

80-880: Seminar on Philosophy of Language
Epistemic Modality and Natural Language

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COURSE WEBPAGE: www.schoubye.net/modals.html

Preliminaries

- * Introductions and Backgrounds
- * Course Requirements
- * Office Hours (BH152)
- * Course Outline + Syllabus

Lecture 1: Modality in Natural Language and Modal Logic

Introduction to Modality: Displacement

- One defining characteristic of natural language is that it is not restricted to discourse about the *actual here* and *now*. This feature is sometimes referred to as 'displacement'.
- There are many types of displacement in natural language. For example, we can refer to individuals that are not present in our immediate environment (1), we can talk about past and future events (2-3), and we can talk about counterfactual, necessary, possible, or probable states of affairs (4-6).
 - (1) Bob is in Copenhagen.
 - (2) Yesterday at noon, it was raining [here].
 - (3) It will rain [here] next week.
 - (4) If Bob had been here, he could have attended the meeting.
 - (5) It's necessary that it's raining in Copenhagen.
 - (6) It's possible that it's raining in Copenhagen.
- We will focus on so-called *modal* displacement (as opposed to e.g. *temporal* displacement), discourse about possibilities and necessities, what *must*, *should*, *could*, *may*, *might* etc. be the case.

- There are many types of expressions and constructions in natural language that give rise to modal displacement:
 - MODAL AUXILIARIES: *must, may, might, can, should, have to*
It must be raining in Copenhagen.
Bob should apologize to his grandmother.
 - MODAL ADVERBS: *maybe, probably, likely, possibly*
Possibly, it is snowing in Copenhagen.
 - GENERIC/HABITUALS:
Bears like honey.
Bob smokes.
 - CONDITIONALS: *if ... then* (both indicative and subjunctive)
If Bob is sick, he is not coming work.
If Bob had been here, he could have attended the meeting.
 - PROPOSITIONAL ATTITUDES: *believe, know, realize, desire, hope, fear ...*
Sue believes that Bob is in Copenhagen.
Sue hopes that Bob is in Copenhagen.
- In this class, we will be more or less exclusively concerned with the first two, namely modal auxiliaries and modal adverbs.

Modal Properties

- The meaning of natural language modals vary across at least two different dimensions.
 - MODAL FORCE: possibility vs. necessity (or universal vs. existential)
— *must, should, would, have to* vs. *may, might, can, could*.
 - MODAL FLAVOR: Modals can be evaluated with respect to different (restricted) types of information, i.e. information about common knowledge or belief, information about physical abilities, information about nomological laws, information about moral obligations, information about goals, information about desires etc.
- We can thus distinguish a number of different modal flavors.

Modal Flavors

- EPISTEMIC MODALS: Modals relating to bodies of knowledge or belief.

- | | |
|--|---------------|
| (7) It <i>might</i> rain today. (for all that's known) | (possibility) |
| (8) It <i>must</i> be raining. (for all I know) | (necessity) |

– DEONTIC MODALS: Modals relating to sets of rules, laws, permissions, or obligations.

- (9) Bob *could* face time in jail. (given the laws of the country)
- (10) Bob *must* resign from his post. (given the rules of the university)
- (11) Bob *should* apologize to his parents. (given the prevailing moral norms)

– TELEOLOGICAL MODALS: Modals relating to sets individual goals and plans.

- (12) Bob *must* write a qualifying paper. (given his plan to advance to ABD)
- (13) Bob *could* do the extra credit exercises (given his goal to get the highest GPA)

– BOULETIC MODALS: Modals relating to e.g. desires and wishes.

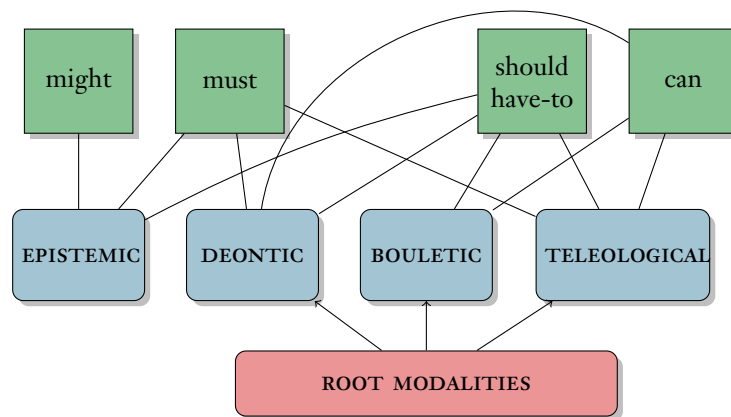
- (14) Bob *should* publish a book. (given his desire to be famous)
- (15) Bob *could* go to Noma. (given his desire to be seen)

– ABILITY MODALS: Modals relating to e.g. abilities.

- (16) Bob *can* lift an elephant. (given his physical abilities)

Multiplicity of Modal Meanings

- As should be clear, the same modal expression can, on different occasions, express different kinds of modality.
- For example, in English we have the following taxonomy: (cf. Portner (2009) for more examples.)



- This multiplicity of meaning is widely attested cross-linguistically, see e.g. [Hacquard \(2010\)](#) for references.

Semantics

- In general, we will follow others in making the simplifying assumption that both modal auxiliaries and modal adverbs are sentential (or propositional) operators. I.e. we will assume that the ‘logical form’ of sentences like (17) is (17a) (or more conspicuously 17b).

- (17) It must be raining in Copenhagen.
- must*(it is raining in Copenhagen).
 - must*(ϕ).

- (18) It’s possible that it’s raining in Copenhagen.
- possibly*(it is raining in Copenhagen).
 - possibly*(ϕ).

- The central question is what the semantics of these expressions is supposed to be, i.e.
 - What function should we assume that these expressions denote?
 - What should we assume about the arguments of these functions?

Non-Truth Functional Operators

- In standard extensional semantics, the semantic value of a sentence (or *wff*) is a truth value (0/1).
- However, when we consider the phenomenon of modal displacement, it becomes immediately obvious that we cannot treat these expressions as truth functional operators, viz. functions from truth values to truth values (like e.g. sentential connectives). To see why, consider what function ‘possibly’ in (18a) would have to denote.
- It should, at least, map truth to truth (since actuality entails possibility). But what about falsity? Two options:
 - Map falsity to falsity ($0 \rightarrow 0$)
Here we get the wrong result whenever the embedded sentence (e.g. ‘it is raining in Copenhagen’) is false but contingent.
 - Map falsity to truth ($0 \rightarrow 1$)
Here we get the wrong result whenever the embedded sentence is necessarily false, e.g. ‘it’s possible that $2 + 2 = 5$ ’.

- In conclusion, in order to give an adequate semantics for modal expressions, we need to move beyond standard extensional semantics and add some level of complexity to our semantic framework.

The Quantificational Analysis of Modals

- In modal logic, modal expressions are analyzed as quantifiers over possible worlds. This is typically done by extending the syntax and semantics of classical logic.
- Take standard classic propositional logic \mathcal{L} , and enrich the inventory and syntax of \mathcal{L} :
 - Introduce two new unary sentential connectives, \Box and \Diamond .
 - If ϕ is formula, so is $\Box\phi$
 - If ϕ is formula, so is $\Diamond\phi$.
 - Define \Box and \Diamond as duals.

$$\Diamond\phi \leftrightarrow \neg\Box\neg\phi$$
- Now define a model, \mathfrak{M} , for \mathcal{L} as follows, $\mathfrak{M} = \langle \mathcal{F}, \mathcal{I} \rangle$, where \mathcal{F} is a *frame*, consisting of a pair $\langle \mathcal{W}, \mathcal{R} \rangle$.
 - \mathcal{W} is a non-empty set of worlds.
 - \mathcal{R} is an accessibility relation on \mathcal{W} , viz. $\mathcal{R} \subseteq \mathcal{W} \times \mathcal{W}$
 - \mathcal{I} is an interpretation function from world-proposition pairs to truth values.

Why might this not work?

- Let \mathcal{W} be the set of every logically possible world.
- Truth conditions for sentential connectives ($\neg, \wedge, \vee, \rightarrow$) are then relativized to worlds accordingly, i.e. given an interpretation \mathcal{I} :

$$\mathcal{I}_w(\neg\phi) = 1 \text{ iff } \mathcal{I}_w(\phi) = 0$$

$$\mathcal{I}_w(\phi \wedge \psi) = 1 \text{ iff } \mathcal{I}_w(\phi) = 1 \text{ and } \mathcal{I}_w(\psi) = 1$$

$$\mathcal{I}_w(\phi \vee \psi) = 1 \text{ iff } \mathcal{I}_w(\phi) = 1 \text{ or } \mathcal{I}_w(\psi) = 1$$

$$\mathcal{I}_w(\phi \rightarrow \psi) = 1 \text{ iff } \mathcal{I}_w(\phi) = 0 \text{ or } \mathcal{I}_w(\psi) = 1$$

- The truth conditions for \Box and \Diamond are given as follows (read ' $w\mathcal{R}w'$ ' as ' w' is accessible from w '):
 - $\mathcal{I}_w(\Box\phi) = 1$ iff for *all* $w' \in \mathcal{W}$ such that $w\mathcal{R}w'$, $\mathcal{I}_{w'}(\phi) = 1$
 - $\mathcal{I}_w(\Diamond\phi) = 1$ iff for *some* $w' \in \mathcal{W}$ such that $w\mathcal{R}w'$, $\mathcal{I}_{w'}(\phi) = 1$

- Now we have a framework where we can evaluate for truth/falsity various modal claims. But is it expressive enough? Can we capture the multi-faceted meanings of natural language modal expressions in this framework?

Modal Inferences

- Ignoring important details about accessibility relations, analyzing modals in terms of quantifiers over worlds has the potential of validating various desirable inferences. For example, intuitively we want validate (19a) and (19b).

$$(19) \quad \begin{array}{l} \text{a. It's necessary that } \phi \rightarrow \text{It's possible that } \phi \\ \text{b. } \textit{must}(\phi) \rightarrow \textit{might}(\phi) \\ \text{c. } \Box\phi \rightarrow \Diamond\phi \end{array} \quad \text{serial frame: } \forall w\exists v(w\mathcal{R}v)$$

- For epistemic modals, we might want to have (20a) and (20b) be valid inferences.

$$(20) \quad \begin{array}{l} \text{a. (It's necessary that } \phi) \rightarrow \phi \\ \text{b. } \textit{must}(\phi) \rightarrow \phi \\ \text{c. } \Box\phi \rightarrow \phi \end{array} \quad \text{reflexive frame: } \forall w(w\mathcal{R}w)$$

Why shouldn't this inference be preserved for deontic modals?
Even for epistemic modals, one might question this. Why?

- Intuitively plausible inferences such as (21a), (21c), (22a), and (22c) follow immediately from the definition of \Box and \Diamond as duals.

$$(21) \quad \begin{array}{l} \text{a. Necessarily } \phi \rightarrow \text{It's not the case that it's possible that not-}\phi \\ \text{b. } \Box\phi \rightarrow \neg\Diamond\neg\phi \quad \forall x\phi \rightarrow \neg\exists x\neg\phi \\ \text{c. Possibly } \phi \rightarrow \text{It's not the case that it's necessary that not-}\phi \\ \text{d. } \Diamond\phi \rightarrow \neg\Box\neg\phi \quad \exists x\phi \rightarrow \neg\forall x\neg\phi \end{array}$$

$$(22) \quad \begin{array}{l} \text{a. It's not necessary that } \phi \rightarrow \text{It's possible that not-}\phi \\ \text{b. } \neg\Box\phi \rightarrow \Diamond\neg\phi \quad \neg\forall x\phi \rightarrow \exists x\neg\phi \\ \text{c. It's not possible that } \phi \rightarrow \text{It's necessary that not-}\phi \\ \text{d. } \neg\Diamond\phi \rightarrow \Box\neg\phi \quad \neg\exists x\phi \rightarrow \forall x\neg\phi \end{array}$$

- On this analysis of modals, we also predict that (23a-23b) are inconsistent, but that (24a-24b) are potentially consistent.

$$(23) \quad \begin{array}{l} \text{a. It's necessary that } \phi \text{ and it's necessary that not-}\phi \\ \text{b. } \textit{must}(\phi) \text{ and } \textit{must}(\neg\phi) \\ \text{c. } \Box\phi \wedge \Box\neg\phi \end{array} \quad \forall x\phi \wedge \forall x\neg\phi$$

$$(24) \quad \begin{array}{l} \text{a. It's possible that } \phi \text{ and it's possible that not-}\phi \\ \text{b. } \textit{might}(\phi) \text{ and } \textit{might}(\neg\phi) \\ \text{c. } \Diamond\phi \wedge \Diamond\neg\phi \end{array} \quad \exists x\phi \wedge \exists x\neg\phi$$

Modeling Different Modal Relations: Accessibility

- Since natural language modal expressions can be used to make very different modal claims, we need a way of restricting the worlds over which various modals quantify.
- For example, suppose I'm looking out of the window and notice that it is not raining. Were I to assert (25), my assertion would intuitively be false.

(25) It might be raining.

- If the modal is assumed to quantify over every *logically* possible world, we would predict that (25) is true.
- The solution is to specify for each modal a relevant accessibility relation:

EPISTEMIC ACCESSIBILITY RELATION, \mathcal{R}^{ep}

$w\mathcal{R}^{\text{ep}}w'$ if only if all the facts known to obtain at w also obtains at w'

DEONTIC ACCESSIBILITY RELATION, \mathcal{R}^{de}

$w\mathcal{R}^{\text{de}}w'$ if and only if w' is a world in which all the laws of w are obeyed.

- Now, we get the following truth conditions for (25):

(25) $\llbracket \text{It might}^{\text{ep}} \text{ be raining} \rrbracket = 1$ iff it is raining in some $w' \in \mathcal{W}$ such that $w\mathcal{R}^{\text{ep}}w'$

(26) $\llbracket \text{John must}^{\text{de}} \text{ go to jail} \rrbracket = 1$ iff John goes to jail in all $w' \in \mathcal{W}$ such that $w\mathcal{R}^{\text{de}}w'$

Why is this essentially cheating in both (25) and (26)?

Compositional Semantics

- We now have:
 - A framework that can assign (seemingly adequate) truth conditions to modal statements.
 - A way of distinguishing between different kinds of modals.
- We don't have:
 - A fully compositional analysis:
 - \Box and \Diamond are *syncategorematic* expressions.
- For a compositional semantics (which is supposed to provide us with a neat connection between the phrase structures associated with natural language sentences and their associated meaning) we assign types to each natural language expression. We thus start by defining a couple of semantic domains from which we will draw and build our semantic types.
 - D_e : The set of all (possible) individuals

- D_t : the set of truth values (1/0)
- If a and b are semantic types, then $\langle a, b \rangle$ is a type.
- $D_{\langle a, b \rangle}$ is the set of all functions from D_a to D_b
- In an intensional system, the semantic value of an expression α is relativized to a world-assignment (and a variable-assignment, but we can ignore this here), i.e.
 - $\llbracket \text{tired} \rrbracket^{w, g} = \lambda x_e . x$ is tired in w .
 - $\llbracket \text{Noam Chomsky} \rrbracket^{w, g} = \text{Noam Chomsky}$
 - $\llbracket \text{adores} \rrbracket^{w, g} = \lambda x_e . \lambda y_e . x$ adores y in w .

We would strictly speaking need to modify composition principles such as functional application, but we'll ignore that.

- In other words, for any expression α , we have $\llbracket \alpha \rrbracket^{w, g}$ — also known as the *extension* of α in w (under assignment g).
- And if α is a sentence, the semantic value of α , $\llbracket \alpha \rrbracket^{w, g}$, is a truth value.
- But we have already seen that we cannot treat modals as truth-functional operators. If the aim is to define a meaning for modal expressions where these take something as argument and output truth values, their inputs cannot also be truth values.
- In other words, extensions of sentences cannot serve as argument inputs to modal expressions. What we need instead is *intensions* but these can be calculated on the basis extensions (which the semantic system already provides):

Leaving presuppositions aside.

The *intension* of $\llbracket \alpha \rrbracket^{w, g} = \lambda w . \llbracket \alpha \rrbracket^{w, g}$

- Intensions are obviously world-independent.
- Using intensions, we can treat modal expressions as *intensional operators* that are capable of shifting world parameters.
- Now, we need to add something to our semantic domain, namely:

- If a is a type, then $D_{\langle s, a \rangle}$ is the set of all functions from \mathcal{W} to D_a

Curious fact: We'll assume that there is no type s and no associated domain. Reason: There are no expressions that refer to possible worlds.

- Intensions are of type $\langle s, t \rangle$ — functions from possible worlds to truth values.
- We can now formulate lexical entries for various modals as follows:

$$(27) \llbracket \text{might}^{\text{ep}} \rrbracket^{w, g} = \lambda p_{\langle s, t \rangle} . \exists w' \in \mathcal{W} \text{ such that } w \mathcal{R}^{\text{ep}} w' \text{ and } p(w') = 1$$

$$(28) \llbracket \text{must}^{\text{ep}} \rrbracket^{w, g} = \lambda p_{\langle s, t \rangle} . \forall w' \in \mathcal{W} \text{ such that } w \mathcal{R}^{\text{ep}} w' \text{ and } p(w') = 1$$

$$(29) \llbracket \text{may}^{\text{de}} \rrbracket^{w, g} = \lambda p_{\langle s, t \rangle} . \exists w' \in \mathcal{W} \text{ such that } w \mathcal{R}^{\text{de}} w' \text{ and } p(w') = 1$$

$$(30) \llbracket \text{must}^{\text{de}} \rrbracket^{w, g} = \lambda p_{\langle s, t \rangle} . \forall w' \in \mathcal{W} \text{ such that } w \mathcal{R}^{\text{de}} w' \text{ and } p(w') = 1$$

Now we also need a rule for *intensional* functional application.

Shortcomings of the Standard Quantificational Analysis of Modals

Problem I: Lexical Ambiguity

- In (27)-(30), the *flavor* of the modals is *hard-wired* into the meaning of the modals (notice the superscripts on the words in denotation brackets).
- This of course implies that modals are genuinely (lexically) ambiguous. While this might seem innocuous, the “ambiguity” is worse than one might immediately realize. Consider (31).

- (31) Bob must be at the meeting.
- a. (Since he is not in his office) Bob *must* be at the meeting. (ep)
 - b. (Given the university laws) Bob *must* be at the meeting. (de)

- Above, the deontic accessibility relation is explicitly given in terms of the university laws. But (31) could easily be asserted having in mind,
 - *the rules of the country*
 - *the rules of the UN*
 - *the rules of his father’s house*
 - *the rules of the prison*
 - *the rules of the dorm etc.*
- The truth of (31) depends crucially on which set of rules is intended.
- **The problem** is that in order to account for this potentially infinite list of different accessibility relations for *must*, we now need a potentially infinite number of lexical entries for *must*.
- Moreover, since the availability of different interpretations of *must*, *may*, *have to* etc. is widely cross-linguistically attested, it is somewhat implausible that these are cases of genuine lexical ambiguities.

Problem II: Inconsistent Sets of Propositions

- When a modal is evaluated with respect to an inconsistent set of propositions, the set of worlds quantified over is empty (the intersection of these propositions is empty).
- In such cases, a modal with universal force (\Box) is predicted to be vacuously true and a modal with existential force (\Diamond) is predicted to be false.
- Suppose three laws have been passed down:

- (32) a. Murder is a crime.
b. Goat owners are liable for damages caused by their goats.
c. Goat owners are not liable for damages caused by their goats.
- If we are evaluating modal claims with respect to the set of worlds characterized by those propositions—the intersection of (32a-32c)—we incorrectly predict that (33a) is true, and that (33b) and (33c) are both false.
- (33) a. Murder must not be a crime.
b. Goat owners may be liable for damages caused by their goats.
c. Goat owners may not be liable for damages caused by their goats.

Problem III: Separating Rules and Ideals from Facts

- Suppose that (34) below is uttered in a context where Bob has committed a murder.

(34) Bob must go to jail.
- Given the current semantic analysis, (34) is predicted to be true if and only if at all the worlds where the law is obeyed, Bob goes to jail.
- **The problem** is that at the worlds where the law is obeyed, there is surely no murder! So, the puzzle is this: how can we talk about what happens when a law has been broken when the worlds at which we're supposed to evaluate this are worlds where no law has been broken?
- On the current analysis, there is no way of separating actual facts and contents of the law/rules. But we need to be able to talk about what *must*, *should*, or *may* be the case (relative to some set of rules) given certain facts known to obtain.

Problem IV: Conditionals

- A fourth problem is conditionals. Conditionals are known to give rise to the so-called Samaritan Paradox. Suppose the law provides:

(35) No murder occurs.
(36) If a murder occurs, the murderer goes to jail.

Now the standard analysis predicts (37) is true for any ϕ .

- (37) It's necessary that if a murder occurs, then ϕ .

Problem V: Graded Modalities

- A third problem is graded modals. There is no way on the standard logical analysis to account for the truth conditions of sentences such as (68)-(70).

- (38) It's barely possible to climb Mount Everest.
- (39) It's more likely that ϕ than ψ .
- (40) It's easily possible that ϕ .
- (41) There's a slight possibility that ϕ .

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Lecture 2: Kratzer Semantics for Modals

Conversational Backgrounds

- Consider the meaning of ‘must’ in the four sentences below.
 - (42) Maori children must learn the names of their ancestors.
 - (43) The ancestors of the Maori must have arrived from Tahiti.
 - (44) If you must sneeze, at least use your handkerchief.
 - (45) When Kahukura-nui died, the people of Kahungunu said:
Rakaipaka must be our chief.
- While the meaning of modals (e.g. *must*) varies across different occasions of use, (42)-(45), we can capture the core of their meanings by paraphrasing what these utterances are intended to convey.
 - (46) *In view of what their tribal duties are*, the Maori children must learn the names of their ancestors.
 - (47) *In view of what is known*, the ancestors of the Maori must have arrived from Tahiti.
 - (48) If, *in view of what your dispositions are*, you must sneeze, at least use your handkerchief.
 - (49) When Kahukura-nui died, the people of Kahungunu said: *in view of what is good for us*, Rakaipaka must be our chief.
- Kratzer writes:

What happened to the four occurrences of *must* in those paraphrases? In each case a substantial part of the meaning the modal had in the original sentence has been transferred to an *in view of*-phrase. The four occurrences of *must* in [(46)] to [(49)] now all have the same meaning. That meaning seems to be the common core we perceive in each occurrence of *must* in [(42)] to [(45)]. It is that

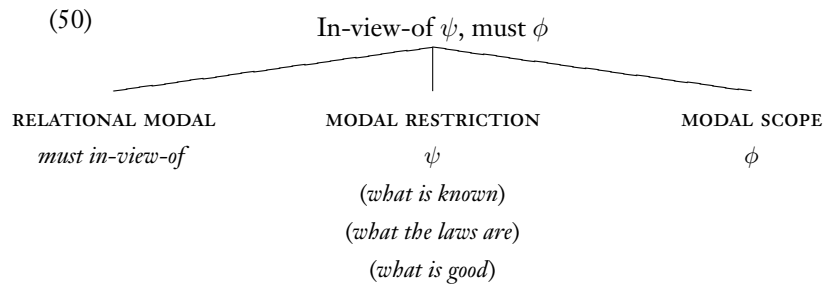
common core that stays the same whenever *must* is used. It is therefore that core that a semantic analysis of *must* should capture. On such an account, there is only one modal *must*. If we insisted on keeping the many different *musts* that are traditionally distinguished we would be forced to accept yet another *must*: the neutral *must* of [(46)] to [(49)]. [(46)] to [(49)] are English sentences, too, and any adequate account of *must* must therefore recognize a neutral *must*. (Kratzer, 1977, 6)

- Kratzer’s proposes that ‘must’ should be analyzed as relational expression, ‘must-in-view-of’, that takes two arguments, A1 and A2:

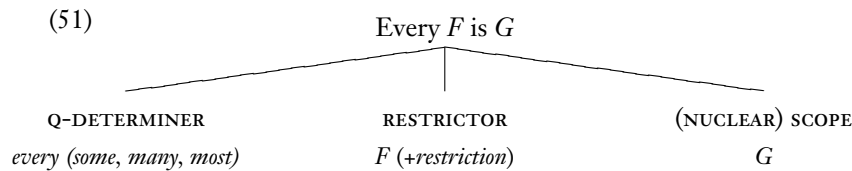
(A1) A free relative (e.g. *in view of what is known* or *in view of what is desired*).

(A2) A sentence (a modal scope).

- The sentences in (46)-(49) thus have the following structure:



- On this analysis of modals, notice the similarity between the structure of quantified sentences and the structure of modalized sentences.



Context Sensitivity

- There are many context-sensitive expressions in natural language, e.g.
 - Indexicals: *I, you, she, we, that, this, today, here* etc.
 - Adjectives: *tall, strong, local* etc.
 - Quantifiers; *every, some, many, more than three, several* etc.

- Following Kaplan (1989), indexical context-sensitivity is standardly handled by treating an utterance context c as an n -tuple of parameters, for example $\langle s, a, l, t, w \rangle$ (speaker, addressee, location, time, world).
- In semantic interpretation, the role of c is to determine the value of any indexical expression. This then determines a proposition. For example, we want our semantics to predict that (52), as uttered by me at this moment, expresses the proposition that Anders is in his office at 12.20pm on September 19th, 2011.

