could } call your mother more often.

Many cooks in this kitchen

- deontic logic
- meta-ethics
- decision theory
- AI
- economics
- natural language semantics

Natural language semantics

- compositionality (internal, external)
- semantics and pragmatics (presuppositions, implicature, …)
- cross-linguistic patterns
- diachronic patterns

Another “feature”: semantics is understaffed

Modal meanings

- expressivism
- dynamic meanings
- static truth-conditions

Context-dependency

(2) [Father to son:]

a. You **may** leave the table.

b. You **have to** take out the garbage.

c. You **ought to** call your grandma.

(3) [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.

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.

The classic semantics

- modals quantify over a set of possible worlds
- that set is determined through the interplay of
  - a modal base: the set of eligible/accessible worlds
  - an ordering: evaluation of the eligible worlds according to a set of criteria

Kratzer's ordering source

- Induce the ordering via a set of propositions
- A world *w* is better than *w'* iff any proposition from the ordering source that is true in *w'* is also true in *w*.

Dimensions of variation

- particular resolutions of the modal base and ordering parameters result in particular contextual readings of modals
- English modals lexically mark their quantificational force
- modals can be lexically specialized for certain kinds of readings (e.g. *might*: mostly epistemic)

Ought

deontic *ought, have to*, etc. say that **all** of the best worlds are worlds where their prejacent is true

Traffic fine

(4) John has to pay a $10 fine.

Modal base: the fact that John obstructed his neighbor's driveway; the options open to him currently
Ordering source: the provisions of the City of Cambridge traffic bylaws
Truth-conditions: (4) is true in *w* iff among the options open to John, given that he obstructed his neighbor's driveway, the ones deemed best by the City of Cambridge traffic bylaws are all ones where he pays a $10 fine

Some challenges

- strong (*must*) vs. weak (*ought to*) necessity
- apparent non-monotonicity Ross' Paradox, Professor Procrastinate
- deontic dilemmas
- deontic conditionals
- **Today**: information-sensitivity

The miners

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

(5) We ought to block neither shaft.

(6) If they're in A, we ought to block shaft A.

(7) If they're in B, we ought to block shaft B.

(8) Either they're in A or they're in B.

The semantic puzzle

(9) We ought to block neither shaft.

AA, BB > AN, BN > AB, BA

Epistemic modal base?

Widening the modal base to include all the worlds compatible with our limited knowledge does not help (by itself) since the obvious ordering still values most highly the worlds where all ten miners are saved.

Two readings

(10) We ought$_s$ to block neither shaft.

(11) If they're in A, we ought$_o$ to block shaft A.

(12) If they're in B, we ought$_o$ to block shaft B.

subjective vs. objective?

The reality of the distinction

(13) We ought$_s$ to block neither shaft.

(14) We ought$_o$ to block the shaft they're in.

What we would need for subjective *ought*

AN, BN > AA, BB > AB, BA

But isn't that crazy?

Alternatives

- Charlow
- Cariani, Kaufmann[2]
- Lassiter
- Silk ($\leftarrow$ Kolodny & MacFarlane?)
- Dowell

Antecedents

- Goble 1996
- van Rooij 1998
- Levinson 2003
- Büring 2003

What is needed for a two readings approach

Modelling

- the distinction
- the interaction of the two readings with conditionals

The two readings

- a reading where all that matters is the right outcome
- a reading where rational decisions in the face of limited information are preferred

An example

Pascal and Mordecai are playing Mastermind (again). The code is red-red-blue-blue. Given the information Pascal has gathered so far, he will gain the best epistemic bang for the buck by testing red-red-red-red. But of course he would instantly win the game if he checked for red-red-blue-blue.

(15) Pascal ought to play red-red-red-red.

(16) Pascal ought to play red-red-blue-blue.

Pascal actually plays red-red-green-green (he's kind of a novice at the game). It takes him five more moves to find the answer. The code is revealed. They debrief.

(17) a. P: Oh man, I ought to have played red-red-blue-blue.

b. M: No, you ought to have played red-red-red-red.