(52) I am here now.

- On Kaplan's picture, we thus analyze context sensitive expressions like I , $here$, now as follows:

(53) $\llbracket I \rrbracket^c =$ speaker in c (value assigned to s in c)

(54) $\llbracket here \rrbracket^c =$ the location of the speaker in c (value assigned to l in c)

(55) $\llbracket now \rrbracket^c =$ time of the utterance in c (value assigned to t in c)

(56) $\llbracket \text{I am here now} \rrbracket^{c, \langle w, t \rangle} = 1$ if and only if, at world w^c and time t^c , the speaker in c is at the location of c at the time and world of c .

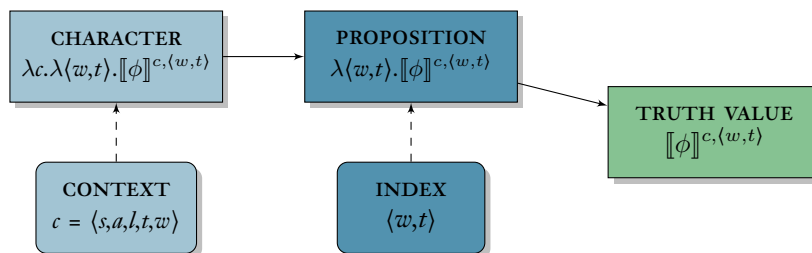
- On the Kaplanian picture (and much in line with what we have already covered), the proposition expressed by (52) is thus:

(57) $\lambda \langle w, t \rangle. \llbracket \text{I am here now} \rrbracket^{c, \langle w, t \rangle}$

- And the *character* (as Kaplan calls the context-invariant meaning) of (52) would then be:

(58) $\lambda c. \lambda \langle w, t \rangle. \llbracket \text{I am here now} \rrbracket^{c, \langle w, t \rangle}$

The Kaplanian Picture



The context-sensitivity of natural language quantifiers

- A sentence such as (59) can, on various occasions of use, be used to express many different things. For example (60)-(62).

(59) Every student aced the exam.

(60) Every student *in my class* aced the exam.

(61) Every student *in the school* aced the exam.

(62) Every student *in the nation* aced the exam.

- While there is less agreement on what semantic analysis is the right way to account for (60)-(62), it's widely agreed that these supplementations of the restrictor clauses is supplied by *context*.

(63) $\llbracket \text{Every } F \text{ is } G \rrbracket^c = 1$ iff $\{x: x \in F\} \subseteq \{x: x \in G\}$ (where the domain of F is determined by c)

- Or as Stanley and Szabó (2000) have proposed.

(64) $\llbracket \text{Every } F_{f(i)} \text{ is } G \rrbracket^c = 1$ iff $(F \cap \{x: x \in c(f)(c(i))\}) \subseteq G$ (where f is a function from individuals to sets, and i is a variable ranging over individuals, and both f and i are determined by c).

Kratzer: Key Idea I

Conversational Backgrounds are Contextually Supplied

Rather than assuming that modals are ambiguous between various modal flavors (epistemic, deontic, bouletic, teleological etc.), Kratzer assumes that modals are context-sensitive, i.e. sensitive to conversational backgrounds.

Conversational backgrounds restrict the domain that modals quantify over. These can be linguistically realized (using e.g. free relative clauses, viz. *in-view-of* phrases), but they can also be, and typically are, supplied only by context.

Premise Semantics

- Kratzer starts by defining the notions of *necessity* and *possibility* in terms of a relation of *logical consequence*.

Necessity: A proposition is necessary with respect to a premise set, iff it *follows* from the premise set. (cf. D2 below)

Possibility: A proposition is possible with respect to a premise set, iff it is *compatible* with the premise set. (cf. D4 below)

- Moreover, propositions are identified with sets of possible worlds.
- The set of propositions is thus the power set of worlds, $\mathcal{P}(\mathcal{W})$.

D1 A proposition p is true in a world $w \in \mathcal{W}$ iff $w \in p$.

D2 If Σ is a set of propositions, and p is a proposition, then p follows from Σ iff $\bigcap \Sigma \subseteq p$, that is iff there is no possible world where all the members of Σ are true but p is false.

D3 A set of propositions Σ is consistent iff $\bigcap \Sigma \neq \emptyset$, that is, iff there is world w where all the members of Σ are true.

D4 A proposition p is compatible with a set of propositions Σ iff $\Sigma \cap \{p\}$ is consistent.

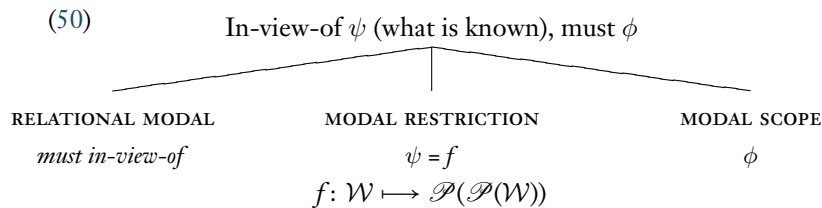
- We can now proceed to composing a derivational analysis of the truth conditions of a modalized sentence — which we assume has the structure given in (50).

- We now need to explicate the meaning of the modal restriction, ‘in view of ψ ’. That is, we need to,

- explicate the meaning ψ .
- explicate the meaning of the *in-view-of* phrase.

- Assume, for illustration, that ψ is the phrase ‘what is known’.

- **What-Is-Known:** since what is known depends on the world in question, Kratzer concludes (simplifying a bit) that the meaning of *what is known* is the function f that assigns to every possible world the set of propositions that are known at that world (viz. a set of set of worlds).



- By taking the intersection of the output of f , $\cap f$, we get a set of worlds — the set over which the modal should quantify.
- **Must (in-view-of):** Kratzer now proposes to treat the *must (in-view-of)* as a function that takes a pair of a proposition p and a conversational background f , $\langle p, f \rangle$ — and outputs another proposition. The proposition output by *must (in-view-of)* is the set of possible worlds such that p follows from $f(w)$ (in the sense described above).
- The meaning of *must (in-view-of)* is that function $f^{\textcircled{1}}$ that satisfies (i) and (ii):
 - (i) The domain of $f^{\textcircled{1}}$, $\mathcal{D}^{(p,f)}$, is the set of pairs $\langle p, f \rangle$ where:

$$p \in \mathcal{P}(\mathcal{W})$$

$$f: \mathcal{W} \mapsto \mathcal{P}(\mathcal{P}(\mathcal{W}))$$
 - (ii) For any p and f such that $\langle p, f \rangle$ is in the domain of $f^{\textcircled{1}}$:

$$f^{\textcircled{1}}(p, f) = \{w \in \mathcal{W}: \cap f(w) \subseteq p\}$$

(50)

In-view-of ψ , must ϕ		
RELATIONAL MODAL	MODAL RESTRICTION	MODAL SCOPE
$must\ in-view-of = f^{\textcircled{1}}$	$\psi = f$	$\phi = p$
$f^{\textcircled{1}}: \mathcal{D}^{(p,f)} \mapsto \mathcal{P}(\mathcal{W})$	$f: \mathcal{W} \mapsto \mathcal{P}(\mathcal{P}(\mathcal{W}))$	$p = \{w: w \in p\}$

- **Can (in-view-of):** For *can (in-view-of)*, Kratzer treats this as a function from $\langle p, f \rangle$ -pairs, to a set of possible worlds compatible with p .
- The meaning of *can (in-view-of)* is that function $f^{\textcircled{2}}$ that satisfies (i) and (ii):
 - (i) The domain of $f^{\textcircled{2}}$, $\mathcal{D}^{(p,f)}$, is the set of pairs $\langle p, f \rangle$ where:

$$p \in \mathcal{P}(\mathcal{W})$$

$$f: \mathcal{W} \mapsto \mathcal{P}(\mathcal{P}(\mathcal{W}))$$
 - (ii) For any p and f such that $\langle p, f \rangle$ is in the domain of $f^{\textcircled{2}}$:

$$f^{\textcircled{2}}(p, f) = \{w \in \mathcal{W}: \cap f(w) \cup \{p\} \neq \emptyset\}$$

Modals Without Free Relatives

- In general, speakers do not make explicit the intended restriction for the modals they use. Kratzer therefore argues that in the typical case, this information is supplied by context. We should therefore think of the conversational background f as a parameter of the context:

$$(65) \quad \llbracket must(\phi) \rrbracket^{c,f} = 1 \text{ iff } \forall w' \in \cap f(w_c), \llbracket \phi \rrbracket^{w',c,f} = 1$$

This is standard notation even if slightly confusing since f is supposed to be a parameter of c (not an independent parameter).

$$(66) \quad \llbracket \text{can}(\phi) \rrbracket^{c,f} = 1 \text{ iff } \exists w' \in \cap f(w_c), \llbracket \phi \rrbracket^{w',c,f} = 1$$

- The lexical entries for e.g. ‘must’ would then look like this.

$$(67) \quad \llbracket \text{must} \rrbracket^{w,g,f} = \lambda \phi_{\langle s,t \rangle} . \forall w' \in \cap f(w_c), \llbracket \phi \rrbracket^{w',c,f} = 1$$

- Drawing a parallel to standard modal logic, $\cap f(w)$ is really the set of accessible worlds.
- And free relatives, i.e. in-view-of ϕ -phrases can now be treated as shifting f (which is otherwise determined by context).

Restrictions on Contextually Supplied Conversational Backgrounds

- Since modal expressions are often limited to a small number of modal flavors, we can state some restrictions on these modals. For example,
 - $\llbracket \text{might}(\phi) \rrbracket^{c,f}$ is defined only if f is an *epistemic* conversational background.
 - $\llbracket \text{must}(\phi) \rrbracket^{c,f}$ is defined only if f is an *epistemic* or a *deontic* conversational background.
 - $\llbracket \text{should}(\phi) \rrbracket^{c,f}$ is defined only if f is an *epistemic*, *deontic*, *teleological*, *bouletic*, ..., conversational background.
- Kratzer has now solved the problem of Lexical Ambiguity (cf. handout from Lecture 1).

Ordering Semantics

- Since Kratzer’s analysis thus far is simply a contextualized version of the standard logical analysis of modals and since, as we saw in the first lecture, the standard logical analysis faces a number of problems (in addition to the ambiguity problem), Kratzer’s theory must be extended.
- The problems were:
 - I. **Inconsistent Sets**
 - II. **Facts & Laws:** The problem of evaluating the consequences of breaking the law in worlds where no laws are broken.
 - III. **Graded Modalities:** There is no way on the standard logical analysis to account for the truth conditions of sentences such as (68)-(70)

(68) It’s barely possible to climb Mount Everest.

(69) It’s more likely that ϕ than ψ .

- (70) It's easily possible that ϕ .
 (71) There's a slight possibility that ϕ .

IV. **Conditionals:** The so-called Samaritan Paradox. Suppose the law provides:

- (72) No murder occurs.
 (73) If a murder occurs, the murderer goes to jail.

Now the standard analysis predicts (74) is true for any ϕ .

- (74) It's necessary that if a murder occurs, then ϕ .

Kratzer: Key Idea II

Double Relative Modals

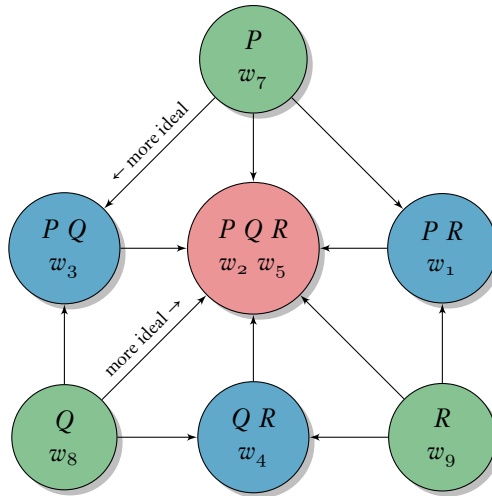
Natural language modal expressions should be evaluated relative to, not one, but two conversational backgrounds, namely what Kratzer calls *the modal base* and an *ordering source*. The modal base is the (contextually supplied) free relative (i.e. *in-view-of* phrase) and it functions as a restrictor of the domain of worlds over which the modal is quantifying.

In contrast, the ordering source imposes an ordering on the worlds in terms of rank. Which ordering is imposed depends on the flavor of the modal.

-
- For example, the **modal base** for an epistemic modal is the set of worlds compatible with the evidence at the world of the context. However, the second conversational background, the **ordering source**, could be *stereotypical* — viz. a set ordered in terms of how closely the worlds correspond to the most normal course of events (given the facts).
 - Hence in addition to modal bases f , we have ordering sources g .
 - modal bases are used to determine relevant facts.
 - ordering sources are used to model ideals (laws, rules, preferences, normal courses of events etc.).
 - Kratzer proposes the following ordering \leq_g which ranks worlds in terms of how close they come to satisfying the ideal:

- (75) For all $v, z \in \mathcal{W}$, and for any $g(w) \subseteq \mathcal{P}(\mathcal{W})$:
 $v \leq_g z$ iff $\{p: p \in g(w) \text{ and } z \in p\} \subseteq \{p: p \in g(w) \text{ and } v \in p\}$

- To illustrate, suppose the law provides propositions P , Q , and R . Suppose further that P, Q, R are consistent with each other. We then get the ordering below (assume that at every world w_i not in the figure below, P, Q , and R are false.)



partially ordered set (poset)

- Given this ordering principle, we get facts like the following:

$$\begin{array}{lll}
 w_2 \leq_g w_4 & w_4 \leq_g w_9 & w_4 \leq_g w_8 \\
 w_5 \leq_g w_3 & w_3 \leq_g w_8 & w_3 \leq_g w_7 \\
 w_2 \leq_g w_7 & w_2 \leq_g w_8 & w_2 \leq_g w_9 \\
 w_5 \leq_g w_7 & w_5 \leq_g w_8 & w_5 \leq_g w_9
 \end{array}$$

- Notice that Kratzer's ordering principles provides partial orders (a reflexive, transitive, and anti-symmetric order with potentially incomparable elements, as in the figure above).
- We can thus have several sets of worlds that are equally close to the ideal.
- We must now revise the semantics for various modal expressions. First, necessity.

$$(76) \quad \llbracket \text{It's necessary that } \phi \rrbracket^{c,f,g} = 1 \text{ iff } \forall w' \in \cap f(w), \exists w'' \in \cap f(w) \text{ such that } w'' \leq_{g(w)} w' \text{ and } \forall w''' \in \cap f(w): \text{ if } w''' \leq_g w'', \text{ then } w''' \in \phi$$

- In other words: $\text{must}(\phi)$ is true at w iff ϕ is true at all accessible worlds (all worlds in the modal base) closest to the ideal established in w .

- Second, a possibility modal.

$$(77) \quad \llbracket \text{It's possible that } \phi \rrbracket^{c,f,g} = 1 \text{ iff } \llbracket \neg \llbracket \text{It's necessary that } \phi \rrbracket^{c,f,g} = 0$$

- If we make the *limit assumption* (viz. the assumption that there always is a unique set of worlds closest to the ideal), this definition could be made significantly less complicated, i.e.

$$(78) \quad \llbracket \text{It's necessary that } \phi \rrbracket^{c,f,g} = 1 \text{ iff } \forall w' \in \text{BEST}_{g(w)}(\cap f(w)): w' \in \phi$$

$$(79) \quad \llbracket \text{It's possible that } \phi \rrbracket^{c,f,g} = 1 \text{ iff } \exists w' \in \text{BEST}_{g(w)}(\cap f(w)): w' \in \phi$$

- Given the new enriched system, it is now possible to define various types of graded modalities.

$$(80) \quad \llbracket \text{there is good possibility that } \phi \rrbracket^{c,f,g} = 1 \text{ iff } \exists w' \in \cap f(w) \text{ such that } \forall w'' \in \cap f(w): \text{if } w'' \leq_{g(w)} w', \text{ then } w'' \in \phi$$

- (80) and (77) are equivalent if one makes the limit assumption. Without the limit assumption, these come apart, for example, in cases where the ordering source yields an infinite sequence of worlds alternating between ϕ and $\neg\phi$ — as ‘it’s possible that ϕ ’ would be true in that case, but ‘there’s a good possibility that ϕ ’ would be false.

$$(81) \quad \llbracket \phi \text{ is at least as good a possibility as } \psi \rrbracket^{c,f,g} = 1 \text{ iff } \forall w' \in \cap f(w) \text{ such that } w' \in \psi, \exists w'' \in \cap f(w) \text{ such that } w'' \leq_{g(w)} w' \text{ and } w'' \in \phi$$

- Notice that ϕ can be a better possibility than ψ even if neither are among the ideal worlds in the ordering.

$$(82) \quad \llbracket \phi \text{ is a better possibility than } \psi \rrbracket = 1 \text{ iff}$$

$$\text{i. } \forall w' \in \cap f(w) \text{ such that } w' \in \psi, \exists w'' \in \cap f(w) \text{ such that } w'' \leq_{g(w)} w' \text{ and } w'' \in \phi$$

$$\text{ii. } \exists w' \in \cap f(w) \text{ such that } w' \in \phi \text{ and } \forall w'' \in \cap f(w) \text{ such that } w'' \in \psi \text{ and } w'' \not\leq_{g(w)} w'$$

(ϕ is at least as good a possibility as ψ)

However, as far as I can tell, ‘weak necessity’ and ‘necessity’ are equivalent if one makes the limit assumption.

Or, if my calculations are correct, if ϕ is a weak necessity but not a necessity, then there is a slight possibility that $\neg\phi$

- Kratzer then defines a notion of *weak necessity*: A proposition ϕ is a weak necessity (with respect to f and g) iff ϕ is a better possibility than not ϕ .
- Kratzer also defines a notion of a *slight possibility*. A proposition ϕ is a slight possibility iff ϕ is a possibility and $\neg\phi$ is a weak necessity.
- Kratzer then relates these notions of necessity and possibility to various modal expressions.

- **necessity**: *must, it's necessary that, should, it's obligatory that ... etc.*
- **weak necessity**: *probably*
- **good possibility**: *there is a good possibility that ...*
- **possibility**: *might, may, can, etc.*
- **slight possibility**: *there is a slight possibility that ...*
- **better possibility**: *— is more likely than —*

- In this way, Kratzer can deal with (a limited range of) graded modalities — something that the standard logical analysis cannot.

Two Kinds of Modal Bases

- Remember that modal bases determine the set of accessible worlds (the set over which the relevant modals quantify).
- It is however important to distinguish two kinds of modal bases, namely **epistemic** modal bases and **circumstantial** modal bases.
- Consider (83) and (84).

(83) Hydrangeas can grow here.

(84) There might be hydrangeas growing here.

Suppose I acquire a piece of land in a far away country and discover that soil and climate are very much like at home, where hydrangeas prosper everywhere. Since hydrangeas are my favorite plants, I wonder whether they would grow in this place and inquire about it. The answer is [(83)]. In such a situation, the proposition expressed by [(83)] is true. It is true regardless of whether it is or isn't likely that there are already hydrangeas in the country we are considering. All that matters is climate, soil, the special properties of hydrangeas, and the like. Suppose now that the country we are in has never had any contacts whatsoever with Asia or America and the vegetation is altogether different from ours. Given this evidence, my utterance of [(84)] would express a false proposition. What counts here is the complete evidence available. And this evidence is not compatible with the existence of hydrangeas. (Kratzer, 1991, 646)

- In other words:
 - **circumstantial modal bases** are sets of worlds where only various material facts which allow or cause an event to take place are considered — e.g. the modal base underlying the use of (83).
 - **epistemic modal bases** are sets of worlds where the totality of what is known in that world or the totality of the evidence available in that world is considered — e.g. the modal base underlying the use of (84).

- Moreover, Kratzer makes the following generalization:
 - **circumstantial modal bases** combine with various kinds of ideals yielding different types of (root) modalities: laws (deontic), wishes (bouletic), goals (teleological), ...
 - **epistemic modal bases** combine with ordering sources related to information, what the normal course of events is like (also called a ‘stereotypical ordering source’), reports, beliefs, rumors.

Kratzer’s View Summarized

A modal is quantifier over possible worlds, restricted by a modal base (which is either epistemic, circumstantial, or possibly empty) and which can be ordered by an ordering source to yield the most ideal worlds of the modal base. Epistemic modal bases combine with information-based ordering sources while circumstantial modal bases combine with various kinds of ideals. Modal bases and ordering sources are contextually determined when not linguistically overt. And when the ordering sources are empty, necessity and possibility claims are evaluated with respect to every world in the modal base (i.e. every accessible world as in standard modal logic).

This now allows for a unified semantics of modals, where modal expressions like ‘must’, ‘should’, ‘might’, ‘may’, and ‘can’ are given a single lexical entry and differ only in modal force.

Solving the Remaining Problems

- As emphasized already, Kratzer’s view has already addressed problem III (graded modalities), but the introduction of ordering sources now enables Kratzer to also solve some of the other problems, namely I and II. Problem IV involving conditionals requires a bit more machinery — more on that later.

Problem I: Inconsistent sets (from Lecture 1)

- Suppose the following laws have been passed down in the legal system.
 - (85) Murder is a crime.
 - (86) Goat owners are liable for damages caused by their goats.

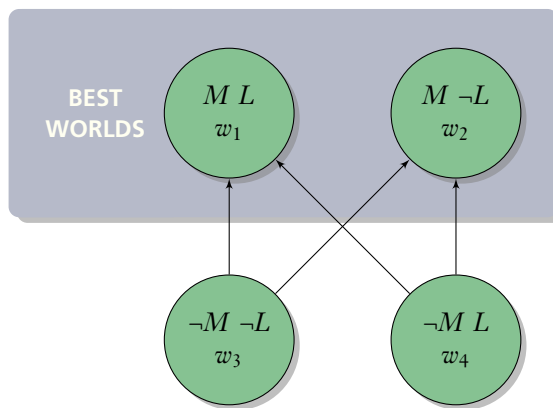
(87) Goat owners are not liable for damages caused by their goats.

- Given this (inconsistent) set of laws, what we want is our system to predict that (88a)-(88c) are true.

(88) In view of what the laws are ...

- Murder must be a crime.
- Goat owners may be liable for damages caused by their goats.
- Goat owners may not be liable for damages caused by their goats.

- Now let (88a) be abbreviated by M , and let (88b) be abbreviated by L .
- Given a deontic ordering source (the laws), we get the following partition (we'll assume, implausibly, that there are only four worlds and that the modal base is empty).



- In less picturesque terms:

$$\begin{array}{cccc}
 w_1 \leq_g w_3 & w_1 \leq_g w_4 & w_2 \leq_g w_3 & w_2 \leq_g w_4 \\
 w_3 \not\leq_g w_1 & w_4 \not\leq_g w_1 & w_3 \not\leq_g w_2 & w_4 \not\leq_g w_2
 \end{array}$$

- Explanation:

- w_1 is better than both w_3 and w_4 since two of the laws passed down are true at w_1 while only one of the laws is true at w_3 and w_4 . Same reasoning goes for w_2
- w_1 and w_2 are incomparable since they are clearly distinct but make the same number of laws (propositions) true. Same goes for w_3 and w_4 .

– It follows that the worlds closest to the ideal are: w_1 and w_2

- Given this ordering, it's easy to verify that (88a), (88b), and (88c) come out true. For example, since in this case $\text{BEST}_{g(w)}(\cap f(w)) = \{w_1, w_2\}$:

$$(89) \quad \llbracket \text{must}(\text{murder is a crime}) \rrbracket^{c,f,g} = 1 \text{ iff } \forall w' \in \{w_1, w_2\}: w' \in \llbracket \text{murder is a crime} \rrbracket^{c,f,g}$$

- Since $w_1, w_2 \in \llbracket \text{murder is a crime} \rrbracket^{c,f,g}$, (88a) is (correctly) predicted to be true. And similarly, (90) is also (correctly) predicted to be true (and as is its narrow scope negation).

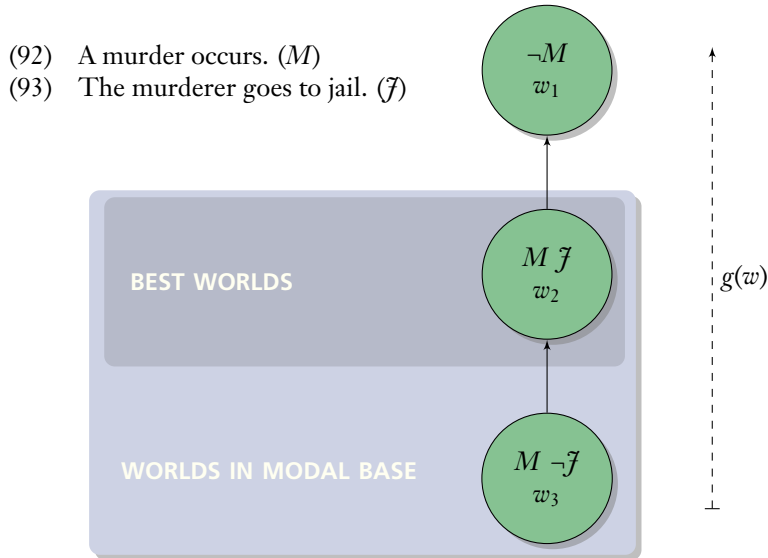
$$(90) \quad \llbracket \text{may}(\text{goat owners are liable}) \rrbracket^{c,f,g} = 1 \text{ iff } \exists w' \in \{w_1, w_2\}: w' \in \llbracket \text{goat owners are liable} \rrbracket^{c,f,g}$$

Problem II: Facts & Laws

- Suppose that (91) is asserted in a context where Bob has committed a murder and that the law provides that (a) murder is forbidden and that (b) murderers go to jail.

(91) Bob must go to jail.

- It should be fairly straightforward to see why making the right prediction for (91) is no longer a problem on Kratzer's view.
- Since there is contextual information that Bob has committed a murder, the modal base automatically rules out worlds where Bob has not committed a murder, and hence worlds where no murder is committed. The ordering source for the modal is deontic, ranking worlds in terms of violations of the law.



- Again, it is easy to verify that (91) is predicted to be true.
- This time, $\text{BEST}_{g(w)}(\cap f(w)) = \{w_2\}$:

(94) $\llbracket \text{must}(\text{Bob goes to jail}) \rrbracket^{c,f,g} = 1$ iff $\forall w' \in \{w_2\}: w' \in \llbracket \text{Bob goes to jail} \rrbracket^{c,f,g}$ Simplifying a great deal here.

Conditionals and the Samaritan Paradox

(A Version of) The Samaritan Paradox

- Suppose the law dictates that murder is prohibited and that if a murder occurs then the murderer will go to jail. The content of the law is thus (95a) and (95b)

- (95) (at the worlds closest to the ideal)
- No murder occurs.
 - If a murder occurs, the murderer will go to jail.

- **Wide Scoping**

On the standard modal logic analysis and if we interpret the conditional in (95b) as material implication, we run into a version of the paradox of material implication. I.e. all the following sentences are predicted to be true.

- (96) It's necessary that ...
- ... if a murder occurs, no murder occurs.
 - ... if a murder occurs, the murderer will be knighted.
 - ... if a murder occurs, the murderer will be given \$1000.

- On the standard analysis there is no way of separating what is dictated by the law and what actually happens. So, at all worlds where the necessity claim is evaluated, no murder occurs. And since the antecedent is false at every world, the material implication analysis dictates that the conditional is true.

- **Narrow Scoping**

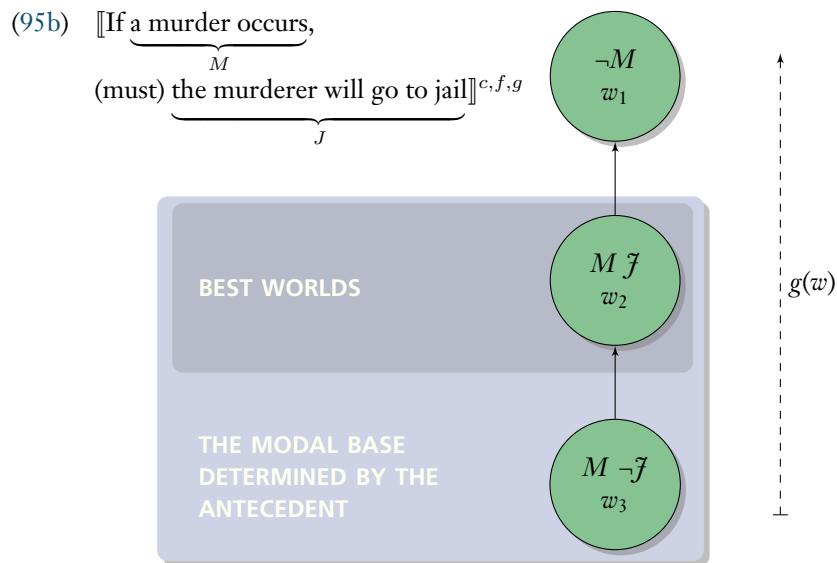
An alternative is to assume that the modal ('it's necessary that) takes narrow scope. However, this option is not much better since we then predict that (95b) is automatically true if no murder occurs.

- **An Alternative Analysis of Conditionals**

Kratzer therefore suggests an alternative analysis of conditionals, namely the analysis in (97). The idea here is to treat the if-clause as shifting the value of f , effectively functioning as a restrictor of the modal base.

$$(97) \quad \llbracket \text{If } \phi, \text{ must } \psi \rrbracket^{c,f,g} = \llbracket \text{must } \psi \rrbracket^{c,f',g} \text{ where for all } w \in \mathcal{W}, f'(w) = f(w) \cup \{\llbracket \phi \rrbracket^{c,f,g}\}$$

- In (95), we have a deontic conversational background and, let's suppose, an empty modal base.
- Assuming the analysis in (97), the function of the antecedent is to restrict the modal base so that it includes only ϕ worlds. With respect to (95a), this means that the modal base is restricted to worlds w such that $w \in \llbracket \text{a murder occurs} \rrbracket^{c,f,g}$.



$$(98) \quad \llbracket \text{must}(\text{the murderer will go to jail}) \rrbracket^{c, f^M, g} = 1 \text{ iff} \\ \forall w' \in \text{BEST}_{g(w)}(\cap f(w)): w' \in \llbracket \text{the murderer will go to jail} \rrbracket^{c, f, g}$$

- In other words, (95b) is correctly predicted to be true in this case given the context described and f and g .
- And Kratzer thus avoids (at least this version of) the Samaritan paradox.

80-880: Seminar on Philosophy of Language
Epistemic Modality and Natural Language

INSTRUCTOR: ANDERS J. SCHOUBYE
COURSE WEBPAGE: www.schoubye.net/modals.html

Lecture 4: Contextualism

Hacking on Possibility

- **Aim:** Define one notion of possibility and state principles of individuation for possibilities of this kind.
- **Leibnizian Necessity and Possibility**
 - That which holds at every *logically* possible world is *necessary*.
 - That which holds at one or more *logically* possible worlds is *possible*.
 - That which holds at no *logically* possible worlds is *impossible*.
 - Subdivisions include the *causally possible*, the *practically possible* etc.
- **Russell's Notions of Necessity and Possibility:**
 - The word *necessary* is “a predicate of a propositional function” — it is true for all possible values of its argument or arguments.
 - “A proposition is necessary with respect to a given constituent if it remains true when that constituent is altered in any way compatible with the proposition remaining significant”
- Hence, the function ‘*x* never encountered Pegasus’ is necessary since it’s true for any choice of argument for *x*.
- Moreover, the proposition ‘Plato never encountered Pegasus’ is necessary with respect to the constituent ‘Plato’ but not with respect to the constituent ‘Pegasus’.
- **A Third Notion of Possibility**

Evidently not all logical possibilities are possible. It is not possible that there are two hundred armchairs in my room as I write these notes, for I am sitting here in these cramped quarters and can see perfectly well that there are only three or four chairs altogether. It would be absurd to say to someone, as if I meant it, that there may be two hundred chairs in this room: not only absurd, but also false. It would be equally silly to say that it is possible that there are two hundred—or even a dozen—armchairs in my room as I write these words. We have a logically possible state of affairs that is not possible. (Hacking, 1967, 145)

- In other words, there is a notion of ‘possible’ (and ‘may’) that doesn’t seem to coincide with the standard notion of logical possibility.
- Similarly,

If I know that $\sim p$, I cannot truly say that it is possible that p ; nor, it seems, will what I say be true if a communicative colleague knows that $\sim p$ (Hacking, 1967, 146)

- Hacking notes that indicative uses of ‘possible’ (typically) distinguishes its meaning from the *logically* possible. I.e. to state what is *only* logically possible (i.e. not epistemically possible), one must use the subjunctive.

I think, however, that there remains enough use of the subjunctive/indicative distinction even among philosophers for the indicative to be a tentative marker of what is possible and not only logically possible. (Hacking, 1967, 147)

- In other words Hacking appears to assume that everything that is (epistemically) possible is also logically possible.
- **Epistemic Possibility**
- Moore’s notion of *Epistemic Possibility*

It is epistemically possible that p within a certain community of speakers if and only if no one in the community knows that it is false that p .

- Hacking’s Counterexample: **The Salvage Ship Case**

Imagine a salvage crew searching for a ship that sank a long time ago. The mate of the salvage ship works from an old log, makes some mistakes in his calculations, and concludes that the wreck may be in a certain bay. It is possible, he says, that the hulk is in these waters. No one knows anything to the contrary. But in fact, as it turns out later, it simply was not possible for the vessel to be in that bay; more careful examination of the log shows that the boat must have gone down at least thirty miles further south. The mate said something false when he said, “It is possible that we shall find the treasure here,” but the falsehood did not arise from what anyone actually knew at the time. (Hacking, 1967, 148)

- Hacking's says right after: "At most it seemed possible to the salvage crew that the wreck was in the bay." (Hacking, 1967, 148). But if it *seemed* possible, should we really think that what the mate said was false?
- Does it follow from Hacking's case that whenever p turns out to be false, an earlier occurrence of 'it's possible that p ' is automatically false? No.

Consider a person who buys a lottery ticket. At the time he buys his ticket we shall say it is possible that he will win, though probably he will not. As expected, he loses. But retrospectively it would be absurd to report that it only seemed possible that the man would win. (Hacking, 1967, 149)

- **Hacking's Analysis of the Salvage Ship Case**

- The mate's statement was false because one could have found out, *from the available data/information*, that the ship could not be there.
- This leads to Hacking's **Working Hypothesis**:

[...] a state of affairs is [epistemically] possible if it is not known not to obtain, and no practicable investigations would establish that it does not obtain. (Hacking, 1967, 149)

- The key word here is *practicable*. It's not the claim that no conceivable method of investigation would establish that it does not obtain, but rather some method which is practically possible.
- For example, there is no 'practicable' way of investigating the ways numbers are drawn in the lottery that would allow us to show that it only *seemed* possible for the lottery ticket owner to win.

Different Occurrences of 'Possible'

- According to Hacking, two different types of uses of the word 'possible' should be distinguished.

(99) It's possible for me to go, but I won't.

(100) # It's possible that I shall/will go, but I won't.

- (99) and (100) have different meanings, and according to Hacking (101) entails (102), but not vice versa. This must be explained by an adequate theory.

(101) It's possible that I shall/will go.

(102) It's possible for me to go.

- Hacking proposes to divide occurrences of the word 'possible' into two classes, *L*-occurrences and *M*-occurrences.

‘Possible that ... ’ will be typical of the *L*-occurrences.

‘Possible for ... ’ will be typical of the *M*-occurrences.

• **Diagnostics for distinguishing different occurrences of ‘possible’**

– ***L*-occurrences** of ‘possible’ are those occurrences where ‘probable’ may be substituted without making the sentence ungrammatical.

– ***M*-occurrences** of ‘possible’ are those occurrences where ‘permissible’ may be substituted without making the sentence ungrammatical.

• For example,

- | | | |
|-------|---|-----------------------|
| (103) | It’s possible that he will go. | probable/*permissible |
| (104) | His defeat is possible. | probable/*permissible |
| (105) | It is possible for him to go. | *probable/permissible |
| (106) | That is a possible course of action
for you to take. | *probable/permissible |

• Hacking denies that ‘possible’ is ‘semantically’ (lexically) ambiguous. Instead, he thinks, that the difference in meaning between *L*- and *M*-occurrences is a structural (or syntactic) ambiguity.

• In other words, ‘it’s possible that’ (without modifiers such as ‘logically’ or ‘causally’) just means ‘it’s epistemically possible that’.

• **Malcolm’s Observation I: Different (Epistemic) Meanings for ‘Possible’**

i. One asserts ‘it’s possible that *p*’ in order to convey that there is some reason to expect *p* to be true.

ii. One asserts ‘it’s possible that *p*’ in order to inform the audience that there is no reason to believe $\neg p$

iii. One asserts ‘it’s possible that *p*’ in order to indicate that the grounds for believing $\neg p$ are not absolutely conclusive.

• Hacking argues that his proposed analysis of ‘it’s possible that’ can capture all of these uses.

• With regards to (i.) consider the following dialogue.

A: “It’s possible that Mrs. Jones will pop in later on.”

B: “Why do you say that?”

? A: “Well, it’s perfectly possible isn’t it?”

- One way to explain the infelicity (or weirdness) of A's second utterance is to assume that 'it's possible that' has the meaning described by Malcolm's (i.).
- However, as Hacking points out, there seems to be various conversational principles that would provide a viable pragmatic explanation as well. For example, that one should only assert p if p is somehow relevant to the audience (or something in that ball park). A's second response is strange precisely because it makes perfectly clear that the mentioned possibility was raised to salience for no apparent reason.
- According to Hacking, each of Malcolm's uses can be explained in a pragmatic way.
- **Malcolm's Observation II: Graded Epistemic Modals.**
- Since one can apply various degree modifiers to the word 'possible', i.e. 'very possible', 'barely possible', Malcolm argues that such uses should be explained in terms of (i.) above, so 'very possible' means 'considerable reason to expect' and 'barely possible' means 'slight reason to expect'.
- Hacking responds to this objection by pointing out that (107) is infelicitous, which it should not be if 'possible' did admit of degree modification.

(107) # His defeat is more possible than his victory.

- As for the 'very possible' case, Hacking argues that this is not functioning as a degree modifier here, but rather as the 'very' in (108)

(108) John and Bill were born on the very same day.

- Moreover, Hacking argues that Malcolm treats 'possible' roughly in the way that one would treat 'probable', but point out that there are important differences between these. For example.

(109) There's a high probability/#possibility that ...

(110) In all probability/#possibility ...

(111) What is the probability/#possibility of ϕ ?

- Hacking concludes:

Hence, aside from a few idioms, it seems that the definition of "possibility" must go along the following lines. There are two kinds of possibility. They must correspond to L - and M -occurrences of "possible". A possibility is either a possible state of affairs (L -occurrence) or something that it is possible to do (M -occurrence). (Hacking, 1967, 164)

DeRose on Epistemic Possibility

- **Three Main Aims**

- (A) Establish that locutions of the form ‘it’s possible that ϕ ’ (where ϕ is in the indicative) typically express propositions whose truth conditions depend on the knowledge state of the speaker (and possibly some other relevant group).
 - (B) Propose a (contextualist) analysis of ‘it’s (epistemically) possible that ϕ ’.
 - (C) Defend the principle that if (from S’s point of view) it’s possible that not- p , then S doesn’t know that p .
- To establish that *epistemic possibilities* are “properly so called”, DeRose considers a couple of different cases.

Background

John has symptoms indicative of cancer. A ‘filtering test’ is run which has two possible outcomes. If the results are ‘negative’, cancer is conclusively ruled out; if the results are ‘positive’, then John might, but might not, have cancer, and further tests will have to be run. Before the test, John and his family are informed by the doctors that there is a 30% chance that John has cancer, and a 45% chance that the test will be positive.

Cancer Test Case 1A (CTC-1A)

John’s doctor has received the results of the test, which are negative, but has not told anyone. John’s wife, Jane, knows that the results are in (viz. that the doctor knows the result), but she doesn’t know the results herself. John’s brother calls Jane and the following exchange takes place.

- (112) a. I’ve heard John has cancer. Is it true?
 b. It’s possible that John has cancer. He has some of the symptoms.
 We’ll find out the results of the test tomorrow.

At the same time, the doctor says (112c) to another doctor:

- (112) c. It’s impossible that John has cancer.

- (112b) and (112c) both seem true, yet the only difference between Jane and the doctor appears to be their epistemic situation, viz. what they know. This thus seems like evidence that the possibility modal is properly epistemic.
- **Possible reply:** Since it is a fact that John cannot have a cancer (as the doctor knows), perhaps Jane’s utterance is simply false?

- **Problem I:** It doesn’t strike us as false.
- **Problem II:** If it was false, then why would Jane make the assertion to begin with then?

Is this a convincing argument? Suppose that the doctor was Gettiered. Would (9c) still sound true then?

Remember, she knows the results are in, so she would also know that she’s potentially saying something false.

– **Problem III:** This response seems to generally overgenerate.

How?

- Notice also the contrast between our judgments in this case and a case in which Jane *does* know the result of the test. In the latter case, Jane’s assertion strikes us as clearly false.

Truth Conditions: First Proposals

IP1 “It’s possible that ϕ ” is true iff the speaker doesn’t know that it’s false that ϕ .

IP2 “It’s possible that ϕ ” is true iff no one in the *relevant* community knows that it’s false that ϕ (where let’s assume the *relevant* community consists of the speaker and her audience).

- Both **IP1** and **IP2** can be used to explain Jane’s utterance.
- The problem with **IP1** and **IP2**:

Background

Same as before...

Cancer Test Case 1B (CTC-1B)

John’s doctor has received the results of the test, which are negative, but has not told anyone. Jane knows that the results are in (viz. that the doctor knows the result), but she doesn’t know the results herself. John’s brother calls Jane and says (113) and Jane responds by asserting (114).

(113) I’ve heard John may have cancer? Is that possible?

(114) I don’t know whether it’s possible, only the doctors know.

- If **IP1** or **IP2** were correct, then Jane’s utterance of (114) should be false — and hence Jane shouldn’t assert it.
- Nevertheless, it seems perfectly reasonable for Jane to assert (114) and it does not seem as if she’s said something false.

DeRose’s Proposed Explanation

- In order to account for both CTC-1A and CTC-1B, one must postulate a certain *flexibility of the relevant community*, i.e. a flexibility in the community with respect to which the modal is supposed to be evaluated.
 - In **CTC-1A**, Jane is saying that John’s having cancer is possible with respect to her own epistemic state (or possibly hers and John’s brother’s epistemic state). The *relevant* community includes only Jane.

- In **CTC-1B**, Jane is saying that she does not know whether John’s having cancer is possible with respect to the epistemic state of a community that includes the doctor. The *relevant* community is therefore one that includes the doctor.
- While **IP1** is clearly inconsistent with this proposed explanation of CTC-1A and CTC-1B, **IP2** appears to be consistent with the explanation.
- However, **IP2** fails for a different reason, namely that it entails the following conditional.

(C) If nobody knows that ϕ is false, anyone can truly assert “ ϕ is possible”.

- But we have already encountered what appears to be a direct counter-example to (C), namely Hacking’s *Salvage Ship Case*.
- DeRose also gives a different counter-example to (C).

Background

Same as before...

Cancer Test Case 2B (CTC-2B)

The result of John’s test are in, but no one has seen the results yet. They were printed out by a computer and Jane is scheduled to pick up the results tomorrow. Jane knows that no one has seen the results yet. John’s brother calls Jane and Jane says (115).

(115) I don’t know whether it’s possible that John has cancer. I’ll find out tomorrow.

- Jane’s assertion is felicitous and intuitively true, but if (C) was true, (115) would be straightforwardly false, since Jane knows that no one knows that John does not have cancer.
- **Hacking’s suggestion:**

An assertion of “It’s possible that p ” is true if and only if (1) no one in the relevant community knows that p is false, *and* (2) there is no practicable investigation by means of which members of the relevant community could establish that p is false.

- But Hacking’s proposal gets **CTC-1A** wrong since if Jane were to drive to the hospital to learn the results of the test, this would clearly count as a “practicable investigation”.

Flexibility in the Relevant Epistemic Situations

- Flexibility of the relevant community is however not sufficient for getting the right results. DeRose makes the following observation: In the case where the computer has generated the results, but no one knows what the results are (and Jane knows that no one knows what the results are), it's still possible for her to respond in two ways to John's brother's question.

(116) Is it possible that John's has cancer?

- a. I don't know whether it's possible. They've run some tests on him and we'll get the results tomorrow.
- b. It's possible that he has cancer, but it's by no means certain.

Does this really sound *literally* true (on its epistemic reading)?

- Here, flexibility in the relevant community cannot explain why both assertions are acceptable.
- What is needed instead is flexibility in the relevant epistemic situations, i.e.
 - When Jane asserts (116a), she is intending the relevant epistemic situation to be one which does not include what her and the relevant community could come to know by means of a practicable investigation.
 - When Jane asserts (116b), she is intending the relevant epistemic situation to include what a practicable investigation would enable her and the relevant community to know.
- DeRose's larger point is this: Hacking is correct that practicable investigations *can* be relevant to the evaluation of truth conditions of epistemic modals, but the flexibility of the relevant epistemic situation sometimes makes it irrelevant.

But is it possible to respond in these two ways even when no practicable investigation could settle the question at hand?

DeRose's Analysis: A Flexible Proposal

S's assertion "It's possible that p " is true if and only if (1) no member of the relevant community knows that p is false, and (2) there is no relevant way by which members of the relevant community can come to know that p is false.

- A worry:
 - This proposal is so flexible that it's useless, i.e. the cases (described above) are not explained by this hypothesis, because this hypothesis is so flexible that it could yield any desired results.

- DeRose's responds:
The hypothesis seems plausible not because it yields the right results for the cases discussed previously but rather because it provides the *intuitively correct* explanation of the cases, i.e. why Jane in several scenarios can felicitously assert both 'it's possible that p ' and 'I don't know whether it's possible that p '.
- One way to improve the proposal is by determining a set of relevant constraints on who can count as a member of the relevant community and what is a relevant way of coming to know.
- **Constraints** (improving the hypothesis)
 - i. The relevant community (of knowers) always includes at least the speaker. (the speaker inclusion constraint)
 - ii. The relevant community usually includes the speaker's audience.
- DeRose doesn't provide any further general constraints.

But are the ones he's suggesting even correct?

Moore's Principle

- Assuming that the speaker is always part of the relevant community makes room for what DeRose calls "Moore's Principle" (MP).

Moore's Principle (MP):

Whenever a speaker S can truly assert "It's possible that p is false", S does not know that p .

- DeRose argues in favor of (MP) by arguing that (117) is *genuinely* inconsistent, viz. that either conjunct *entails* the negation of the other.

(117) # It's possible that not- p but I know that p .

- Reasons to think that (117) is *genuinely* inconsistent:

(R1) It *seems* inconsistent, i.e. we intuitively judge that it's inconsistent.

- The worry here is that intuitions of inconsistency can arise in cases where there is no inconsistency, i.e. as in the Moorean sentence (118).

(118) # It's raining and I don't know that it's raining.

- How do we know that (118) is not inconsistent? If it was, then “each [conjunct] would entail the negation of the other” (DeRose, 1991, 597). But that leads to absurd results, i.e.

(119) It's raining \Rightarrow I know that it's raining. (false)

(120) I don't know that it's raining \Rightarrow It's not raining. (false)

- Moreover, there is a **pragmatic explanation** of the intuitive judgment that (118) is inconsistent:

- When one asserts that p , one represents oneself as knowing that p . Hence, when one goes on to say that one does not know that p in a locution of the form ‘ p , but I don't know that p ’, an inconsistency arises between what one asserts to be the case (in one conjunct) and what one *represents as being the case* (in the other conjunct).

- DeRose concludes:

- When we check for *genuine* inconsistencies, we must consider whether the relevant entailments could plausibly be thought to hold and whether there are potential deflationary (pragmatic) explanations available.

- (R2) The entailment from one conjunct of (117) to the negation of the other conjunct doesn't seem that implausible.

(121) It's possible that not- $p \Rightarrow?$ I don't know that p .

(122) I don't know that $p \Rightarrow?$ It's possible that not- p .

- One might object that there is a better deflationary explanation of the seeming inconsistency of (117). Since (203) holds, (117) entails (124)

(123) I know that $p \Rightarrow p$

(124) # It's possible that not- p , but p .

- And since (124) sounds inconsistent too, one might think that the putative inconsistency of (117) should be explained in terms of (124).

- But (124) is not genuinely inconsistent, since the negation of one conjunct of (124) is not entailed by the other conjunct. I.e.

(125) It's possible that not- $p \not\Rightarrow$ not- p .

- Given this, if the putative inconsistency of (117) derives solely from its entailing (124), then (117) is not *genuinely* inconsistent, since (124) is not *genuinely* inconsistent.

- But now consider how we would need to explain the seeming inconsistency of (124): If we explain this as we did with the Moore sentence, (118), we get that the reason that (124) seems inconsistent is because one is (a) asserting that it's possible that not- p but (b) simultaneously *representing oneself as knowing that p* .
- But obviously, that explanation makes sense only if *knowing that p* is genuinely inconsistent with the *possibility* of not- p .
- In other words, explaining the putative inconsistency of (117) in terms of (124) appears to require that it's presupposed that (117) is genuinely inconsistent!
- To sum up:
 - (126) # p , but I don't know that p .
 - (127) # It's possible that not- p , but p .
 - (128) # It's possible that not- p , but I know that p .
- Given the test for *genuine* inconsistency, viz. whether the negation of either conjunct is entailed by the other conjunct, only (128) is plausible candidate for being genuinely inconsistent. Both (126) and (127) can be (pragmatically) explained in terms of (128).