Back to the miners

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

Finer grain

ABK miners in A, we block B, we know where the miners are

ANI miners in A, we block neither, we are ignorant of where the miners are

Better lucky than rational

AAK, AAI, BBK, BBI > ANI, BNI > ABI, BAI

(18) ^{T}We ought to block the shaft they're in.

(19) ^{F}We ought to block neither shaft.

(20) ^{T}We ought to have blocked A. after learning A

Better rational than lucky

AAK, BBK > ANI, BNI > AAI, BBI, ABI, BAI

(21) ^{F}We ought to block the shaft they're in.

(22) ^{T}We ought to block neither shaft.

“Better lucky” recast

Order worlds by how many of these propositions they make true:

p: we save all ten miners

q: we save at least nine miners

Kratzer’s ordering source

All that matters is the number of miners saved.

“Better rational” recast

Order worlds by these propositions:

p: our action is known to save all ten miners
q: our action is known to save at least nine miners

Now, ANI is better than AAI.

Observers with full information

(23) They ought to block shaft A.

[because that's where the miners are]

(24) They ought to block neither shaft.

[because they shouldn't make risky decisions]

Miner conditionals

(25) If the miners are in A, we ought to block A.

(26) If the miners are in B, we ought to block B.

Conditionals

Another ingredient adopted from Kratzer:

- *if*-clauses restrict modals
- they narrow the set of accessible worlds to those where the antecedent is true

What's the problem?

Conditionals knock non-antecedent worlds out of the modal base.

(27) If the miners are in A, we ought to block A.

better rational: AAK, ~~BBK~~ > ANI, ~~BNI~~ > AAI, ~~BBI~~ > ABI, ~~BAI~~

Just because the miners (by assumption) are in A doesn't mean we know that they are in A. So, we're still comparing only worlds in which we don't know where they are. No change in prediction: (27) is false. The *if*-clause is idle. Not the reading we want.

What's the problem?

Conditionals knock non-antecedent worlds out of the modal base.

(28) If the miners are in A, we ought to block A.

lucky: AAK, AAI, ~~BBK~~, ~~BBI~~ > ANI, ~~BNI~~ > ABI, ~~BAI~~

Under the "better lucky" ordering, the conditional comes out true. As desired.

Idle *if*s

(29) Even if the miners are in A, we ought to block neither shaft (because we don't know where they are).

(30) No matter where the miners are, we ought to block neither shaft (because we don't know where they are). $\approx$
$\forall$ locations *x*: if the miners are in x, we ought to block neither shaft

(31) Whether the miners are in A or in B, we ought to block neither shaft.

Not enough?

Appealing to the "better lucky" ordering might not be enough.

(32) If the miners are in A, the rational thing is to block A.

Partial information gain

- Three shafts A, B, C.
- If we block the shaft they're in, all ten are safe.
- If we do nothing, two will die.
- Blowing up A will kill them all if they're in A, but save exactly nine if they're not (blowing up A precludes blocking B or C unfortunately).
- We have no idea where they are.

(33) If they are not in A, we ought to blow A up.

Options

- Make the ordering sensitive not to what is known but to a more abstract "information state"

  (various ways to do that, all(?) weakening the classic semantics)

- Have the conditional take us to a state that's not just one where A is the case but where A is known

if A = if we learn A?

certainly not always:

(34) If my partner is cheating on me, I'll never know.

Thomason pc to van Fraassen

but sometimes:

(35) If my partner is cheating on me, I'd be surprised.

Urgent action

(36) If they are in A, block A!

(37) If they are in A, we must block A!

Magda Kaufmann

Conclusion

- we need a way to model (something like) the subjective/objective distinction
- two interpretations for *if*-clauses:
  - restricting modal base to antecedent-worlds
  - restricting modal base to worlds where the antecedent is "known"

- It is not obvious that information-sensitivity cannot be modeled within the confines of the classical semantics.
- Now comes the hard part of comparing theories of (almost) identical empirical coverage.