Possible *that* vs. Possible *for*

- According to Hacking the entailment in (129) holds, but the reverse does not.
 - (129) It's possible that I shall/will go \Rightarrow It's possible for me to go.
 - (130) It's possible for me to go \nRightarrow It's possible that I shall/will go.
- However, this alleged entailment cannot be handled by DeRose's (nor Hacking's own) theory.
- Luckily, the entailment does not hold. DeRose gives the following example. Suppose it's impossible for Frank to run a four-minute mile, but two friends of Frank are beginning to suspect that Frank is a track star.

We have uncovered very good evidence that Frank is on the track team. And he does have the build of a [four-minute] miler. Come to think of it, he has expressed a good deal of knowledge about who has held the world record in the mile at various points of time—more knowledge than he has expressed about any other event. This suggests that he might be a miler. And I've heard that all of the milers on our track team do run four-minute miles. So, while we can't be certain that Frank runs four-minute miles, it certainly is possible that he does. (DeRose, 1991, 604)

- However, (131) still seems false.

(131) It's possible for Frank to run a four-minute mile.

- The question now is why one would intuitively think that the entailment in (129) holds.
- DeRose argues that three plausible principles can explain our judgment.
 - (a) In flat out asserting that p , one represents it as being the case that one knows that p .
 - (b) "It's possible that p " is genuinely inconsistent with "I know that not- p ."
 - (c) If one doesn't know that x doesn't V , then one doesn't know that it's not possible for x to V .
- These three principles explains the clash of (132).

(132) It's possible that x V 's, but it is not possible for x to V .

- The feeling of inconsistency is now explained as follows:
 - (1.) If S asserts the first conjunct of (132), this entails that S doesn't know that x doesn't V . (according to principle (b).)
 - (2.) If S doesn't know that x doesn't V , then S doesn't know that it's not possible for x to V . (according to principle (c).)
 - (3.) By asserting the second conjunct of (132), S represents himself as knowing that it's not possible for x to V . (according to principle (a).)
 - (4.) (2.) and (3.) lead to an intuition of inconsistency.
- This now explains the judgment of inconsistency in (132), but the inconsistency is not *genuine*. Hence, we can maintain that the inference in (129) is invalid.
- If it was valid, there should be a genuine inconsistency between "It's possible that x V 's" and "It's not possible for x to V ". But, we already seen that there are strong reasons to think that these are not genuinely inconsistent.

80-880: Seminar on Philosophy of Language
Epistemic Modality and Natural Language

INSTRUCTOR: ANDERS J. SCHOUBYE
COURSE WEBPAGE: www.schoubye.net/modals.html

Lecture 5: Relativism

Egan, Hawthorne and Weatherson (EHW) on Epistemic Modals

- **The Central Question:** For a contextualist analysis of epistemic modals, the central question is what the class of epistemic agents are, and how this class is determined by context.
- **EHW's Key Claims:**
 - There are too many puzzles concerning the class of relevant epistemic agents for contextualism to come up with a plausible story.
 - On a relativist analysis, these puzzles have natural and elegant solutions.

First Puzzle

- **Background**

Professor Granger is in Prague and overhears Myles saying that she might be in Prague. Professor Granger was planning on going to Prague, but changed her plans in the last minute. Trying to figure out why Myles' assertion seems false, Professor Granger runs through the following short argument.
- (P1) When Myles says, 'She might be in Prague' he says that I might be in Prague.
(P2) When Myles says, 'She might be in Prague' he speaks truly iff neither he nor any of his mates know that I'm not in Prague.
(P3) Neither Myles nor any of his interlocutors know that I'm not in Prague.
(P4) If Myles speaks truly when he says that I might be in Prague, then I might be in Prague.
(P5) I know I'm not in Prague.
(P6) It's not the case that I know I'm not in Prague if I might be in Prague.

- These premises are jointly inconsistent, so which premise should we reject?
- EHW proposes to consider various versions of contextualism to see which premise must be given up and what consequences this will have.

Three Types of Contextualist Analyses and their Problems.

Contextualism Type I

- Recall DeRose's original suggestion.

S's assertion 'It's possible that p ' is true iff (1) no member of the relevant community knows that p is false, and (2) there is no relevant way by which members of the relevant community can come to know that p is false.

- Recall also DeRose's constraint on the relevant community — the **Speaker Inclusion Constraint (SIC)**

The relevant community always includes the speaker.

- Given the SIC, DeRose predicts that (P1) is false (when asserted by Professor Granger).

(P1) When Myles says, 'She might be in Prague' he says that I might be in Prague.

- Given the SIC, then in the mouth of Granger 'I might be in Prague' denotes a proposition whose truth depends on Granger's knowledge state. A proposition that is then obviously false. But that's not the proposition that Myles intended to express.
- In other words, **if the SIC is true, then one cannot report speech involving epistemic modals disquotationally**. But that's counter-intuitive since something like (P1) seems very natural.

Speech Reports

- Maybe (P1) really is false, i.e. maybe the problem is speech reporting itself.
- For example, (133) could mean two things when asserted by e.g. a milkman and a chemist.

(133) The bottle is empty.

- However, (134) seems appropriate.

(134) When the chemist says 'the bottle is empty', she says that the bottle is empty.

- But what about the chemist uttering (135). Maybe we would feel less “ambivalent” about denying that (135) sounds fine.

(135) The milkman said (truly) ‘the bottle is empty’, so the bottle is empty.

- That seems like something we would possibly like to deny is acceptable. If so, maybe speech reports *do* license contextual shifts.
- I.e. what seems to be going on here is that the semantic value of the context-sensitive “escapes” disquotation.

Belief Reports

- However, while the problem with words like ‘empty’ extends to belief reporting, this is not the case with ‘might’. For example, it’s unacceptable for the chemist to assert (136) (or (137)) in the context described above.

(136) The milkman believes that the bottle is empty.

(137) Since the milkman sincerely asserted ‘the bottle is empty’, the milkman believes that the bottle is empty.

- This is supposed to contrast with uses of ‘might’. Reporting on Myles’ beliefs, Granger could felicitously respond:

(138) Myles believes that I might be in Prague.

- In generalized form, the following inference pattern seems to be acceptable.

(139) A sincerely asserted “It might be that *S*” where *S* on that occasion of use meant *p*.
 ⇒ A believes that it might be that *p*.

- If the SIC holds universally, then if B makes the inference above, B is in effect inferring that A believes that for all B knows it might be that *p*—which is clearly incorrect.
- In other words, if the SIC holds universally, then anyone making the inference above is making a mistake.

The dialectics are a bit subtle here, but basically EHW are arguing that while one might think we should give up a disquotational principle for speech reports because of the problems we see with words like ‘empty’, these problems carry over to belief reports. But with words such as ‘might’ there are no identifiable problems with regards to belief reports. So, the disquotational principle shouldn’t be given up for might-claims.

Second Problem with Contextualism Type I: Temporal Modifiers

- Consider this example: A military instructor is telling his troops about how to prepare for jungle warfare. He says:

(140) Before you walk into an area where there are lots of high trees, if there might be snipers hiding in the branches, clear away the foliage with flamethrowers.

- The military expert is clearly not suggesting that if, for all HE knows, there are snipers hiding in the branches, the soldiers should do *x*. Nevertheless, if the SIC is strictly upheld, this is what one predicts.

It's not totally clear to me why EHW are talking about temporal modification here. This looks more like quantification over situations.

Contextualism Type II

- This is the same as Type I only it assumes that the SIC doesn't hold in certain environments, e.g. in the scope of *that*-clauses and "temporal modifiers".
- Given this restriction, one can accept that (P1) is true.
- The problem on this view is (P4).

(P4) If Myles speaks truly when he says that I might be in Prague, then I might be in Prague.

- Since the occurrence of 'might' in the consequent is not in the scope of a *that*-clause nor a "temporal modifier", the relevant community for that occurrence of 'might' must include the speaker. But if it includes the speaker, viz. Granger, the conditional is clearly false.
- We would also have to reject (141).

(141) If Myles has a true belief that I might be in Prague, then I might be in Prague.

- Since the occurrence of 'might' in the consequence is not in the scope of any temporal modifiers or *that*-clauses, the relevant community for that 'might'-claim is the speaker, again making the conditional false.
- EHW claim that the constraints concerning *that*-clauses and temporal modifiers are ad hoc.
- Finally, EHW argues that certain inferential patterns fail when these constraints on the SIC are imposed, e.g.

If this sounds OK to you consider: "If Bob speaks truly when he says that John is not tall, then John is not tall".

We're making the plausible assumption that the antecedent is true.

Would it really be bad to say that there is at least of reading of this on which it's false?

But are they?

- (1) Myles believes that it might be that ϕ .
- (2) Myles' belief is true.

\therefore So, it might be that ϕ .

- This is not valid since the 'might' in (1) can/must be evaluated with respect to a community not including the speaker (i.e. possibly just Myles), whereas the 'might' in the conclusion must be evaluated with respect to a community that includes the speaker.

- **Unembedded Violations of the SIC**

Ann is planning a surprise party for Bill. Unfortunately, Chris has discovered the surprise and told Bill all about it. Now Bill and Chris are having fun watching Ann try to set up the party without being discovered. Currently Ann is walking past Chris's apartment carrying a large supply of party hats. She sees a bus on which Bill frequently rides home, so she jumps into some nearby bushes to avoid being spotted. Bill, watching from Chris's window, is quite amused, but Chris is puzzled and asks Bill why Ann is hiding in the bushes. Bill says,

(142) I might be on that bus.

- One reason to think that this argument is not particularly strong, consider this case:

Ann is planning a surprise party for Bill. Unfortunately, Bill has not only discovered that Ann is planning the surprise, he has also told Ann that he's at work today and will be coming home, as usual, on the 4 o'clock bus. However, Bill has actually called in sick, and him and Chris are now having fun watching Ann try to set up the party without being discovered. Currently Ann is walking past Chris's apartment carrying a large supply of party hats. She sees the 4 o'clock bus which Bill ALWAYS rides home from work. Afraid that Chris will see her, she immediately jumps into some nearby bushes to avoid being spotted. Bill, watching from Chris's window, is quite amused, but Chris is puzzled and asks Bill why Ann jumped into the bushes. Bill says,

(143) I'm on that bus. good? felicitous?

Contextualism Type III

- The third contextualist theory that EHW considers is DeRose's original proposal where the SIC is completely abandoned.
- Here the relevant community for 'might ϕ ' can freely shift—the analogy being words like 'nearby' or 'local'. But, on this view, the problem with the initial argument is now (P6).

(P6) It's not the case that I know that I'm not in Prague if I might be in Prague.

- (P6) seems intuitively quite plausible, but it is nevertheless not true if the 'might' in the antecedent is not required to include the speaker.

Contextualism and Variables

- Jason Stanley (2000) has made the following claims:
 - All contextual effects on truth conditional content is traceable to variables in the syntax (taking pronouns, demonstratives and indexicals to be, or be associated with, variables)
 - There is evidence for the presence of a (aphonic/unarticulated/covert) variable in a sentence *S* iff there are readings of *S* that require a variable to be bound by a higher quantifier.
- Hence, if a contextualist analysis of 'might' is to be correct, we should expect there to be a variable (for the relevant agent) associated with 'might' and for it to be possible to construct sentences where this variable is bound by a higher quantifier. For example, (144) should have an interpretation along the lines of (145)

(144) Everyone might be at the party.

(145) For all *x*, it is consistent with what *x* knows that *x* will be at the party tonight.

- The problem, of course, is that (145) is not an available interpretation of (144).
- But this is not a good argument against contextualism, as EHW point out.
- von Stechow and Iatridou (2004) have already argued that in sentences such as (146), the epistemic modal always takes wide scope.

(146) Every *F* might be *G*.

- If that's correct, it's no surprise that there are no cases where the variable associated with 'might' is bound. Moreover, von Stechow and Iatridou do note that it's possible for epistemic modals to take narrow scope with respect to generic quantifiers.

(147) Before you walk into an area where there are lots of high trees, if there might be snipers hiding in the branches use your flamethrowers to clear away the foliage.

- In (147), it does seem as if this is a bound reading of the epistemic modal.

Evidence for hidden variables, e.g. traces: "Who do you want to succeed?"

Invariantism about Epistemic Modals

- On this proposed analysis, the relevant community for the epistemic modal is invariably “the world”.
- On this view, speakers are generally saying *false* things when they assert “it might be that ϕ ”, but the assumption is that various pragmatic principles can explain why communication nevertheless succeeds.
- It can be compared to the view that says that when A asserts “every student passed the exam”, A *literally* asserts that every student in the universe passed the exam. However, the *pragmatics* of domain restriction then explains why A is not typically interpreted as saying that.
- **Advantages to Invariantism**
 1. It’s simple (or rather, the semantic analysis is simple).
 2. Given an invariantist view, the premise in the initial argument that turns out to be false is (P2). This, EHW claim, is good, because (P2) has “weaker intuitive support” than the other premises.
 3. Eavesdropping cases are no longer hard to explain.
- Regarding eavesdropping cases, consider the following:

Holmes and Watson are using a primitive bug to listen in on Moriarty’s discussions with his underlings as he struggles to avoid Holmes’s plan to trap him. Moriarty says to his assistant

(148) Holmes might have gone to Paris to search for me.

Holmes and Watson are sitting in Baker Street listening to this. Watson, rather inexplicably, says ‘That’s right’ on hearing Moriarty uttering [(148)]. Holmes is quite perplexed. Surely Watson knows that he is sitting right here, in Baker Street, which is definitely not in Paris. But Watson’s ignorance is semantic, not geographic. He was reasoning as follows. For all Moriarty (and his friends) know, Holmes is in Paris searching for him. If some kind of contextualism is true, then it seems that [(148)] is true in Moriarty’s mouth. And, thought Watson, if someone says something true, it’s OK to say ‘That’s right’.

- On the invariantist analysis, it’s easy to explain why Watson shouldn’t say what he says.

Problems with Invariantism

- According to the invariantist analysis, (149)-(151) are inconsistent.

(149) x might be F

- (150) x might not be F
 (151) Someone knows whether x is F

- Pragmatic principles are supposed to explain this, the question of course is how.
- But the invariantist proposal, where one just accepts that people say false things all the time, has deeper problems, namely that this carries over to belief.
- In order to avoid attributing widespread inconsistent beliefs to speakers, i.e. the beliefs that might ϕ , that might $\neg\phi$, and that someone knows whether ϕ , the invariantist must again invoke pragmatics and say something like the following. Speakers might *believe* that they believe that might ϕ , but they don't.

Reporting Epistemic Modals

- Standardly when one reports other people's speech in terms of a belief, one cannot simply disquote. For example,

- (152) a. I'm really tired.
 b. #John believes that I'm really tired.

- (153) a. Spud Webb is too short. (said during NBA game)
 b. #John believes that Spud Webb is too short. (said before physical for pilot certificate)

- (154) a. The enemy has the advantage! (said by our enemies)
 b. #Someone believes that the enemy has the advantage! (said by one of us)

- The problem is that it seems that there are no problems with disquotational belief reports of epistemic modal speech. Suppose in the Watson/Holmes/Moriarty case that Holmes didn't hear what Moriarty said, and the following exchange takes place.

- (155) Holmes: "What did Moriarty think?"
 (156) Watson: "He thinks that you might have gone to Paris to search for him."

- This is a perfectly felicitous report for Watson to make, but there is a sense in which we should expect it to be infelicitous. So, contextualism for 'might' doesn't look like the quite right model here.

Summing Up

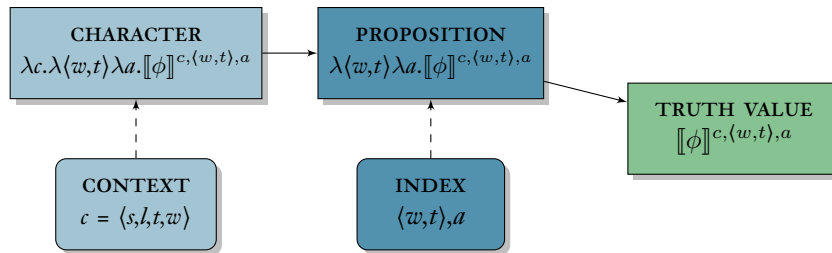
- EHW have presented six reasons to give up (various versions of) contextualism.
 1. Any contextualist view will have problems. Different variations will simply have different problems.
 2. Since there is no SIC for words like 'local' and 'enemy' (and these are the quintessential cases for a contextualist analysis), we shouldn't expect a SIC to hold for 'might'. But while it's easy to "shift" unembedded occurrences of 'enemy' and 'local' (so that their semantic value is not relative to the speaker), this is quite hard with epistemic modals (i.e. it only works when we are using the modal to explain or justify someone's behavior, or when they occur in embedded environments).
 3. Embedded and unembedded occurrences of 'might' behave very differently. 'Local' and 'enemy' are not analogous in this respect.
 4. If someone says 'the local bars are really good' when in Williamsburgh, NY, someone else could easily overhear and say 'that's true', i.e. agree. In contrast, Watson cannot felicitously assert 'that's true' when Moriarty says that Holmes might be in Paris searching for Moriarty. So, there are some disanalogies in terms of data concerning agreement/disagreement.
 5. When contexts shift, context-sensitive words cannot typically be disquoted in reporting. However, modals like 'might' appear to be unproblematic in this respect.
 6. The relativist theory has none of these flaws.

Relativism about Epistemic Modals

- There are a number of words that seem to be context-sensitive but which can be disquotationally reported, e.g.
 - (157) Vinny the Vulture: "Rotting flesh tastes great."
John: "Vinny thinks that rotting flesh tastes great".
 - (158) Marvin the Martian: "These are the same colour (*said of two colour swatches that look alike to Marvin*).
Brian: "Marvin thinks that these are the same colour".
- Notice that these seem perfectly felicitous and also that it would be infelicitous for the reporter to agreeing by saying e.g. 'that's true'.
- For words such as these, a relativist treatment is a good option.
- **Key Relativist Claim**

The truth of an utterance containing an epistemic modal is *relative* to a context of evaluation, i.e. not just relative to a world and time.

- The relevant community can thus be conceived of here as a parameter of the index (or the circumstance of evaluation).



- **First Problem:** Assertability Conditions
- If the truth of ‘might ϕ ’ is relative to a context of evaluation, when is it appropriate to assert ‘might ϕ ’?
- EHW argue: The correct norm is to assert only when the claim is true relative to the context you are in.
- Given this norm, Myles’ statement and Moriarty’s statements are appropriate even though some of their audience members know that “they speak falsely”.

Does it even make sense to say that they speak falsely though?

This helps explain, we think, the somewhat ambivalent attitude we have towards speakers who express epistemic modals that are false relative to our context, but true relative to their own. What the speaker said wasn’t true, so we don’t want to endorse what they said. Still, there is a distinction between such a speaker and someone who says that the sky is green or that grass is blue. That speaker would violate the properly relativized version of the only say true things rule, and Myles and Moriarty do not violate that rule. (Egan *et al.*, 2005, 156)

- Since relativists hold that the truth of an utterance is relative to a context of evaluation, they must deny at least one of the following

A1 **Absoluteness of Propositional Content:** If an utterance expresses the proposition p relative to some context of evaluation, then it expresses that proposition relative to all contexts of evaluation.

Example: If an assertion of the sentence ‘You are tired’ expresses the proposition that Bob is tired relative to one context of evaluation, it expresses that proposition relative to all contexts of evaluation.

A2 Absoluteness of Propositional Truth-Value: If a proposition p is true relative to one context in a world it is true relative to all contexts of evaluation in that world (e.g. if ‘Bob is tired’ is true relative to one context of evaluation, it’s true relative to all).

- Accepting both (A1) and (A2) yields what EHW call *Absoluteness of Utterance Truth*.
- **Two Types of Relativism:** Content Relativism (A1) and Truth Relativism (A2)

Content Relativism

On this view, the proposition *expressed* by ‘might ϕ ’ varies across contexts of evaluation. For example, ‘might ϕ ’ will express one proposition relative to Moriarty and a different proposition relative to Watson and Holmes.

Truth Relativism

On this view, the proposition *expressed* by ‘might ϕ ’ remains stable (same proposition is expressed across different contexts of evaluation), but the truth value of this proposition will vary with contexts of evaluation.

- **Problems for Content Relativism**

- (a) Embeddings of ‘might’ in belief reports:

(159) Moriarty believes that Holmes might be in Paris

- When (159) is asserted by Watson, content relativism predicts that (159) says that—relative to Watson—Moriarty believes that as far as Watson knows, Holmes is in Paris. This is clearly not correct.

How is truth relativism supposed to make correct predictions without making various assumption about what happens when epistemic modals occur in embedded positions?

- (b) The social function of assertion: The content relativist will have to give up the plausible Stalnakerian principle that to assert a proposition p is to propose that p be added to the common ground. The reason is that on the content relativist view, there is no unique proposition asserted.

Again, doesn’t truth relativism face a variant of this problem?

- (c) Temporal modifiers: On the content relativist view, (160) is false relative to more or less everyone.

(160) The Trojans were hesitant in attacking because Achilles might have been with the greek army.

- (d) Content relativism and commands.

(161) If it might rain, bring your umbrella

- An agent who complies with this command on Monday will nevertheless be predicted to not have complied with the command the day after (if on the previous day it didn't rain).

- **Truth Relativism to the Rescue**

- On one standard conception of *propositions*, these are functions from worlds to truth values.
- On the relativist view, propositions are not true or false relative to worlds, but rather relative to positions within in worlds—*centred worlds*.
- Propositions on the relativist view can thus be construed as functions from world-individual pairs to truth values.

- **Truth Relativism's Solution to the Problems Above**

- (a) With respect to (159), truth relativism predicts the following:

When one says that *a believes that b might be F*, one says that *a* believes the proposition *b might be F*. And *a* believes that proposition iff *a* believes it is consistent with what they know that *b* is *F*. And that prediction seems to be entirely correct. It is impossible for Watson to use [(159)] to mean that Moriarty believes that for all Holmes knows he is in Paris, or that for all Watson knows Holmes is in Paris. This seems to be an interesting generalization, and while it falls out nicely from the truth relativist theory, it needs to be imposed as a special constraint on contextualist theories. (Egan *et al.*, 2005, 158)

How does truth relativism predict this without making assumptions about the semantics of the attitude verb? And with those assumptions in place, why would a contextualist analysis be less desirable?

- (b) According to EHW, the truth relativist can maintain the Stalnakerian picture of assertion since on their view a unique proposition *is* expressed by 'might ϕ '.

- (c)/(d) The truth relativist can now also explain the problems with temporal modifiers and commands. EHW write:

In general it seems that the truth of an explanatory claim of the form, *X ϕ ed because p* depends only on whether *p* is true in *X*'s context (plus whether the truth of *p* in *X*'s context bears the right relation to *X*'s fing). Whether or not *p* is true in our context is neither here nor there. [...] [(160)] can be true because Achilles might have been with the Greek army could be true relative to the Trojans. (Egan *et al.*, 2005, 159)

They don't explain how though and it's not entirely clear how this is supposed work. I.e. what set-theoretic operation are we supposed to perform when someone utters a centred proposition?

Again, here the relevant explanation seems to rely on assumptions about 'because'-clauses. Would a contextualist not be in a position to use the same explanation?

- **Truth Relativism's Solution to the Initial Argument**

- Distinction between $\text{true}_{T(\text{-schema})}$ and $\text{true}_{B(\text{inary})}$.
- True_B denotes a (binary) relation between an utterance and a context of evaluation. This is not a relativist concept. Suppose *p* is true_B (relative to *C*). In that case, relative to all *C'*, *p* is true_B (relative to *C*).

- (162) Vinny: "Rotting flesh tastes great."
- (163) Vinny's Brother: "That's true."
- (164) John: "What Vinnie's brother said is false."

- (162) is true_B relative to Vinny's (and his brother's) context (of evaluation) and but false_B relative to John's context.
 - True_T is a unary (and relative) concept. It says: *S is true_T iff S will be true_B relative to any context.*
 - I.e. if A asserts that S is true_T , A asserts that—relative to each individual's context—S is true_B .
 - Vinny's brother says that Vinny's utterance is true_T and that's right since relative to Vinny's brother's contexts of evaluation, "Rotting flesh tastes great." is true_B .
 - However, Vinny's brother's statement is false_T relative to John's context of evaluation since "Rotting flesh tastes great" is false_B relative to John's context of evaluation. So, John spoke truly.
- The problem with the initial argument is thus either (a) or (b).
 - (a) If "Myles spoke truly" means that Myles said something true_T , then (P2) is false.
 - (b) If "Myles spoke truly" means that Myles said something true_B , then (P4) is false.

80-880: Seminar on Philosophy of Language
Epistemic Modality and Natural Language

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Lecture 6

Epistemic Modals are Assessment-Sensitive – MacFarlane

Solipsistic Contextualism (SC)

- (SC): The truth (and falsity) of an epistemic modal claim depends on the knowledge state of the speaker. (Contextualism + Speaker Inclusion Constraint)
- (SC) is intended to explain two (otherwise puzzling) facts:
 - a. It explains why it is appropriate to make epistemic modal claims on the basis of ignorance: “Joe might be in Boston.”
 - b. It explains the infelicity of (Moore-) paradoxical sentences such as:

(165) Joe might be in Boston, but I know that he isn't
(166) Joe might be in Boston, but he isn't.

Problems for (SC)

- **The General Problem for (SC): Disagreement**
- **Problem 1: Third Person Assessments**
There is a disanalogy between third person assessments of truth values of assertions of the form ‘might ϕ ’ and ‘for all I know, ϕ ’.
- I.e. suppose Joe is in New York. Moreover, suppose that Sue has reason to believe that Joe is in Boston and while talking to some friends, she asserts either (167) or (168).

(167) For all I know, Joe is in Boston.
(168) Joe might be in Boston.
- Here most people judge that (167) is true, but that (168) is false.

- **Problem 2: Retractions**

According to MacFarlane, it is natural to retract modal claims if e.g. an interlocutor provides information that the prejacent is in fact false.

- (169) a. Sue: “Joe might be in Boston”.
 b. Jack: “No, he can’t be. I just saw him five minutes ago”.
 c. Sue: “OK, scratch that then. I guess I was wrong”.
 d. ? Sue: “OK, then he can’t be in Boston. But I stand by what I said a second ago”.

- But if (SC) was correct, it would be strange to *ever* retract an epistemic modal claim and it should be natural to stand by it.

- **Problem 3: Disputes**

- Consider again (169). One would think that Jack’s assertion is intended to reach consensus and to resolve a question under discussion. It is therefore crucial that one understands Jack’s assertion as *contradicting* or disagreeing with Sue’s assertion.

- But (SC) cannot account for this intuitive disagreement. According to (SC), Jack and Sue are simply making claims about their own epistemic states.

- **Possible Reply**

- Allow uses of epistemic modals to have freely shifting perspectives (on the model of *local*) — I.e. give up the speaker inclusion constraint.

- That won’t help, because in that case, Jack would simply be denying that ϕ is possible with respect to Sue’s belief/knowledge state which is not general enough. Jack is making a more general claim.

- Possible Response: Widespread Error (Theory)

Nonsolipsistic Contextualism (NSC)

- One option is to adopt a broader view according to which the truth of epistemic modal claims depend on not only on the belief/knowledge state of the speaker, but rather on the accumulated beliefs/knowledge of a group.

- This view explains the retraction data. If the relevant body of knowledge includes the interlocutor, it is easy to explain why the speaker would retract (the speaker was simply wrong about what the common body of beliefs/knowledge entailed).

- The view can also explain (assuming the speaker inclusion constraint) why (165) and (166) are somehow anomalous.

- **Problems for (NSC):**
- **Speaking Falsely:** Consider again (167) and (168).
 - To explain why we judge that Sue spoke falsely when she asserted (168), it would have to be assumed that when we assess Sue’s assertion, we are suddenly part of the relevant group of discourse participants — despite the fact that Sue might have no idea who we are.
 - More generally, to explain the data, (NSC) must implausibly assume that the relevant group of knowers must be expanded to anyone ever in a position to assess the claims.
- **Retractions**
 - Same problem with retractions. If someone was to jump in and offer more information, this would justify retracting, the relevant group of discourse participants must be expanded include potentially anyone.
- **Trivializing (NSC)**
 - This makes (NSC) useless — it essentially becomes equivalent to invariantism:
 - ‘might ϕ ’ will be true iff *no one* is in a position to rule out that ϕ is false.
 - The resulting predictions are that a very large number of completely standard (and generally permissible) uses of epistemic modals are plainly false. In turn, this makes it completely mysterious why anyone would ever risk making assertions of the form ‘might ϕ ’.

Alternative Expansions of the Relevant Belief/Knowledge Base

- **Hacking (1967):** Epistemic modal claims are sensitive to objective factors, for example whether the relevant group of knowers *could come to know* through some practicable investigation.
- ‘might ϕ ’ is true iff *what is in the epistemic reach of the relevant believer/knower (or group of believers/knowers)* does not rule out ϕ .
- MacFarlane writes,

I am skeptical that speakers make any implicit distinction in their use of epistemic modals between “practicable” and “impracticable” investigations, or between what they can easily come to know and what they can come to know only with difficulty or by the cooperation of fate. For example, it seems correct to say that people who used to think that it was possible that there were even numbers greater than 2 and less than 10^{17} that were not the sum of two primes were wrong—since we have now now verified computationally that there cannot be any such numbers—even though this computation was not a practicable investigation for *them*. (MacFarlane, 2011, 153)

This seems correct, but what about the lottery case. It does not seem right to say after the numbers have been drawn that S’s assertion “I might win” was false.

- Moreover, it can be felicitous to assert ‘might ϕ and might not- ϕ ’ while acknowledging that a practicable investigation might rule out one possibility. This doesn’t seem consistent with Hacking’s analysis. For example

(170) The treasure might or might not be located in this bay. Let’s check the log.

- (170) should sound infelicitous according to Hacking’s analysis, but it does not.

General Conclusion about Contextualist Approaches

- The less solipsistic the theory becomes, the more difficult it is to explain why it makes sense to make epistemic modal claims.
- MacFarlane concludes that the real tension here is between two types of data:
 - Data focusing on the speaker’s epistemic state: If only facts known to the speaker are attended to, (SC) looks like the right view.
 - Data focusing on assessments of the epistemic modal claim: If facts not known to the speaker are attended to, something like (NSC) seems required.
 - Problem is that when one moves to (NSC), the data originally motivating (SC) can no longer be explained.

We are led to a kind of paradox: although the truth of a claim made using epistemic modals must depend somehow on what is known—that is what makes it “epistemic”—it does not seem to depend on any *particular* body of knowledge. And there is no way to account for this in the framework of contextualism, which requires that the relevant body of knowledge be determined by features of the context of use. The fundamental problem with Solipsistic Contextualism lies with its Contextualism, not its Solipsism. MacFarlane (2011)

A Non-Truth Conditional Alternative

- **Modals as Force Modifiers:** Perhaps modals should be treated as simple force modifiers as in (171).

(171) Speaking frankly, she’s too good for him.

The truth of (171) seems to depend only on the embedded clause, not on the speech act indicator.

- Asking what truth conditional contribution ‘speaking frankly’ makes is a misguided question. The thought is that this might also be a misguided question for modal claims in general.

- However, while it's easy to identify what *is* expressed by (171), it's not so clear what would be expressed by 'might ϕ ' if we assume that 'might' is simply a force modifier.
- A couple of suggestions about a force modifier meaning of might:
 - Might ϕ : I have a minimal degree of credence in ϕ .
 - Might ϕ : Do not overlook the possibility that ϕ .
- **Embedding Problems** (Frege/Geach): On this (fairly vague sketch of a non-truth conditional) view of modals, one is hard pressed to account for the meaning of modals as these occur in various embeddings, e.g. under negation, in conjunctions, under attitude verbs, in conditionals etc.
- There is a disanalogy here between modals and standard force modifiers such as 'speaking frankly', because the latter do not happily embed.

(172) a. If it might be raining, we should bring umbrellas.
 b. # If speaking frankly she's too good for him, she'll realize this.

(173) a. It's not possible that Joe is in Boston.
 b. # It's not the case that speaking frankly, Joe is in Boston.
- **The Problem of Retraction:** On the force modifier approach, it's not clear why someone would ever retract a modal claim, i.e. say 'OK, so I was wrong.' in the face of new information.

Relativism to the Rescue

- On the relativist approach, two types of contexts are distinguished, namely
 - **Context of Use:** the setting for an actual or possible use of a sentence (or proposition) in a speech act or mental act.
 - **Context of Assessment:** the setting from which such a use is being assessed for truth or falsity on some actual or possible occasion of assessment.
- **MacFarlane's central claim**

Truth, reference, and other semantic properties can depend on not just features of the context of use, but features of the context of assessment — in other words, there is not just context-sensitivity in natural language, there is also assessment sensitivity.
- I.e. the truth of epistemic modal claims are assessment sensitive, i.e. their truth depends on (and hence is relative to) what is known by various assessors. Epistemic modal claim thus have no "absolute" truth values.
- So, a sentence like 'Joe might be in Boston' could be true relative to the speaker while being false relative to an assessor with more information.

Explaining the Data

- **Third party assessments**, cf. examples (167) and (168)

(167) For all I know, Joe is in Boston.

(168) Joe might be in Boston.

- Since the truth of an epistemic modal claim depends on what the assessor knows, explaining third party assessments is straightforward: Relative to an assessor's point of view (an assessor with more information), (168) is straightforwardly false whereas (167) is straightforwardly true.
- Whereas the (NSC) view had trouble explaining *why* Sue would assert (168) to begin with, this is easy to explain for the relativist. (168) is true relative to the context of assessment that Sue inhabits.

But doesn't solipsistic relativism have a similar problem here?

- **Retraction Data**, cf. example (169)

- The relativist can also easily explain why it is natural for Sue to retract in (169c).
 - After the addressee informs Sue that Joe cannot be in Boston, she will now assess her previous claim from a new context of assessment—a context where she has information ruling out that Joe is in Boston.
 - Similarly, if Sue was to come to know that Joe can't be in Boston through some other source (perhaps by investigating the issue herself), it would be perfectly natural for her to retract her earlier claim and it would also be easy to explain this on the relativist picture.

- **Explaining Disputes**, cf. example (169)

- According to MacFarlane, the relativist can make sense of the disagreement in (169), whereas the contextualist cannot.

However, how does one disagree over a perspectival proposition?

- There is a proposition the truth of which is being debated — it just so happens that the truth of this proposition is perspectival.

Compositional Semantics

- Showing that a relativist semantics for epistemic modals can deal with embedded uses of modals.

A Simple (Solipsistic) Contextualist Semantics

- A finite definition of “true at a context c ”. Method, give a recursive definition of truth at a *point of evaluation* and define truth at a context of use in terms of truth at a point of evaluation.

- Point of Evaluation: $\langle c, w, i, a \rangle$ (context, world, information state, assignment)

Collapsing context and index in the style of Lewis (1980)

- **Truth:** $F(\alpha)$ is true at $\langle c, w, i, a \rangle$ iff $\text{EXT}(\alpha)^{\langle w, c, i, a \rangle} \in \text{EXT}(F)^{\langle w, c, i, a \rangle}$

$\llbracket \text{might } \phi \rrbracket^{\langle c, w, i, a \rangle} = 1$ iff for some w' in i , ϕ is true at $\langle c, w', i, a \rangle$

$\llbracket \text{For all } \alpha \text{ knows at } \tau, \phi \rrbracket^{\langle c, w, i, a \rangle} = 1$ iff ϕ is true at $\langle c, w', i', a \rangle$, where i' is the set of worlds not excluded by what is known by $\alpha^{\langle c, w, i, a \rangle}$ at $\tau^{\langle c, w, i, a \rangle}$ and $w' \in i'$

- These are equivalent — see (MacFarlane, 2011, fn.20)

• Truth at a Context

An occurrence of a sentence ϕ at a context c is true iff ϕ is true at every point of evaluation $\langle c, w_c, i_c, a \rangle$ (where a is an assignment of objects to variables from the “domain relevant at c ”).

- Note: Truth at a Context is defined only for sentences (viz. formulas with no free variables).

• Logical Truth

sentence ϕ is *logically true* iff for every possible context of use c , ϕ is true at c .

• Logical Consequence

a sentence ϕ is a *logical consequence* of a set Γ iff for every possible context of use c , if every member of Γ is true at c , then ϕ is true at c .

• Logical Necessity

a formula Φ is *logically necessary* iff for every point of evaluation π , Φ is true at π .

- Now, logical necessity \Rightarrow logical truth, but the opposite direction doesn't hold. (for example, consider the sentence ‘I am here now’.)

- Given these definitions, the semantics for ‘*might* ϕ ’ and ‘For all α knows at τ , ϕ ’ turn out to be logical consequences of each other.

A Simple (Non-Solipsistic) Contextualist Semantics

- To make the semantics less solipsistic, we can simply change what the i -parameter ranges over.

– Let i_c = the set of worlds that are not excluded by what is known *distributively* at c — or by *the group of knowers relevant at c* .

– Let i_c = the information relevant at c .

The important thing to notice here is that when we're considering truth at a context, the context determines the relevant world and information state of the points of evaluation.

A Simple Relativist Semantics

- To make the semantics relativistic, the recursive definition of truth at a point of evaluation needs not be modified.
- What must be changed is the definition of truth at a context (or contexts!). I.e.

- **Truth at a Context of Assessment**

An occurrence of a sentence ϕ at a context of utterance c_U is true as assessed from a context of assessment c_A iff ϕ is true at every point of evaluation $\langle c_U, w_{c_U}, i_{c_A}, a \rangle$, where:

w_{c_U} = the world of the context of utterance.

i_{c_A} = the set of worlds not excluded by what is known at the context of assessment by the agent of the context of assessment.

a = an assignment of objects from the domain relevant at c to the variables.

- **Logical Truth**

A sentence ϕ is *logically true* iff for every possible context of use c_U and context of assessment c_A , ϕ is true as used at c_U and assessed from c_A .

- **Logical Consequence**

A sentence ϕ is a *logical consequence* of a set Γ of sentences iff for every possible context of use c_U and context of assessment c_A , if every member of Γ is true as used at c_U and assessed from c_A , then ϕ is true as used at c_U and assessed from c_A .

- **The Non-Equivalence of 'FAK_{now}^I: ϕ ' and 'might: ϕ '**

Given these amendments to the semantics, 'For all I know now, ϕ ' and 'might ϕ ' are no longer equivalent, because the latter is assessment-sensitive which the former is not.

- I.e. the semantics of 'FAK_{now}^I: ϕ ' will force the relevant information state to be the speaker's at c_U , whereas this is not the case for 'might: ϕ '.
- These are however *diagonally equivalent* — for example, in situations where c_U and c_A coincide, both are either true or both are false.

Monadic Truth

- The relativist has two truth predicates:
 - Truth of a formula at a point of evaluation.
 - Truth of a sentence at a context of use and a context of assessment.
- What about the ordinary language predicate 'true', i.e. the truth predicate that applies to propositions? MacFarlane says:

- Assume that there are propositions.
- Assume that propositions have truth values relative to worlds but also relative to information states (viz. sets of worlds not excluded by what is known).
- Since the truth-predicate of natural language is monadic, it has no argument places for information states. The semantic theory must specify how those are filled in.
- Answer: They are extracted from points of evaluation, so:

The extension of ‘True’ at a point of evaluation $\langle c_U, w, i, a \rangle$ is the set of propositions p such that p is true at $\langle w, i \rangle$

Some Problems for Relativism

The Lottery Case

- Hacking’s lottery case: A man buys a ticket and loses. Retrospectively we do not want to say, Hacking claims, that it was not possible that he would win. I.e. (174) seems true.

(174) It’s possible that he would win.

- On the face of it, this looks like a problem for the relativist, since (174) is predicted to be false when judged from our context of assessment.
- MacFarlane responds:

- The embedded clause “he would win” is in the subjunctive. This indicates that the use of ‘possible’ is not epistemic. In comparison, (175) sounds false.

(175) It was perfectly possible that he had the winning ticket.

- Second, MacFarlane claims that if one assumes that the universe evolves deterministically, then (174) sounds false. But whether the universe evolves deterministically or not should not influence or truth value judgments about (174).

But what about “he might have won” or “he didn’t win but he might have”.

Ignorant Assessors

- A variant of Dietz case: Suppose Bob is in Boston and that Jack knows this. Suppose further that Jack asserts (176)

(176) Bob cannot be in New York.

- Now, it seems that if Sue does not know that Bob is in Boston, and hence does not know that Jack knows that Bob is in Boston, it should then be true for her to say (177), after overhearing Jack's assertion.

(177) Jack is wrong. Bob might be in New York.

- But this seems false.
- MacFarlane suggests, as a solution, that whose knowledge is relevant to the evaluation of an epistemic modal claim is itself determined by the context of assessment. I.e. the following revision:

- **Flexible Relativism**

- **Truth at a Context of Assessment**

An occurrence of a sentence ϕ at a context of utterance c_U is true as assessed from a context of assessment c_A iff ϕ is true at every point of evaluation $\langle c_U, w_{c_U}, i_{c_A}, a \rangle$, where:

w_{c_U} = the world of the context of utterance.

i_{c_A} = the set of worlds *not excluded by the information that is relevant at the context of assessment*.

a = an assignment of objects from the domain relevant at c to the variables.

- So, in some cases the information relevant to the context of assessment will be the knowledge of the speaker in the context of utterance. This is then supposed to be enough to avoid the problem.

Concluding Remarks

- Contextualist accounts cannot make sense of retrospective assessments, retractions, nor disagreement.
- Expressivist accounts cannot account for retractions nor disagreement, and cannot explain embeddings.
- Relativism can do all of these things.
- Problems for relativism include interactions with temporal modifiers (but every account faces this problem).
- Remaining problems are philosophical problems, i.e. making sense of an assessment-sensitive truth predicate.

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Lecture 7

Relativism vs. Contextualism

CIA Leaks – von Fintel & Gillies

- **CIA Theory**
 - Contexts of Utterance
 - Indices of Evaluation (Circumstance of Evaluation)
 - Assessment Points
- CIA theorists include Egan *et al.* (2005), MacFarlane (2011), Lasersohn (2005)

The Standard Theory (The Canon)

- Logical form of (178) given by (179), where B restricts the domain over which ‘might’ quantifies. (standard Kratzerian picture — tripartite structure of modal statements, B is the modal base)

(178) Billy might be at the party.

(179) $\text{might}(B)(\phi)$

- Epistemic modals quantify over possibilities compatible with *what is known* — or possibilities *compatible with the available evidence / information at hand* in the context.

(180) $\llbracket B \rrbracket^{c,i} = \{v : v \text{ is compatible with the } c\text{-relevant information at } i\}$

- $\llbracket \text{might}(B)(\phi) \rrbracket^{c,i} = 1$ iff $\exists w' \in \llbracket B \rrbracket^{c,i} : \llbracket \phi \rrbracket^{c,\langle w',t_i \rangle} = 1$
- $\llbracket \text{must}(B)(\phi) \rrbracket^{c,i} = 1$ iff $\forall w' \in \llbracket B \rrbracket^{c,i} : \llbracket \phi \rrbracket^{c,\langle w',t_i \rangle} = 1$

The Master Arguments for CIA Theories: Disagreement

- Retractions and Disagreement

- MacFarlane (2004):

- (181) a. **Sally**: “Joe might be in Boston.”
 b. **Joe**: “He can’t be. I saw him just five minutes ago.”
 c. **Sally**: “Oh, then I guess I was wrong.”
 d. **#Sally**: “Oh OK. So he can’t be in Boston. Nonetheless, when I said “Joe might be in Boston,” what I said was true, and I stand by that claim.

- Egan (2007) — Eavesdroppers.

Cases of modal disagreement like these seem to pose a dilemma for the canon. On the one hand, each asserter of a might-claim is perfectly within their (linguistic and epistemic) rights to say what they said, and the thing they end up saying seems true. Given the facts about her utterance situation, (the early) Sally seems to be saying that Joe’s being in Boston is compatible with the facts she had at the time of utterance. And that seems true. Given the facts about his utterance situation, Blofeld seems to be saying that Bond’s being in Zürich is compatible with the facts he had at the time of utterance. And that seems true. But, on the other hand, we get the sense that there is a disagreement between you and Kratzer, between Sally and George, between Sally and her earlier self, and between Blofeld and Leiter. In each case, one of the parties assents to a might-claim that the other denies. [...]

The CIA theory says we can dodge the choice: the semantics of epistemic modals is relative not only to a context and index, but also to an assessor—someone, somewhere, who is doing the interpreting. Information at the point of assessment—roughly, what the assessor knows—enters into the semantics, determining the possibilities that the modals quantify over. (von Fintel and Gillies, 2008, 80)

Relativistic Semantics

- Judge Dependent Semantics (notice in particular the definition of the modal base)

- (182) a. $\llbracket \text{might}(B)(\phi) \rrbracket^{c,i,a} = 1$ iff $\exists w' \in \llbracket B \rrbracket^{c,i,a} : \llbracket \phi \rrbracket^{c,\langle w',t_i \rangle,a} = 1$
 b. $\llbracket \text{must}(B)(\phi) \rrbracket^{c,i,a} = 1$ iff $\forall w' \in \llbracket B \rrbracket^{c,i,a} : \llbracket \phi \rrbracket^{c,\langle w',t_i \rangle,a} = 1$
 c. $\llbracket B \rrbracket^{c,i,a} = \{v : v \text{ is compatible with what } j_a \text{ knows at } t_a \text{ in } w_a\}$

Problems for the CIA theories - Data

- **Problem 1: Unstable Retraction Data**

However, is this example covered by MacFarlane's distinction between *being wrong in claiming that p* and *being wrong to claim that p*?

- (183) a. **Alex**: “The keys might be in the drawer.”
 b. **Billy**: (*looks in the drawer, agitated*) “They’re not. Why did you say that?”
 c. **Alex**: “Look, I didn’t say that they *were* in the drawer. I said that they *might be* there—and they might have been. Sheesh.”

- **Problem 2: Conditional *Mights***

- (184) a. If John is not in his office, he might be in New York.
 (*later we discover a note in John’s office saying he’s in Boston*)
 b. ?? I guess I was wrong then.

- von Fintel and Gillies conclude: *Solipsistic readings* of epistemic modals are almost always available.
- Moreover, intuitions in eavesdroppers cases and disagreement cases are not robust—which should be explained by our theory. CIA-theories are not equipped to do this.

But, neither would it seem are standard contextualist theories.

- **Problem 3: Disagreement Tracking**

- Question: What is disagreement and how do we track it?

Or think about the cases from Huvenes (2011) I mentioned last week: A: “I like this chili”, B: “No, it’s too hot for me”.

- (185) a. A: “I think it’s raining.”
 b. B: “No, it isn’t”/“No, it can’t be.”
 c. ?? B: “No, you don’t.”

- No disagreement in (185b) with *the proposition expressed* by A’s utterance of (185a). In contrast, (185c) is infelicitous.
- So even if there is an *intuitive sense* of disagreement in (185), there is no disagreement — why should we not think the same about the epistemic modal cases.
- **Problem 4: Flexibility in Responses to Modal Claims:**

Game of Mastermind. Mordecai gives Pascal hints about the solution. Pascal says (186). Mordecai knowing the solution can respond using any of (186a)-(186d).

- (186) There might be two reds.
 a. That’s right. There might be.
 b. That’s right. There are.

- c. That's wrong. There can't be.
- d. That's wrong. There aren't.

- It's not clear that the CIA-theories do anything towards explaining this flexibility in possible responses.

- **THE OVERARCHING WORRY:**

On the one hand, it is relatively easy to construct cases in which we have pretty robust intuitions that: (i) a prior might-claim is perfectly acceptable; (ii) some intervening discourse reveals some new facts; and (iii) that same might-claim could not be acceptably uttered in the posterior situation. But all parties are—or should be—agreed that no pro-CIA conclusion follows from this. What is needed is evidence that the proposition expressed by the prior might-claim goes from true to false: and that is data that, roughly put, bridges the gap between denying an earlier claim and disagreeing with it. (von Fintel and Gillies, 2008, 84)

- **Problem 5: Time Lag**

- On CIA-theories, the modal base is determined relative to *the context of assessment* a , cf. (182c).
- Assuming, plausibly, that knowledge accumulates, the set of worlds compatible with assessment points will be comparatively smaller for each later assessment point.
- It should become comparatively harder for might-claims to be true as the set of worlds compatible with the judge's information contracts. In other words, it is harder for a simple might-claim to be true for an assessor in a later context of assessment a (where $t_a > t_c$) than it is the claim to be true in the original context of utterance c .

But the facts go the other way: as t_a gets much later than t_c , it becomes increasingly silly to go in for the sort of rejection that the CIA predicts. Suppose we are putting a randomly chosen card in an envelope. You catch a glimpse of the card and know that it is a black-suited face card. You say [(187a)]. Then, ten years later when we open the envelope—it's the Jack of Clubs—we cannot complain with [(187b)].

- (187) a. You: It might be the King of Spades.
 b. ?? Us (*ten years later*): Wrong!/What you said is false!

(von Fintel and Gillies, 2008, 86)

Question: Is the argument here any different than their previous argument about the lack of robustness in retraction/disagreement data?

- **Problem 6: Index-Shifting Operators, e.g. Tense Operators.**

- On the CIA-theories, the modal base is determined relative to assessment points (i.e. individuals). This contrasts the standard contextualist theory on which the modal base is determined relative to the index (and hence the parameters in the index).
- This means that the modal base (the worlds over which the modal quantifies) is not sensitive to operators that shift parameters in the index. For example,

(188) *Suppose Sue explains her rummaging through the freezer by asserting (188a).*

 - a. There might have been ice cream in the freezer.
 - b. PAST(*might*(ice cream in the freezer))
- Assuming that PAST is an operator whose function is to shift the time of the index (i.e. shift t in i to t' where $t' < t$), the standard theory straightforwardly predicts that the sentence in (188a) is true.
- The relativist has a problem here. Since a is determined solely by the relevant assessor, the shift of the time parameter in the index has no influence on the truth conditions. Hence, (188a) is predicted to be false.

The basic point is that CIA theories insist that the index of evaluation is pretty much invisible to, and irrelevant for, the interpretation of epistemic modals. This is conceptually pretty awkward: the CIA requires us to jettison the nifty way of dealing with embeddings in a general way. And it is also empirically pretty embarrassing: many a *might*-claim outscopied by a past tense operator is predicted to be false (so long as at a the prejacent of the might is known to be false). (von Fintel and Gillies, 2008, 87-88)

• **Problem 7: Aggregating Modal Information.**

- Consider the following scenario:

The Boss has two informants, Jack and Zack. There is a meeting of spies in a room, and The Boss, Jack, and Zack know that one and only one of their (conveniently named) comrades P , Q , R is a turncoat. Jack looks through his peep hole and sees clearly that it is either P or Q who is the turncoat, and Zack looks through his peep hole and sees clearly that it is either Q or R who is the turncoat. Each slips The Boss a note informing him: (von Fintel and Gillies, 2008, 88)

- (189) a. [From Jack]: It must be that either P is the turncoat or Q is the turncoat.
 b. [From Zack]: It must be that either Q is the turncoat or R is the turncoat.

- On a standard contextualist analysis, Jack's assertion expresses a proposition whose truth depends on information ruling out R . Similarly for Zack and P . So, the Boss is in a position to infer that Q is the turncoat.

- In contrast, on the relativist analysis, the Boss evaluates Jack's and Zack's statements from his context of assessment. And since the Boss' context of assessment contains both *R*- and *P*-worlds, both statements are predicted to be false.

- **Problem 8: Modal Disjunctions (and Conjunction)**

- Consider (190) below.

(190) Joe might be in Boston or he might be in New York.

- (190) is an instance of a *free-choice* disjunction—i.e. it entails both its disjuncts, viz. (190a) and (190b)

(190) a. Joe might be in Boston.
b. Joe might be in New York.

- Here, the relativist predicts that if Mary happens to know that Joe is in New York, Mary disagrees with the speaker of (190) and can felicitously state this disagreement. I.e. (191) should be a felicitous response.

(191) ?? No/That's False! Joe is in New York.

- Retracting is equally strange.

(192) ?? Oh, I guess I was wrong then.

- Same problem arises with conjunctions.

(193) a. Alex might be hiding upstairs or she might be hiding downstairs
b. That's false/wrong. I'm hiding downstairs.

- **Problem 9: 'Might' Embedded under Factive Verbs.**

- Two facts about presuppositions:

- Factive verbs presuppose their complements.
- Presuppositions triggered in the antecedent of a conditional *project* out of the conditional.

- Nevertheless, might-claims can be true when embedded in the scope of a factive attitude verb *even when the interlocutors both believe the prejacent is false.*

- Consider:

Blofeld and Number 2 are at SPECTRE headquarters plotting Bond's demise. Bond planted a bug and some misleading evidence pointing to his being in Zürich and slipped out. Now he and Leiter are listening in from London. As they listen, Leiter is getting a bit worried: Blofeld hasn't yet found the misleading evidence that points to Bond's being in Zürich. Leiter turns to Bond and says: (von Fintel and Gillies, 2008, 93)

(194) If Blofeld realizes you might be in Zürich, you can breathe easy — he'll send his henchman to Zürich to find you.

- The problem for the relativist is that she should predict that Bond can reject this as false (since at every relevant *w*, there are no Bond-in-Zürich-worlds).
- Question I: Does it really seem correct to say that the presupposition of the factive verb projects here?
- Question II: How is a standard contextualist analysis supposed to get the right results here?

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Lecture 8

Semantics and the Objects of Assertion – Ninan

Main Questions

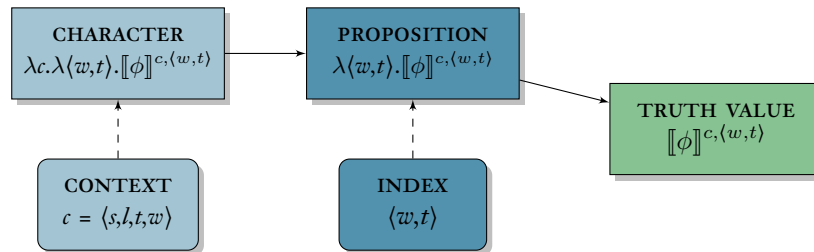
- What is the relation between semantics and the objects of assertion — and what constraints does a semantic theory impose on a definition of assertoric content?
- What are the objects of assertion? (classical, temporal, centered propositions)
- **By semantic theory**, Ninan means a compositional and truth-conditional theory which is capable of handling both general context-sensitivity (incl. indexicality) as well as ‘shifty phenomena’ such as tense and modality.

Two Dogmas of Natural Language Semantics

- **Dogma I:** If the index of a semantic theory contains a parameter X (e.g. world, time, ‘judge’), then the semantic theory entails that the objects of assertion vary in truth value over X .
- **Dogma II:** If the index of a semantic theory does not contain a parameter X then the semantic theory entails that the objects of assertion do not vary in truth value over X .
- **Ninan’s goal:** Argue that both of these dogmas are false. Use this fact to argue for contextualism for epistemic modals.

Kaplan, Lewis, and “Content”

The Kaplanian Picture



- Kaplan distinguishes between two kinds of meaning: *character* and *content*. Consider the sentence in (195)

(195) It's raining today.

- The *character* of an expression is its context-invariant meaning and it can be thought of as “a rule of use”.
- The *content* of an expression is a pair of a character and a context of utterance. In other words, the *content* is the proposition expressed on some particular occasion of use, i.e. “what is said” by a sentence when asserted in a particular context.
- On the Kaplanian view, if the content of (or the proposition expressed by) S when asserted in c is ϕ , ϕ is the central piece of information that is communicated by an utterance of S in c .
- Or in Stalnakerian terms, ϕ is the set of possible worlds that the speaker proposes to add to the common ground when asserting S in c .

Compositionality and Content

- Kaplan’s theory is designed to be able to deal with two different set of phenomena, namely indexicality and ‘shifty’-operators.
- Kaplan’s insight (or rather Hans Kamp’s insight) was that these two phenomena are quite different despite looking very similar and needs to be dealt with in different ways.

Indexicality

- Indexicals are expressions such as *I, you, she, they, that, this, today, here, now*.

- The meaning of indexicals is determined by the context and the context is thus conceived of as a n-tuple of parameters supplying proper semantic values for various indexical expressions, e.g.

⟨speaker, location, time, world, ...⟩

- The character of indexical expressions is relativized to one or more specific parameters of context, for example the character of *I* is ‘the speaker in *c*’.
- In other words, determining the *content* of a sentence *S* (on a given occasion of use), requires *first* determining the semantic value of whatever indexical expressions occur in *S*.

Shifty Phenomena

- “Shifty” phenomena includes temporal, locative, and modal expressions, e.g. *Last week, In Boston, It’s possible that ... etc.*
- In contrast to indexical expressions, these expressions are assumed to operate on *contents* (propositions), i.e. they are functions whose domain are functions from world-time pairs to truth values and whose range are truth values.
- Kaplan has already assumed, cf. above, that contents are relative to an n-tuple of parameters (i.e. the context), but he assumes that truth is also relative to an n-tuple of parameters (many of which are the same as those comprising a context).
- More specifically, an utterance of *S* in *c* will be true iff at the *evaluation points* (which absent any “shifty” operators are determined by the context), ϕ holds (where ϕ is the proposition expressed by *S* in *c*).
- What “shifty” operators are assumed to do is *shift* the value of the evaluation points, i.e. *w* and *t*.
- So, while a sentence such as (195) will standardly be evaluated at the location of the context, l_c , the function of an operator such as *In Boston* is to shift the value of the evaluation point *l* to Boston, viz. l_{Boston} .
- A sentence such as (196) will thus be true iff it’s raining at w_c at time t_c at location l_{Boston} .

(196) In Boston, it’s raining.

- In sum, the difference between indexicals and “shifty” operators is that they are operative at different computational stages, viz. they are relative to two different components of the semantic system, namely the context of utterance and the index (circumstance of evaluation).

The central point here is that Kaplan's contents, viz. the proposition expressed by an assertive utterance of S in c or what is communicated in c by an assertion of S , play an important compositional role—they are the objects on which “shifty” operators operate!

- **Why is Double Indexing Needed?**

- Since a context is a tuple of parameters, e.g. $c = \langle s, l, t, w \rangle$, and an index (circumstance of evaluation) is also a tuple of (many of the same) parameters, e.g. $i = \langle l, t, w \rangle$, why do we need both?

- We need both because:

- Indexicals do not shift when embedded in the scope of a “shifty” operator.
- To account for the meaning of sentences such as (197), two different parameters are needed.

(197) In Boston, people long for the food here.

- I.e. if we have only one location-parameter and the “shifty operator” above shifts the value of this parameter, we will predict that (197) is true iff people in Boston long for the food in Boston.¹
- Kaplan's paper is also famous for its explicit denial of “monsters” in English—monsters are operators that can shift the value of a parameter of the context.

- In conclusion, the semantic characterization of *truth*, on Kaplan's (and Lewis') view, is doubly relative—relative to both *context* and *index*.

So the content of a sentence plays two roles in Kaplan's overall theory: it plays a compositional role in the semantics proper, as the input to intensional operators, and it plays a role in the theory of linguistic communication, as the assertoric content of a sentence at a context. One of the central lessons in David Lewis's paper “Index, Context, and Content” (1980) is that these two roles place very different demands on what we can take contents to be. Since contents are the objects of assertion, they will have to be responsive to our views about what the objects of thought and talk are like. If, for example, we think that the information we normally convey in speech is time-specific, i.e. not something that changes its truth value over time, then we will want contents to likewise be time-specific. But since Kaplanian contents are also the inputs to operators, they must also be sensitive to what kinds of operators natural language contains.

Consider, as an example, a sentence such as “In every context, I'm hungry”

¹ A point that is often attributed to Kaplan, but which was actually made by Hans Kamp (1971)—also noted by Kaplan himself in Kaplan (1989).

For example, if natural language contains temporal operators, then indices will have to contain time parameters, and so contents will be functions from time-containing indices to truth values. Thus, if natural language contains temporal operators, contents will have to be time-neutral, i.e. things that change their truth value over time. (Ninan, 2010, 362)

- **Potential Conflict** It could turn out that *contents*—given Kaplan’s definition—cannot both do the job they need to do vis-à-vis compositional semantics and the job they need to do vis-à-vis assertion/information exchange.

Lewis offered a simple solution to this problem: drop the requirement that a single object – *the* content – play both these roles. Define one kind of object – *assertoric content* – to play the assertion role, and define a second kind – *semantic value* – to play the compositional role. As long as both types of content are easily definable in terms of the formal semantic theory, no problem remains. (Ninan, 2010, 361)

Separating Semantic Content from Assertoric Content

- **Defining Semantic Content**

- Functions from indices to truth values remain well suited to play the role of *semantic contents*, so we can continue to accept this identification.
- If so, Dogma I holds true for *semantic values*.

- **Defining Assertoric Content: Three Options**

- **Option 1**

Classical Proposition of ϕ at c : $\lambda w. \llbracket \phi \rrbracket^{c, \langle w, t_c, l_c \rangle}$

- If we define assertoric content in this way, Dogma I is false. On this definition, the index *does* contain parameters over time and location, and yet the objects of assertion are not neutral with respect to time or location.

[...] once we see that we can separate semantic values from assertoric contents, we see that no particular definition of assertoric content, Lewis’s included, is forced upon us by the semantics. The semantics constrains what we can take the assertoric content to be — assuming we want that notion to be definable in terms of the semantic theory — but it does not determine a unique candidate for playing that role. (Ninan, 2010, 361-362)

- **Option 2**

Temporal Proposition of ϕ at c : $\lambda \langle w, t \rangle. \llbracket \phi \rrbracket^{c, \langle w, t, l_c \rangle}$

- **Option 3**

Centered Diagonal Proposition of ϕ at c : $\lambda \langle w, t, x \rangle. \llbracket \phi \rrbracket^{\langle w, t, x, l_c \rangle, \langle w, t, l_c \rangle}$

- The definition of *assertoric content* now has a status similar to that of Kaplan's notion of *truth at a context*.
- **Truth at a Context:** A sentence ϕ is true at a context c iff $\llbracket \phi \rrbracket^{c, \langle w_c, t_c, I_c \rangle} = 1$

But note that the notion of truth at context simpliciter (as opposed to truth a context and index) plays no role in our formal semantics proper, the compositional derivation of truth-conditions. Rather, it is a notion that is defined only once we have the semantic theory in hand; it is part of the postsemantics, to use the terminology of MacFarlane (2003, 329). I propose that the definition of assertoric content also be regarded as part of the postsemantics, and that its theoretical significance is comparable to that of the definition of truth at a context. (Ninan, 2010, 362)

Indices and Epistemic Modals

- **The Standard Contextualist View**
- On the standard view, (198) expresses different propositions in different contexts.

(198) Sam might be in Boston.
 \Rightarrow It's compatible with what I (the speaker) knows that Sam is in Boston.

- **Speaker Inclusion Constraint**
- Contextualists normally assume that the relevant group of knowers, or the relevant information state, must contain the speaker.
- This helps explain e.g. the infelicity of Moore sentences such as (199).

(199) Sam is in Boston, but he might not be.

- **What kind of context-sensitive expression is 'might'?**
- **The Indexical Analysis:** Given the speaker inclusion constraint, treating 'might' on the model of an indexical seems like a plausible option. However, the indexical analysis of 'might' is immediately refuted by cases where 'might' is embedded under a propositional attitude verb, e.g. (200).

(200) John thinks that Sam might be in Boston.

- (200) does not mean the same as (201). This is however what the indexical view seems to predict.

(201) John thinks that it is compatible with what I/we know that Sam is in Boston.

- **A hidden variable analysis:** $\llbracket \text{might } x \phi \rrbracket^{c,i,g} = 1$ iff there is a world w compatible with what $g(x)$ knows at t_i in w_i such that $\llbracket \phi \rrbracket^{c,(w,t_i,l_i),g} = 1$
- On this analysis, (200) is not a problem, because one can assume that the variable over individuals, x , is free, and hence that the variable assignment can assign it to John.
- Alternatively, one can assume that (200) has the following structure:

(202) John λx x thinks [might x Sam is in Boston]

- The problem for these views are the Moore-paradoxical sentences. It seems that in order to explain the infelicity of e.g. (199), the speaker inclusion constraint is needed. But on these proposed analyses, that constraint is given up.
 - The question then is how do we get flexibility enough to deal with embedded cases without thereby losing our explanation of the Moore-paradoxical sentences.
 - **Constraining the Variable**
 - Phi-feature constraints: $\llbracket \text{she}_7 \rrbracket^{c,i,g} : g(7)$ is female . $g(7)$
 - One could constrain the variable (of the hidden variable analysis) by assuming that it has a 1st person phi-feature constraint. I.e.
- $\llbracket b_7 \rrbracket^{c,i,g} : g(7)$ is (a group that includes) x_c . $g(7)$
- The first problem is that cases such as (200) can now not be explained anymore.
 - The second problem is that if the variable really did have this 1st person phi-feature constraint, it should only be bindable by appropriate antecedent containing a 1st person pronoun. And so, a structure like (202) should simply be illicit.

Shiftable Contextualism

- Two pieces of data that the contextualist have problems accommodating.
 - a. That “John thinks that Sam might be in Boston” is true iff John thinks that it is compatible with what *he* (John) knows that Sam is in Boston.
 - b. The infelicity of Moore-paradoxical “might” sentences like (199).
- **Shiftable Contextualism** consists of two components:
 - A semantic theory.
 - A definition of assertoric content.

Semantics

- First, we expand the index to include an individual (or ‘judge’). The index i (in $\llbracket \cdot \rrbracket^{c,i,g}$) is now a triple consisting of a world w_i , a time t_i , and an individual x_i
 - Second, we make the semantics of ‘might’ sensitive to the new parameter of the index: $\llbracket \text{might } \phi \rrbracket^{c,i,g} = 1$ iff there is a world w compatible with what x_i knows at time t_i in w_i such that $\llbracket \phi \rrbracket^{c,\langle w,t_i,x_i \rangle,g} = 1$
 - Third, define the relevant attitude verbs to be sensitive to the judge-parameter: $\llbracket x \text{ thinks } \phi \rrbracket^{c,i,g} = 1$ iff all the worlds w compatible with what x thinks at t_i in w_i are such that $\lambda i'. \llbracket \phi \rrbracket^{c,i',g}(w, t_i, x) = 1$ (iff $\llbracket \phi \rrbracket^{c,\langle w,t_i,x \rangle,g} = 1$)
- It’s now easy to predict that the truth of (200) depends on John’s information state rather than the speaker’s. (cf. derivation on page 16)
 - To explain the infelicity of (199) we however need to say something about assertoric content.

Assertoric Content

As a genuine contextualist (as opposed to relativist), the shiftable contextualist wants the assertoric content of an epistemically modalized sentence to be something that does not vary in truth value across individuals. Let’s assume that the shiftable contextualist wants the assertoric content of a sentence at a context to be a possible worlds proposition. To achieve this end, the shiftable contextualist can adopt Lewis’s definition of assertoric content: the assertoric content of a sentence at a context is the proposition one gets by abstracting over the world parameter in the index while setting all the other index parameters to their corresponding context values. (Ninan, 2010, 370)

- Hence:

$$\lambda w. \llbracket \text{might } [\text{Sam is in Boston}] \rrbracket^{c,\langle w,t_c,x_c \rangle,g} =$$

$$\lambda w. \text{ there is a world } w' \text{ compatible with what } x_c \text{ knows at time } t_c \text{ in } w \text{ such that Sam is in Boston in } w'.$$
- This means that when there are no shiftable operators, i.e. attitude verbs, the value of the judge-parameter is determined by the context, namely the speaker of the context.
- And this also means that this analysis satisfies the speaker inclusion constraint.
- In other words, the cases of Moore-paradoxical sentences can now be explained (precisely as they were explained before on e.g. DeRose’s account).

• General Conclusion

- If you think that Dogma I is true, you will overlook the shiftable contextualist option. If the first dogma is true, adding a judge-parameter to the index immediately results in a relativist view, namely a view on which the objects of assertion, ‘what is said’, is judge-neutral (or individual-neutral).

- **A problem for Ninan's view?**

- The following inference pattern looks valid:

(203) John believes that Sam might be in Boston.
Sam can't be in Boston.

So, John's belief is false.

- However, with a shiftable contextualist analysis, we cannot validate this inference.

80-880: Seminar on Philosophy of Language
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Lecture 9

New Contextualism - 'Might' Made Right

The Canon

- On the canonical analysis, modal sentences are analyzed as tripartite structures

$\text{MODAL}(B)(\phi)$

- MODAL is a quantifier over worlds (e.g. universal, existential).
 - B is the *modal base* — the restrictor on the worlds over which the modal is quantifying.
 - B is settled either by context or by linguistically overt restricting phrases such as “in view of what the laws are”, “in view of what we know” etc.
 - ϕ is the target proposition — the proposition whose semantic value must be checked at the relevant worlds.
- *Bare epistemic modals* (BEMS) are modal statements where the restrictor (B) is not linguistically supplied, but rather supplied by context.
 - **Puzzling Facts About Bare Epistemic Modals**
 - BEMS (almost) always have speaker-centered (speaker only) interpretations available.
 - However, since it can be felicitous to say “I don’t know whether it might be that ϕ ”, interpretations where the modal base includes more than just the speaker’s information state must sometimes be available.

(204) I don’t know whether John might have cancer; only the doctors know.
I’ll find that out tomorrow when the results of the test are revealed.

(205) ?? I don't know whether in view of what I know John might have cancer; only the doctors know. I'll find that out tomorrow when the results of the test are revealed.

- More than just the speaker's information is required to explain the felicity of (204).
- However, the canon is non-committal as regards how context determines what the relevant information states are—there is therefore plenty of flexibility in the standard story.
- One could assume that any given context determines a relevant group of individuals—the modal base can then be calculated on the basis of this group, e.g.

(11) Fix a c -relevant group G_c . Then $\llbracket B \rrbracket^{c,i} = \bigcap_{x \in G} f_x(i)$

- From this, the following plausible information aggregation principle follows:

(10) **AGGREGATION:**
Suppose c determines B by determining G and c' determines B' by determining G' . Then $G \subseteq G'$ implies $\llbracket B' \rrbracket^{c',i} \subseteq \llbracket B \rrbracket^{c,i}$.

- In slogan-form: *The bigger the group, the smaller the information state.*

Problems for the Canon: A Realistic Scenario

- Assumption: BEMS quantify over possibilities compatible with the pooled information of some *relevant* group.
- Since there are many potential interpretations of epistemic modals (solipsistic, non-solipsistic, eaves-droppers etc.), context should determine a specific one.
- **Problem:** Contexts fail to do this.
- **The Missing Keys:**
Alex is aiding Billy in the search for her keys.

(206) Alex: You might have left them in the car.

- Two possible responses depending on whether Billy can rule out the keys being in the car.

(207) Billy: You're right. Let me check.

(208) Billy: No, I still had them when we came into the house.

- There are several ways that context could potentially resolve, or determine, what the relevant group G is. Three possibilities:

$G1 = \{\text{Alex}\}$ (speaker-centric resolution — the A reading)

$G2 = \{\text{Billy}\}$ (addressee-centric resolution — the B reading)

$G3 = \{\text{Alex, Billy}\}$ (collective resolution — the A+B reading)

- **Problem:** Neither resolution is right.

(G1) Suppose context resolves to $G1$:

If so, how could Billy possibly deny what Alex said? On the speaker-centric resolution, Alex is making a claim only about what is compatible with her information state and it would be irrational for Alex to deny that. Even the “You’re right” response would be odd, since it would be strange for Billy to think that he’s in a position to judge what is compatible with Alex’ information state.

(G2) Suppose context resolves to $G2$:

This option makes very little sense. Why would Alex possibly think that she has privileged information about what is compatible with Billy’s information state?

(G3) Suppose context resolves to $G3$:

If so, (207) and (208) both seem to be acceptable responses. However, the problem that now arises is a problem related to the problem with $G2$, namely how Alex could possibly take herself to be in a position to know what information is compatible with Billy’s information state?

Given some fairly minimal normative constraints on assertion (i.e. knowledge, justified belief, truth of asserted content), Alex does not seem to be in a position to legitimately assert (206).

- This is where the relativist will jump in to save the day. However, von Fintel and Gillies believe there is a potential explanation which salvages the contextualist line.

So, what does the BEM really mean [in (206)]? Our contention is that rather than having neither of the solipsistic or group readings (and thus having some as of yet novel reading, perhaps such as the one promoted by the CIA agents), Alex’s BEM actually has both readings—possibly many more, in fact—and that this kind of multiplicity of meanings is precisely what gives bems their peculiar properties. The context does not, in general, determine what the relevant group is. Instead, it leaves this underspecification intact, and—we will say—epistemic modals exploit this. (von Fintel and Gillies, 2011, 117)

Contexts and Ambiguity

- von Fintel and Gillies' central claim: the canon requires too much of contexts — **Contexts do simply not fully determine a relevant group of agents.**
- Contextual underspecification is ubiquitous in natural language, but communication does not always break down when this is the case. I.e. in some cases, contextual “ambiguities” are irrelevant with regards to communication.

[...] Billy meets Alex at a conference, and asks her:

(18) Where are you from?

That question is supposed, given a context, to partition answer-space according to how low-level in that context Billy wants his details about Alex to be. But notice that it's not really clear whether Billy wants to know where Alex is currently on sabbatical or where Alex teaches or where Alex went to graduate school or where Alex grew up. And—the point for us—Billy might not know what he wants to know. He just wants to know a bit more about Alex and will decide after she answers whether he got an answer to his question or not. He doesn't have to have the level of granularity sorted out before he asks the question. So context (or context plus Billy's intentions) need not resolve the contextual ambiguity. (von Fintel and Gillies, 2011, 118)

Is it really plausible to say that it's not really clear what Billy wants to know?

- When BEMS are used, there might be several ways of drawing the boundaries for what counts as the relevant group.

And indeed, we will assume that there is a one-one correspondence between admissible contexts and potential resolutions of the relevant group. (von Fintel and Gillies, 2011, 118)

This seems extreme, no? Just consider large groups and how many potential resolutions of such groups there'll be.

- So what's the idea here? **The cloud of contexts:**

The context of the conversation really does not provide a determinate resolution and we propose to model this by saying that there is a cloud of contexts at the given point of the conversation. (von Fintel and Gillies, 2011, 118-119)

- One way of construing von Fintel and Gillies' idea here is to say that BEMS express not propositions, but rather sets of propositions. However, this is not the view they endorse.
- Instead von Fintel and Gillies say that when a speaker uses a BEM, she *puts into play* multiple propositions. They refer to this as what *travels* in a conversation:

(19) TRAVEL:
Suppose the facts (linguistic and otherwise) up to t allow the groups G_1, G_2, \dots as resolutions of the contextual parameter, these resolutions delimiting

the cloud C of contexts. Then an utterance of $\text{might}(B)(\phi)$ with respect to C at t puts into play the set of propositions P such that for some $c \in C$:
 $\llbracket \text{might}(B)(\phi) \rrbracket^c = P.$ (von Fintel and Gillies, 2011, 119)

- In other words, in terms of the semantics, there is no underspecification. Depending on what context is picked, a determinate proposition is expressed by the BEM.
- However, since there is *a cloud* of admissible contexts, it is indeterminate which proposition is expressed.
- In other words, now pragmatics takes over.

Back to Alex and Billy

- Alex says (206):

(209) The keys might be in the car.

- **The Speaker Side of the Exchange**

- Three propositions are put into play:

(209) a. The keys might_{alex} be in the car.
 b. The keys might_{billy} be in the car.
 c. The keys might_{alex+billy} be in the car.

- However, we have already seen that Alex is not strictly speaking in a position to assert either (209b) or (209c).
- But since the utterance is appropriate, it seems that Alex need not BE in a position to flat out assert these in order to put them into play!
- This yields the following generalization about assertions of BEMS:

(20) **ASSERT:**
 Suppose an utterance of $\text{might}(B)(\phi)$ by S puts into play the propositions P_1, P_2, \dots . Then S must have been in a position to flat out assert one of the P_i 's. (von Fintel and Gillies, 2011, 120)

Asserting 'might ϕ ' while knowing that $\neg\phi$

- By adopting ASSERT, we can now explain why a speaker can assert 'might ϕ ' even when the speaker knows that $\neg\phi$.

Pascal and Mordecai are (still) playing Mastermind. After some rounds where Mordecai gives Pascal hints about the solution, Pascal asks whether they might be two reds. Mordecai answers:

(24) That's right. There might be.

He can answer this way even if he knows there aren't two reds. As far as the norms of assertion go, it's as if he had uttered an explicit claim about Pascal's evidence. (von Fintel and Gillies, 2011, 120-121)

- **The Hearer Side of the Exchange**

- Since multiple propositions are put into play, which one should the hearer react to?
- Here, von Fintel and Gillies suggest that the hearer should react to *the most informative* proposition in play. This leads to a dominance of negative responses.

(22) **CONFIRM/DENY**

Suppose an utterance of *might(B)(ϕ)* by *S* puts into play propositions P_1, P_2, \dots . Then a hearer *H* can confirm (deny) the BEM if the strongest P_i that *H* reasonably has an opinion about is such that *H* thinks it is true (false). (von Fintel and Gillies, 2011, 121)

- The strongest interpretation of Alex' assertion is the $A+B$ interpretation (strongest because it has the highest requirements for being true)
- So, if Billy is in a position to rule out the prejacent of (209), Billy should deny Alex' assertion.
- Since the ultimate goal is to figure out where the keys are, what each individual's evidence is is not at issue. That is also the reason why Alex shouldn't default to a more charitable interpretation of Alex' assertion and respond only to the A -interpretation of the utterance.
- But what about a case where Billy is not in a position to rule out the prejacent.

Obviously, he will confirm the BEM (You're right). Which reading of the BEM is he reacting to? Our principle says that it is the strongest reading he reasonably has an opinion about. Which one is that? It is obvious that he reasonably has an opinion about the B-reading. What about the stronger $A+B$ -reading? Can he reasonably have an opinion about that? [...] When Alex utters the BEM, Billy concludes that Alex is not in a position to rule out the prejacent. If Billy himself is also not able to rule out the prejacent, he might put 2 and 2 together and conclude that the group of the two of them cannot rule out the prejacent. (von Fintel and Gillies, 2011, 122)

However, Billy would then need to assume that Alex's grounds for asserting (209) was not the B -interpretation.

- A different problem here is that to know what follows from the group’s accumulated knowledge, each group member must know what the accumulated knowledge is.

$$K_A\phi, \neg K_A\psi, K_A(\phi \wedge \psi \rightarrow \neg\chi) \qquad K_B\psi, \neg K_B\phi, K_B(\phi \wedge \psi \rightarrow \neg\chi)$$

- Even if A knows that $(\neg K_B\chi \wedge \neg K_B\neg\chi)$, viz. that χ is compatible with what B knows, A cannot infer: χ is compatible with K_{A+B}
- χ is compatible with A ’s knowledge and it’s compatible with B ’s knowledge, but not their collective knowledge.
- Hence, even if B was to come to know that χ is compatible with A ’s information state, that would not license the inference to “ χ is compatible with the group’s knowledge” (i.e. the $A+B$ reading).
- However, since this is probably a rare occurrence, von Fintel and Gillies propose a defeasible closure principle:

(23) **DEFEASIBLE CLOSURE**

If H knows that ϕ is compatible with what x knows, for each $x \in G$, then it is reasonable for H to defeasibly infer that ϕ is compatible with what G knows. (von Fintel and Gillies, 2011, 122)

Alex, Billy, and Chuck

- Suppose that Alex, Billy, and Chuck are all parties to the conversation, and that Alex says (209).

(209) The keys might be in the car.

- There are now six possible readings:

Solipsistic Readings: A, B, C

Group Readings: $A+B, A+C, A+B+C$

- Alex needs only be in a position to assert the A -proposition in order to felicitously assert, but what are possible, and plausible, responses on the part of Billy and Chuck?
- **CONFIRM/DENY** says that interlocutors should respond to the strongest proposition about which they can reasonably have an opinion.
- **Information Ruling Out the Prejacent**
If either Billy or Chuck has information that rules out the prejacent, they should deny the $A+B+C$ reading.

- **No Information Ruling Out the Prejacent**

If neither Billy nor Chuck has information that rules out the prejacent, Billy should believe the $A+B$ -reading, and Chuck should believe the $A+C$ -reading.

- That is, Billy and Chuck each assent to different floated readings of (209).
- After this, each of them (Alex, Billy, and Chuck) can (under appropriate conditions) appeal to defeasible closure, and infer the $A+B+C$ -reading.

- **Affirming the Strongest Proposition Directly**

If one can *anticipate* that no member of the group is in a position to rule out the strongest proposition, one can—on this assumption and by applying defeasible closure—jump directly to affirming the strongest proposition.

Recall the “Is Springfield ready to rock?”-case.

Being in a conversation in which BEMS are issued is a lot like going to a rock concert. The strong group-readings in our example are floated or put in play by Alex. That amounts to something like a collective conjecture and we say that the same type of conversational rules can apply for taking up such readings as apply in answering whether Springfield is ready to rock. That means that hearers can confirm a BEM and take up one of its strong group readings even if they are not in a position to flat out assert such a strong disambiguation. Denying a BEM does not involve the same bending of normal conversational rules. But neither does answering the rock star’s collective query negatively: if we are not ready to rock, then it just is not true that Springfield is, and we may say so. So it is with BEMS: if the prejacent is not compatible with what a hearer knows then it is not compatible with what any group to which she belongs knows.

(von Stechow and Gillies, 2011, 126-127)

- This leads to the following principle:

(30) **ANTICIPATION**

Suppose an utterance of *might*(B)(ϕ) by S at i puts in play the propositions P_1, P_2, \dots . And suppose that these quantify over the information available to G_1, G_2, \dots respectively. Then if $H \in G_i$ and $f_H(i) \cap \llbracket \phi \rrbracket \neq \emptyset$, then H may infer defeasibly that $f_x(i) \cap \llbracket \phi \rrbracket \neq \emptyset$, for each $x \in G_i$.

- **ANTICIPATION** combined with **DEFEASIBLE CLOSURE** allows one to affirm, directly, the strongest proposition floated.
- Retraction data is now to be explained in terms of giving up **ANTICIPATION**

But even if we do appeal to **ANTICIPATION**, we may have to retract the judgments based on it. [...] if Investigator #2 pipes up with information to the contrary:

- (31) a. Investigator #2: No, the window was locked from the inside
b. Investigator #1: Oh, OK. He can’t have got out that way.

This kind of retraction plays a big role in training CIA agents. No sense can be made of this, they say, unless truth values of sentences involving BEMS are sensitive to context and indices and points of assessment to boot. Note that when Investigator #1 retracts in this way, she retracts the strong reading floated. If the issue of the day had been what she knew and not how the culprit got away, she could stick to her guns just fine. That proposition is of little use now, but isn't and wasn't false. So there is no more reason to think this behavior of BEMS in conversation points in the direction of a radically relativized semantics than does finding out that, contra our expectations, Springfield is not ready to rock. It is perhaps reason for sadness, for rocking is what Springfield ought to want to do, but no reason for despair (or signing up with the CIA). (von Fintel and Gillies, 2011, 127)

Eavesdroppers

- Cases involving eaves-droppers typically causes a lot of grief for contextualist theories, because it seems that in order to accommodate such cases, the group whose information state is relevant to evaluating a BEM, must be extended indefinitely.
- This, in turn, makes it too hard for epistemic modal claims to be true.
- On von Fintel and Gillies' "Cloud of Contexts" story, what is required for rejecting a BEM is that one is "engaged (in some sense) in the same investigation as the overt partners in the conversation".

CIA agents complain that this makes BEMS too strong to allow any speaker to assert them. We agree. It is extremely unlikely that Alex is asserting the BEM under the reading that includes [the eavesdropper]. But that is not what our story says. Alex is licensed to utter the BEM as soon as she is in a position to assert it under one relevant reading (the solipsistic one, typically). But since she utters it as a *bare* epistemic modal, she thereby puts into play multiple readings and it is one of those that [the eavesdropper] rejects, which then results in the prejacent being rejected as well. (von Fintel and Gillies, 2011, 128)

- However, there are limits. If one cannot sensibly be interpreted as being engaged in the *same* investigation as the *relevant* group, rejections will be infelicitous.

- (32) a. You: It might be the King of Spades.
b. Us [ten years later]: ??Wrong!/What you said is false!

- von Fintel and Gillies end by saying that many cases will be borderline.

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Lecture 10

Epistemic Modality and Truth Conditions I
Swanson on the Language of Subjective Uncertainty

Issues to be Addressed

1. The effects of the language of subjective uncertainty on the *addressees'* subjective uncertainty.
2. The effects of the language of subjective uncertainty on *conversational* uncertainty.
3. The interaction between modals and quantifiers.
4. The norms of assertion governing the language of subjective uncertainty.

Subjective Uncertainty and Quantitative Expressions

- Traditional approaches to epistemic modals tend to focus on modals that can also be used to express non-epistemic modalities, so modalities that can usually be captured in terms of the familiar operators \square and \diamond .
- However, there is a wide range of expression which cannot be analyzed simply as universal or existential quantification over some possibility space. E.g.

- | | |
|--|--|
| (210) It's not unlikely that ϕ . | (213) It's highly probable that ϕ . |
| (211) It's a little more likely than not that ϕ . | (214) Probably ϕ . |
| (212) There's a 10% chance that ϕ . | (215) Five to one that ϕ . |

- An adequate analysis of natural language modality should not only be capable of dealing with the standard expressions, but also these distinctively *quantitative* expressions.

Doxastic Uncertainty

- It's widely assumed that doxastic uncertainty cannot be represented in terms of propositional content. Instead, doxastic uncertainty is often captured in terms of probabilities.
- For example, if S is uncertain whether it rained in Seattle yesterday, we might say that S has a 0.5 credence in the proposition that it rained in Seattle yesterday.
- It is also natural to think that to express a 0.8 credence in the proposition that it rained in Seattle yesterday, a speaker will say (216).

(216) There's an 80% chance that it rained in Seattle yesterday.

- It would then also seem natural to treat operators such as "there's an $n\%$ chance" as functions $f(\cdot)$ from propositions into real numbers in the interval $[0,1]$.
- The semantic value of (216) would then be 0.8. The truth conditions of (216) can thus also be stated in terms of real number, i.e. it's true iff it's semantic value is 0.8.
- But if semantic values, viz. truth conditions, are supposed to give the meaning of the sentences expressing them, we need to output propositions as semantic values (i.e. functions from worlds to truth values, not simply numbers).
- In other words, $f(\cdot)$ would have to be a function from propositions and degrees of uncertainty (i.e. real numbers) into propositions.

That is, to provide truth conditions for [(216)] is to provide propositions that one is (nearly) certain about just in case one is uncertain to degree 0.8 [...] about the proposition that it rained in Seattle yesterday. Construing subjective uncertainty about whether ϕ in terms of near certainty about some other proposition seems wrongheaded. But unless the truth conditional theorist can find such propositions, there is no reason to suppose that an assertion of a doxastically hedged sentence will inculcate the appropriate partial belief in the addressee. And the project of finding such propositions looks quixotic if not impossible. (Swanson, 2011, 251)

- It gets worse though. We'll need functions from *intervals* in $[0,1]$ and propositions to propositions for (217). And for (218) and (219), we will need functions from intervals in $[0,1]$ and pairs of propositions into propositions.

(217) There's an 80% to 90% chance that it rained in Seattle yesterday.

(218) It's twice as likely that it rained than it is that it snowed.

(219) It's between two and three times likelier that it rained than that it snowed.

- **The key question:** what propositions are these supposed to be?

The Ways the World Could Be

- **Initial Motivation for Truth Conditional Semantics:**

Propositions (i.e. truth conditions) represent the ways the world could be.

- The problem is that we should not expect the language of subjective uncertainty (let alone subjective uncertainty simpliciter) to simply represent or misrepresent the world.

- **Argument:**

- Represent full belief by ordered pairs, consisting of 1 and a proposition, $\langle 1, \phi \rangle$
- Represent partial belief by ordered pairs consisting of some $n \in [0, 1]$ and a proposition, e.g. $\langle 0.8, \phi \rangle$
- Let the set of full beliefs be denoted by \mathcal{F} , and let the set of partial beliefs be denoted by \mathcal{P} .
- Clearly, $\mathcal{F} \subset \mathcal{P}$
- But, by stipulation, \mathcal{F} suffices to represent all the ways the world could be, so \mathcal{P} must be represent something *more* than this.
- But, the truth conditional theorist holds that there are *propositions* to play the representational role played by the elements of $\mathcal{P} \setminus \mathcal{F}$
- But, how is this then to accord with the assumption that propositions *represent* ways the world could be?

One fundamental ambition of truth conditional semantics—to help explain how language represents the world by providing the conditions under which language successfully represents the world—thus looks inconsistent with giving a truth conditional theory of the language of subjective uncertainty. (Swanson, 2011, 252-253)

Conversational Uncertainty

- Above Swanson emphasized the ways in which the language of subjective uncertainty is used to convey various kinds of subjective uncertainty.
- However, the language of subjective uncertainty also has an important impact on, what Swanson calls, *conversational uncertainty*, i.e. uncertainty within a group of discourse participants.
- **What is Conversational Uncertainty?**
- On the standard Stalnakerian picture:
 - To presuppose that ϕ is to take it to be commonly believed that each discourse participant treats ϕ as true for the purposes of the conversation.

- In the (idealized) case where all discourse participants make the same presuppositions, **a conversation can be said to be uncertain as to whether ϕ** just in case neither discourse participant presupposes that ϕ or that $\neg\phi$.

- **The relation between the language of subjective uncertainty and conversational uncertainty**

Doxastically hedged assertions can influence not only the subjective uncertainty of the individuals in a conversation, but also which propositions the conversation is uncertain about. In a normal conversational context in which no one demurs, for example, an utterance of ‘It might be that ϕ ’ ensures that the conversational participants do not presuppose that $\neg\phi$. (Swanson, 2011, 253)

- An example:

- (220) a. SMITH: The weather report says it will definitely rain tomorrow, so it will rain tomorrow.
 b. JONES: It might not rain tomorrow—weather reports are sometimes wrong.

- The ‘might’-claim is used to ensure that the common ground does not exclude every world where it rains tomorrow.
- So, in a sense, the ‘might’ claim is used create conversational uncertainty.

Stretching the original meaning of “context change potential” somewhat, I will call the aspiration of ‘It might be that ϕ ’ to ensure that it is not presupposed that $\neg\phi$ the context change potential of ‘might’ statements. This context change potential—combined with the crucial fact that speakers can often felicitously use ‘might’ statements without having much evidence that bears on the truth of the embedded claim—gives ‘might’ statements a surprising kind of power. Someone who gives very little credence to the proposition that ϕ may nevertheless still be obligated to admit that it *might* be that ϕ . (Swanson, 2011, 254)

- An important difference between *subjective* and *conversational* uncertainty is that conversations (or discourses) can be uncertain with respect to particular propositions even though no discourse participant’s credence in those propositions is low. (think of the skepticism case).
- The difference between subjective and conversational uncertainty is also reflected in certain expressions that have the same ‘context change potentials’ but convey different degrees of subjective uncertainty.

(221) It’s raining.

(222) It must be raining.

- As assertion of either of these both induce the same change to the common ground (if uncontested), namely an exclusion of worlds where it's not raining.
- However, an assertion (222) is likely to make interlocutors less confident that it is raining than an assertion of (221).
- In other words, there is a difference between the context change potentials of these sentences and what Swanson calls the *doxastic change potential*, i.e. their effect on doxastic states.
- **The general problem:** In order to understand the language of subjective uncertainty, we need a theory that captures both effects on the conversational context and effects on doxastic states — but there is no way to derive one from the other.
 - Contexts and context change is non-degreed, hence there is no way to recover *doxastic change potentials* from *context change potential*.
 - Doxastic change potentials do not incorporate, e.g., the order of conjuncts, hence there is no way to derive *context change potentials* from *doxastic change potentials*.

Force Modifier Analyses

- On the 'force modifier' analysis of epistemic modals, epistemic modals are used indicate less than full commitment to the prejacent—epistemic modal statements are assertions with 'tempered force'.
- On the force modifier type analysis, it would seem that one can both explain the relation between the language of subjective uncertainty and subjective uncertainty itself, and the relation between the language of subjective uncertainty and conversational uncertainty.
- The immediate problem for analyses such as these is a familiar one, namely how to explain the meaning of epistemic modals in embedded contexts.
- The key problem, Swanson argues, is explaining the interactions between modals and quantificational expressions.
- A couple of examples:
 - (223) Lots of people we don't know might be the murderer, so no one we know *has* to be the murderer. QDP > ◇
 - (224) Be careful where you step, because every inch of the floor might have paint on it. QDP > ◇

The fact that epistemic modals can exhibit such scope relations shows that the essential doctrine of force modifier approaches—that in asserting a statement headed by an epistemic modal, a speaker puts forward a non-hedged proposition with less than the usual authority or certainty—is untenable. (Swanson, 2011, 257)

- Consider (224).
 - **Wide scope QDP:** The speaker can sincerely assert (224) while *knowing* that it's not possible every inch of the floor has paint on it.
 - This means, that the most natural interpretation of (224) requires a distributed interpretation of the quantifier—for every inch of the floor, it's possible that that inch has paint on it.
 - The question then is how a force modifier analysis—an analysis on which an epistemically modalized claim is an assertion of a proposition with less than usual force—is supposed to capture this.
 - In other words, what proposition is supposed to be asserted here (with less than usual force)? Two options:
 - * The proposition that at least one inch has paint on it. (asserted with less than usual force) — *too weak*.
 - * The proposition that every inch has paint on it. (asserted with less than usual force). — *too strong*. Notice the speaker can *know* that it's not possible that every inch has paint on it.
- A similar problem arises with *epistemic adjectives*.

(225) The person we hire for the job doesn't need any special qualifications. So even though only one person will be hired for the job, most of the applicants are possible hires. QDP > ◇

- It is common ground that only one person will get the job, and yet (225) is felicitous. In other words, the QDP must take wide scope.
- Swanson suggests that these cases of “modal involvement” can be handled by a compositional, but non-truth conditional, analysis by assuming that a sentence such as “Most *F*s are *G*s” (where *F* is the set $\{a,b,c\}$) is fundamentally a disjunctive claim, namely the claim that *a* and *b* are *G* or *a* and *c* are *G* or *b* and *c* are *G*, or *a*, *b*, and *c* are *G*.
- So, “Most of the candidates are possible hires” is then to be analyzed as the claim that: *a* and *b* are *possible hires* or *a* and *c* are *possible hires* or *b* and *c* are *possible hires*, or *a*, *b*, and *c* are *possible hires* — assuming that the set of candidates is $\{a,b,c\}$.
- Swanson claims that there is no way for force-modifier approaches to mimic this.

It's a bit hard to see how this semantics is supposed to capture that the speaker doesn't need any information about *who* belongs to relevant restrictor set.

- **Epistemic Adjectives and Syntax: A Problem for Force Modifier Analyses**
- For the force modifier analysis, what is the logical form of sentences containing epistemic adjectives? Only one option seems plausible:
 - (a) [It's possible that [Al is a hire]].
- While only (a) seems plausible (given the explanation of the meaning that is offered by the force modifier theorist), (b) would be better from a syntactic point of view. In (b), the epistemic adjective modifies only the noun, forming a complex predicate.
 - (b) [Al [is a possible [hire]]].
- Some level of revisionist syntax seems required then.
- But it gets worse: how is the force modifier analysis supposed to deal with (c).
 - (c) Al is a likely candidate and a possible hire.
- (c) seems to mean the same as (d), so the force modifier theorist could attempt to explicate the meaning of (c) in terms of (d). However, as far as syntax is concerned that seems to commit the force modifier theorist to the claim that (c) and (d) have the same *syntactic structure*. This seems very implausible.
 - (d) It's likely that Al is a candidate. It's possible that Al is a hire.

Norms of Assertion

- Swanson has already argued that attempting to explicate the meaning of the language of subjective uncertainty in terms of the language of (near) certainty is likely to be problematic.
- Another way to see that this is problematic is to consider norms of assertion—we should ask ourselves: *what are the norms for asserting e.g. 'might'-sentences?*
- It's well known that standard truth conditional theories have considerable difficulties accounting for assertions of (226) in response to a query about the location of a particular set of keys.

(226) The keys might be on the kitchen table.

• Solipsistic Semantics

- Suppose the speaker of (226) doesn't know where the keys are.
- So it's consistent with what the speaker knows that the keys are on the kitchen table.

- Suppose further that the addressee knows that the speaker doesn't know that the keys are not on the kitchen table.
- In that case, it's still felicitous for the speaker to assert (226)—i.e. as an attempt to guide the addressee's attention to that possibility.
- However, on a solipsistic analysis, the speaker is predicted to assert a proposition that is thoroughly uninformative to the addressee. And such assertions are generally not appropriate.

- **Non-Solipsistic Semantics**

- On the non-solipsistic semantics, the speaker asserted something about not only his own, but also the interlocutors information state.
- This means that the speaker must be (near) certain that the interlocutor hasn't ruled out that the keys are on the table.
- But this example is easily described so that the speaker is *not* (near) certain that the interlocutor has ruled this out — and yet the speaker's assertion is appropriate.

- Notice also that it's easy to imagine scenarios where the speaker *would* say (226), but wouldn't say (227).

(227) I know that the keys might be on the table.

- This seems to suggest that Williamson's (2000) 'knowledge norm of assertion' — that one must assert p only if one knows that p — is incorrect.
- Similarly, Brandom (1994, 173) is wrong to claim that speakers "undertake a specific task responsibility, namely the responsibility to show that they are *entitled* to the commitment expressed by their assertions".

Clearly my housemate can say that my keys might be on the table without any special epistemic entitlement—let alone the responsibility to show that he has such an entitlement—and without making any special commitments. (Swanson, 2011, 262)

- One option is to deny that speakers are in effect *asserting* when they utter a 'might'-sentence. However, this makes it difficult to explain what we should say about sentences such as (228) and (229).

(228) Half these tires are worn, and might have punctures too.

(229) Most of the candidates are possible hires, and well-credentialed too.

- In general, it simply seems as if the norms of assertion for doxastically hedged statements are less stringent than the norms governing non-hedged statements.

Epistemic Authority

- Non-hedged statements signals that the speaker has a certain level of authority.
- In contrast, a speaker who makes a doxastically hedged assertion will in effect signal her ignorance with respect to the hedged proposition expressed and this weakens the norms governing the assertion.
- But the relation between claims of authority and the language used is a bit more complicated than this. For example, consider (230)-(232)

(230) The keys might be on the table.

(231) The keys are likely on the table.

(232) The keys are very likely on the table.

- A speaker asserting (230) seems to claim less authority than a speaker asserting (231). Similarly, a speaker asserting (231) seems to claim less authority than a speaker asserting (232).
- What kind of authority a speaker claims in making a statement seems to depend on the epistemic position the speaker is required to be in in order to appropriately assert. With 'might'-statements, the speaker can be in a very weak epistemic position and still assert.
- But some uses of the language of subjective uncertainty does not automatically signal ignorance on the part of the speaker. For example,

(233) It's 90% likely that ϕ .

- (233) does not signal uncertainty on the part of the speaker because in order to flat out assert (233), the speaker must be in a relatively strong epistemic position, i.e. to make such a precise estimation of the probability of ϕ , the speaker must be (near) certain. In contrast,

(234) It's quite probable that ϕ .

- To assert (234), the speaker needs to be in a much less privileged epistemic position, because a number of different credences in ϕ would be compatible with that claim. I.e. if the speaker has, say, credence 0.7-0.85 in ϕ , the speaker could comfortably assert (234).

One important lesson to draw from these examples is that often speakers have quite modest intentions when they use doxastically hedged statements. Often, their hedging indicates that they are communicating from a position of ignorance. But this indication not only conveys a credence other than certainty

or near certainty. It also indicates a kind of epistemic and communicative modesty—a disposition to take one’s own credence as less than authoritative, and an intention that one’s addressees take the expression of that credence as less than authoritative—that attenuates the authority that she claims with her assertion, and hence the norms that govern it. (Swanson, 2011, 265)

- This leads Swanson to posit the following principle:

AUTHORITY REFLECTS RANGE:

The authority that a speaker claims in asserting that ϕ decreases with increases in the size of the range of credences such that ‘S believes that ϕ ’ is true (holding fixed context, content of the prejacent, vagueness of expression, intonation, stakes, background conditions, and other factors that help determine the authority that a speaker claims).

- The lack of authority indicated by an assertion of ‘might ϕ ’ also explains why it would be “unfair” to respond to (230) in the following way:

(235) No, I’ve already looked on the kitchen table. They’re not there. So why did you say they might be there?

By appealing to the ways in which the language of subjective uncertainty can modulate the authority of an assertion, we can explain aspects of cases that are commonly used to motivate relativist theories of the content of doxastically hedged statements. (Swanson, 2011, 265)

EAVESDROPPING: The White spies are spying on the Red spies, who are spying on the gun for hire. The gun for hire has left evidence suggesting that he is in Zurich, but one clever White spy knows that he is in London. After finding the planted evidence, one Red spy says to the others, “The gun for hire might be in Zurich,” and the others respond “That’s true.” The clever White spy says “That’s false—he’s in London” to the other White spies, and explains how he knows this.

- Rather than explaining the Red spies utterance appealing to the assessor’s epistemic position, Swanson argues that we are inclined to judge the Red spy’s utterance in a “lenient” way (because it signals uncertainty).
- Moreover, it’s appropriate for the White spy to respond as he does, because he’s in a more privileged epistemic position.
- One argument in favor of explaining this case in terms of claims to authority is the following: We have a stronger sense that (236) is straightforwardly false than we do for (237).

(236) RED SPY: “The gun for hire can’t be in London.”

(237) RED SPY: "The gun for hire might be in Zurich."

- The explanation would be that (236) signals a higher level of authority and thus imposes stronger requirements on the epistemic position that Red Spy would have to be in to appropriately assert.

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Lecture 11

Epistemic Modality and Truth Conditions II
Yalcin on Epistemic Contradictions

Epistemic Contradictions

- The sentences below are clearly infelicitous.
 - (238) # It is raining and it might not be raining.
 - (239) # It is raining and possibly it is not raining.
 - (240) # It is not raining and it might be raining.
 - (241) # It is not raining and possibly it is raining.
- The logical form of (238)-(239) is (242), and the logical form of (240)-(241) is (243).
 - (242) $(\phi \wedge \diamond \neg \phi)$
 - (243) $(\neg \phi \wedge \diamond \phi)$
- The standard way of explaining the infelicity of these sentences is to treat them essentially as instances of Moore-paradoxical sentences, i.e. (244) and (245) below.
 - (244) It is raining and I do not know it is raining.
 - (245) It is not raining and for all I know it is raining.
- The standard explanation for the infelicity of (244) and (245), following DeRose (1991), is that the speaker involves himself in some kind of pragmatic conflict:
 - By asserting “it is (not) raining”, the speaker represents himself as knowing that it is (not) raining.
 - The assertion of “I know it is (not) raining” is inconsistent with this representation.

– Hence, the sentences sound contradictory.

- Extending this explanation to the epistemic contradictions above requires only one assumption:

$$(246) \quad \diamond\phi \models \neg K_i \neg\phi. \quad (i = \text{the speaker})$$

$$(247) \quad \diamond\neg\phi \models \neg K_i \phi.$$

- Given this, (238)-(241) will each entail a Moore-paradoxical sentence, i.e.

$$(248) \quad \begin{array}{l} \text{It is raining and it might not be raining.} \\ \leadsto \text{It is raining and I do not know that it is raining.} \end{array} \quad (244)$$

$$(249) \quad \begin{array}{l} \text{It is not raining and possibly it is raining.} \\ \leadsto \text{It is not raining and for all I know it is raining.} \end{array} \quad (245)$$

Problem: Embedded Epistemic Contradictions

- Consider the following examples.

(250) **Suppositions**

- # Suppose it is raining and it might not be raining.
- # Suppose it is not raining and it might be raining.
- # Suppose it is raining and possibly it is not raining.
- # Suppose it is not raining and possibly it is raining.

(251) **Conditionals**

- # If it is raining and it might not be raining, then ...
- # If it is not raining and it might be raining, then ...

- These sentences are clearly infelicitous—in fact, barely comprehensible.
- Let's represent the logical form these sentences as follows.

$$(252) \quad \# \text{ Suppose } (\phi \wedge \diamond\neg\phi) \quad (250a) / (250c)$$

$$(253) \quad \# \text{ Suppose } (\neg\phi \wedge \diamond\phi) \quad (250b) / (250d)$$

- These cases cannot be explained along the same lines as the epistemic contradictions above as witnessed by the fact that (254) and (255) below sound perfectly felicitous.

$$(254) \quad \text{Suppose it is raining and I do not know that it is raining.}$$

$$(255) \quad \text{Suppose it is not raining and for all I know it is raining.}$$

Like Moore-paradoxical sentences, epistemic contradictions are not assertable; but unlike Moore-paradoxical sentences, they are also not supposable, not entertainable as true. (Yalcin, 2007, 987)

- How should we explain that these epistemic contradictions are infelicitous under suppositions and in conditionals? We seem to face a dilemma.
 - Suppose that $\neg\phi$ is truth conditionally compatible with $\diamond\phi$. If so, there should be no problems with *supposing* the conjunction of two. However, it seems that such suppositions are not intelligible.
 - Suppose that $\neg\phi$ is truth conditionally *incompatible* with $\diamond\phi$. If so, $\diamond\phi$ must entail the negation of $\neg\phi$, viz. ϕ . But that's obviously absurd.
- In short, there is a tension between three constraints on logical consequence.
 - (a) **Classical Consequence:** ' \models ' is classical.
 - (b) **Nonfactivity of Epistemic Possibility:** $\diamond\phi \neq \phi$.
 - (c) **Epistemic Contradiction:** $(\neg\phi \wedge \diamond\phi) \models \perp$
- These are jointly incompatible, so what do we do?

The nonfactivity of epistemic possibility is surely nonnegotiable. Given that we keep it, we seem to face a choice between the principle of epistemic contradiction and the thesis that the consequence relation is classical. If we reject epistemic contradiction, we need to explain what it is about our epistemic contradictions that makes them semantically defective in embedded contexts. This does not look easy to do. Again, if epistemic contradiction is false and $\neg\phi$ and $\diamond\phi$ really are consistent in the sense appropriate to the correct semantics of the language, it is not clear why they should not be simultaneously entertainable as true, or why their conjunction does not embed intelligibly. On the other hand, if we keep epistemic contradiction, we need to clarify the nonclassical alternative notion of consequence in play. (Yalcin, 2007, 989)

Problems with Standard Relational Semantics

- On the standard relational view of modality, the truth conditions for possibility modals is given as follows: (we can assume that R is determined by context)

(256) $\llbracket \diamond\phi \rrbracket^{c,w}$ is true iff $\exists w' (wRw' \wedge \llbracket \phi \rrbracket^{c,w'}$ is true)
- We assume that context determines a particular modal accessibility relation, i.e. an epistemic accessibility relation:

(257) wRw' iff w' is compatible with evidential state S in w .
(where w' is compatible with S just in case w' is left open by S in w .)

- Most discussions have focused on how to determine S , viz. the relevant information/evidential state, but Yalcin argues that there is a more basic problem.

Let us set aside these questions for now. For even bracketing the question of whether it is actually possible to sort out what the right S is in any given case, we can see that there is a more basic problem with this semantics. It is the problem this paper we [*sic*] began with. On a relational semantics of the sort just described, epistemic contradictions are mistakenly predicted to be entertainable as true, and mistakenly predicted to be felicitous in embedded contexts.

(Yalcin, 2007, 991)

- I.e. this relational semantics will predict that sentences like (251) have straightforwardly true interpretations and hence are felicitous.

(258) # If it is not raining and it might be raining, then for all I know it is raining.

- The second conjunct of the antecedent is going to be true just in case the relevant agent is not in a position to rule out that it is not raining. Obviously, such a scenario is completely consistent with it in fact not raining, and hence (258) is predicted to be true.
- **What is wrong with relational semantics?** Yalcin writes:

Why does it miss the facts? The problem, I suggest, is the idea, practically built into a relational semantics for modals, that the evidential state relevant to the truth of an epistemic modal clause is ultimately determined as a function of the evaluation world—the world coordinate of the point at which the modal clause is evaluated. If we model epistemic modals as if they behaved that way, epistemic modal clauses end up acting like (covert) descriptions of epistemic states. And as a result, sentences like (1)–(4) are incorrectly predicted to be as embeddable as the overtly epistemic-state-describing counterparts of these sentences—that is, Moore-paradoxical sentences.

(Yalcin, 2007, 992)

Domain Semantics

- On the relational semantics above, the *index* consists of only a world-parameter:

$$[[\cdot]]^{c,w}$$

- Yalcin proposes to expand the index to include an information state parameter, s , ranging over bodies of information—formally a set of worlds:

$$[[\cdot]]^{c,(s,w)}$$

- The information parameter will now be assumed to supply the domain of quantification for epistemic modals, so:

$$(259) \quad \llbracket \diamond\phi \rrbracket^{c,(s,w)} \text{ is true iff } \exists w' \in s: \llbracket \phi \rrbracket^{c,(s,w')}$$

- Only (epistemic) modal expressions (more or less) will place constraints on s .
- Next, to resolve the dilemma outlined above, Yalcin gives a semantics for supposition verbs and conditionals.

$$(260) \quad \llbracket x \text{ supposes } \phi \rrbracket^{c,(s,w)} \text{ is true iff } \forall w' \in S_x^w: \llbracket \phi \rrbracket^{c,S_x^w,w'}$$

$$(261) \quad S_x^w =_{\text{def}} \text{the set of worlds not excluded by what } x \text{ supposes in } w.$$

- In general, the computing the truth conditions of a supposition attribution won't require inspection of the s -parameter.
- However, when the complement of the supposition contains an epistemic modal, i.e. when the epistemic modal is embedded under a supposition-verb, the epistemic modal will in effect quantify over supposition-worlds.

$$(262) \quad \llbracket x \text{ supposes } \diamond\phi \rrbracket^{c,(s,w)} \text{ is true iff } \forall w' \in S_x^w: \exists w'' \in S_x^w: \llbracket \phi \rrbracket^{c,S_x^w,w''} = 1$$

- In other words, the supposition-verb shifts s to the supposition worlds, viz. S_x^w .
- So, the truth conditions of (262) can be reduced to this: $\exists w'' \in S_x^w: \llbracket \phi \rrbracket^{c,S_x^w,w''} = 1$
- It can now be shown that there is no state of supposition making $(\neg\phi \wedge \diamond\phi)$ true.

$$(263) \quad \llbracket x \text{ supposes } (\neg\phi \wedge \diamond\phi) \rrbracket^{c,(s,w)} \text{ is true iff}$$

$$\text{a. } \forall w' \in S_x^w: \llbracket \neg\phi \rrbracket^{c,S_x^w,w'} \text{ and}$$

$$\text{b. } \exists w' \in S_x^w: \llbracket \phi \rrbracket^{c,S_x^w,w'}$$

- Since we have less time than usual, I'll skip Yalcin's analysis of the conditional cases.
- The puzzle, outlined above, is now largely solved using an analysis where $\diamond\phi$ and $\neg\phi$ are modeled as having *compatible* truth conditions because they place constraints on different coordinates:

$\diamond\phi$ places constraints on s .

$\neg\phi$ places constraints on w .

- Their joint incompatibility in embedded environments is explained by a failure to be jointly acceptable in a single information state.

However, it's not clear to me that Yalcin can predict that an imperative of the form "suppose that $\neg\phi$ and suppose that $\diamond\phi$ " is impossible to comply with—seems like dynamic conjunction is needed.

It does seem like Yalcin can predict that it's impossible to comply with "Suppose $(\neg\phi \wedge \diamond\phi)$ ".

Consequence

- Given that the puzzle was setup as a tension between one notion of consequence (classical consequence) and epistemic contradiction, it's instructive to consider which notions of consequence work with the proposed solution.
- Yalcin sets aside the notion of consequence defined in terms of truth at every point of evaluation.
- First, recall Kaplan's notion of truth at a context. (ϕ_c is an occurrence of ϕ in c).

$$\phi_c \text{ is true iff } \llbracket \phi \rrbracket^{c, \langle s_c, w_c \rangle} \text{ is true}$$

- First notion of consequence to be considered: *diagonal consequence*.

Diagonal Consequence

ϕ is a *diagonal consequence* of a set of sentences Γ , $\Gamma_d \phi$, just in case for any context c , if every member of Γ_c is true, then ϕ_c is true.

- The evaluation points relevant for determining diagonal consequence are only the pair of a context and the evaluation points determined by that context—call these points *diagonal points*.
- Some properties of diagonal consequence and the information parameter:

Reflexivity: For every diagonal point $\langle c, s, w \rangle$, $w \in s$

Non-collapse: For some diagonal point of evaluation $\langle c, s, w \rangle$, $\{w\} \neq s$

- In short, what is true at c is possible at c , and what is possible is not *merely* what is actual.
- On this notion of consequence, (264) follows.

$$(264) \quad (\neg\phi \wedge \diamond\phi) \not\equiv_d \perp$$

- Since diagonal consequence gives up **epistemic contradiction**, there is a *classical* notion of consequence compatible with the solution to the puzzle.
- TWO CHALLENGES TO DIAGONAL CONSEQUENCE:
 - (a) Diagonal consequence requires a definition of truth for epistemic modal claims *at a context*, i.e. it requires a specification of how c determines a relevant s , viz. s_c . But there is no consensus on how context is supposed to do that.
 - (b) Diagonal consequence has a hard time explaining the following inference patten: Suppose it's not raining. Given this supposition, might it be raining? No. Hence $\neg\phi$ and $\diamond\phi$ are incompatible.

- **Acceptance and Informational Consequence**

- As an alternative to diagonal consequence, Yalcin consider a different notion that he calls *informational consequence*.

The notion of consequence I have in mind preserves, not truth, but a different property of sentences in context—one they have in relation to a state of information. We might call this property *acceptance*. (Yalcin, 2007, 1004)

(265) **Acceptance**

ϕ_c is accepted in information state s iff for all worlds w in s , $\llbracket \phi \rrbracket^{c, \langle s, w \rangle}$ is true.

- Informational consequence is the defined as follows:

Informational Consequence

ϕ is a *informational consequence* of a set of sentences Γ , $\Gamma \models_i \phi$, just in case for every context c and body of information s , if every member of Γ_c is accepted in s , then ϕ is accepted in s .

- Hence, *informational consequence* is preservation of *acceptance* (rather than truth).
- The advantages of informational consequence:

(a) **No Definition for Diagonal Points**

This notion of consequence does not require a definition of diagonal points. (it only requires truth at a point of evaluation).

(b) **Epistemic Contradiction**

It respects the intuitive pattern of inference from $\neg\phi$ to $\neg\Diamond\phi$. (for a state to accept $\neg\phi$ is for ϕ to be false at every world in the state. Hence, there is no possibility that ϕ , so $\neg\Diamond\phi$ is true.)

(c) **Non-Factivity**

It respects non-factivity of \Diamond : $\Diamond\phi$ only requires that the state contains one ϕ -world (to be accepted)— ϕ requires that every world in the state is a ϕ -world. So, there is no inference from $\Diamond\phi$ to ϕ .

- **Non-classical consequence**

- Since (b) and (c) are classically incompatible, viz. non-factive epistemic possibility and epistemic contradictions, and both are validated by informational consequence, informational consequence is non-classical.

Informational consequence is built around the notion of acceptance. Acceptance is a gappy notion. Fixing context, there is a gap between (nonepistemic) ϕ being accepted with respect to some s and $\neg\phi$ being accepted (ϕ being rejected) with respect to that s . It may be that ϕ is neither accepted nor rejected.

Nonepistemic sentences are therefore what we might call acceptance-trivalent. The epistemic possibility operator \diamond exploits this trivalence: semantically it maps acceptance-trivalent sentences onto acceptance-bivalent ones. (Along with negation, it can be construed as an acceptance-functional operator.) It is the existence of a third acceptance value which introduces the nonclassical behaviour, and which lets us have both epistemic contradiction and nonfactivity. (Yalcin, 2007, 1006)

Content and Communication

- Two questions to be distinguished:
 1. What is the compositional semantics of an epistemic modal sentence?
 2. What informational content do modal sentences communicate?
- Only the first question has been addressed so far.
- The second question is, among other things, relevant to the notion of consequence discussed above—i.e. one might think that the notion of consequence adopted should preserve the content communicated in context.
- **Background:** A Stalnakerian model of communication.
 - Communication takes place against a background of shared *presuppositions*.
 - The goal of assertion is to coordinate on a body of information.
 - Discourse participants can take different attitudes towards the propositions in the common ground (i.e. knowledge, justified belief, conjecture, fiction, etc.) — Yalcin refers to this as the *conversational tone*.
- Two different analyses of the pragmatics of epistemic modal statements: One analysis which is congruent with the *diagonal* notion of consequence and one which is congruent with the *informational* notion of consequence. (In the interest of time, I'll only discuss the latter analysis.)
- **Epistemic Modals as Compatibility Claims:**

To say $\diamond\phi$ is not to propose to add some informational content, some proposition, to the common ground, as with assertions. Rather, it is to make explicit that ϕ -possibilities are compatible with the common ground—to make 'explicit that the negation of ϕ is not presupposed in the context' (to quote a passing suggestion of Stalnaker 1970, p. 45). (Yalcin, 2007, 1010)
- In other words, according to Yalcin, there is no *proposition expressed* by an epistemic modal claim—and hence there is no question whether the proposition expressed is true or false.

At most we can ask whether the claim is appropriate to accept or not, given the conversational tone(s) of the conversation. (Yalcin, 2007, 1011)

- This fits well with the informational notion of consequence, since it is essential to that notion whether a sentence is *accepted* in a given state or not—not whether it is true/false.
- In short:

Informational View

To say that $\diamond\phi$ in a context c is to propose to make $\diamond\phi_c$ accepted with respect to the context set of c .

- **Advantages of the Informational View:**
 - Like informational *consequence*, the informational view of assertion does not require the definition of diagonal points of evaluation.
- One argument in favor of the informational view—Suppose you are told the following:
 - Nobody, including ourselves, knows whether there is lead on Pluto.
 - Nobody is even close to having evidence on the question either.
 - As a matter of fact, there is no lead on Pluto.
- Now consider (266):

(266) There might be lead on Pluto

- Intuitively, (266) is false.
- This suggests, at least, that epistemic modal statements are not relative to a body of information *possessed* by a relevant set of agents, but rather relative, simply, to a body of information.

When you evaluated ‘There might be lead on Pluto’ for truth, plausibly what you considered was whether lead’s being on Pluto would be compatible with the information you were asked to take for granted. We could say that you assessed whether the sentence was acceptable (in the technical sense) with respect to a certain temporary or ‘derived’ context set, one which included the information provided by premisses I asked you to take as given. Your judgement of falsity, on this interpretation of the facts, was really a (correct) judgement that the sentence could not be accepted with respect to that body of information. (Yalcin, 2007, 1012)

But in what sense is an epistemic modal claim neither true nor false on Yalcin’s view? — After all, the semantics presented in the earlier sections did state quite explicitly the truth conditions for sentences of the form $\diamond\phi$.

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Lecture 13
Probability Operators

What are Probability Operators?

- Paradigm cases (in English) include: *probably* and *it is likely that*.
- **Main Point of Yalcin's Paper:**
How to devise and integrate an analysis of probability operators into a compositional semantics.
- More specifically, an analysis that both makes correct predictions about various inferences licensed by probability-talk, and which explains the interesting interactions and relations between modals, conditionals, and probability-talk.
- **Three Assumptions:**
 - i. Probability operators combine with sentence meanings (i.e. propositions)—perhaps after first combining with some (possibly hidden) morphology.
 - ii. *Probable* and *likely* make the same semantic contributions.
 - iii. Probability talk is fundamentally comparative in nature (and thus parallels gradable adjectives more generally).
- The question concerning differing interpretations of probability, e.g. *objective chance* vs. *subjective Bayesian* interpretations, won't be addressed.

Relative Likelihood: Kratzer's Analysis of Probability

- Kratzer assumes that probability operators should be analyzed along the same lines as various modal expressions.
- Recap of Kratzer's analysis of modals:
 - Modals are quantifiers over possible worlds.

- The interpretation of modals is relative to two separate contextual parameters—conversational backgrounds, namely
 - (a) **Modal Bases:** the domain of the modals—the set of worlds over which the modals quantify.
 - (b) **Ordering Sources:** A reflexive and transitive ordering relation (pre-order), \geq over the worlds in the modal base.
- For the interpretation of probability operators, Kratzer assumes that the modal base is a set of epistemically accessible worlds (i.e. worlds compatible with some information state), and that the ordering source is *stereotypical*, i.e. ordered in terms of (some notion of) *normality*.
- Orderings are determined on the basis of a set of propositions \mathcal{P} (provided by context)—the propositions *normally* true.
- The more elements of \mathcal{P} are true at a world w , the higher w is ranked.

$$w \geq w' \text{ iff } \{p \in \mathcal{P}: w' \in p\} \subseteq \{p \in \mathcal{P}: w \in p\}$$

- Kratzer now defines the comparative constructions in (267) and (268) as a reflexive and transitive relation, \succeq , (defined in terms of the normality preorder).

$$(267) \quad \phi \text{ is as least as likely as } \psi \quad = \phi \succeq \psi$$

$$(268) \quad \phi \text{ is at least as probable as } \psi \quad = \phi \succeq \psi$$

$$\phi \succeq \psi \text{ iff } \forall w \in \psi: \exists w' \in \phi: w' \geq w$$

- And (269) can then be defined as follows:

$$(269) \quad \llbracket \phi \text{ is more likely than } \psi \rrbracket = 1 \text{ iff } (\phi \succeq \psi) \wedge \neg(\psi \succeq \phi)$$

$$(270) \quad \llbracket \text{Probably } \phi \rrbracket = 1 \text{ iff } (\phi \succeq \neg\phi) \wedge \neg(\neg\phi \succeq \phi)$$

- So, on Kratzer's view, a proposition is probable only if it's more probable than it's negation.

- In short:

[F]irst, context supplies a set of epistemically accessible worlds and a set of propositions to serve as the ordering source; second, the ordering source induces a preorder over the epistemically accessible worlds; third, this preorder on worlds induces the preorder \succeq on propositions semantically expressed by *is as at least as probable/likely as*; finally, semantics for the rest of the probability operators are defined in terms of \succeq . On this account, probability operators are effectively gradable epistemic modal operators. (Yalcin, 2010, 919)

Advantages of Kratzer's Account

- One problematic aspect of Kratzer's account is the notion of *normality*. Since no clear definition of this notion is available, and since what counts as *normal* depends largely on what is held fixed in a context, it's not entirely clear how to generate predictions on Kratzer's analysis.
- However, Kratzer's analysis does validate a number of intuitively correct inference patterns, i.e. the following.

V1 **Probably** $\phi \Rightarrow$ **Not-probably-not** ϕ

$$\frac{\text{Probably } \phi}{\text{---}} \text{---} \\ \text{---} \text{Probably } \neg \phi$$

V2 **Distributed Conjunction**

$$\frac{\text{Probably } (\phi \wedge \psi)}{\text{---}} \\ \text{Probably } \phi \wedge \text{Probably } \psi$$

V3 **Chancy Disjunction Introduction**

$$\frac{\text{Probably } \phi}{\text{---}} \\ \text{Probably } (\phi \vee \psi)$$

- As regards interactions between modals and probability claims, Kratzer's analysis validates some plausible inferences, e.g.

V6 **Must** $\phi \Rightarrow$ **Probably** ϕ

$$\frac{\text{Must } \phi}{\text{---}} \\ \text{Probably } \phi$$

V7 **Probably** $\phi \Rightarrow$ **Might** ϕ

$$\frac{\text{Probably } \phi}{\text{---}} \\ \text{Might } \phi$$

- Kratzer also gets nice results for conditionals.
- Two crucial features of Kratzer's analysis of conditionals

- (a) ‘if’-clauses are analyzed as domain restrictors—formally, as shifting the modal-base.
- (b) Conditionals are analyzed as being (covertly) modalized, i.e.

$$\begin{aligned} \llbracket \text{If } \phi, \psi \rrbracket^{c,f,w} &= \llbracket \text{MUST}(\psi) \rrbracket^{c,f^\phi,w} \\ \llbracket \text{MUST}(\psi) \rrbracket^{c,f^\phi,w} = 1 &\text{ iff } \forall w' \in \text{BEST}_{g(w)}(\cap f(w)): w' \in \llbracket \psi \rrbracket^{c,f,w} \end{aligned}$$

V8 Chancy Modus Ponens

$$\frac{\begin{array}{c} \text{If } \phi, \psi \\ \text{Probably } \phi \end{array}}{\text{Probably } \psi}$$

V9 Chancy Modus Tollens

$$\frac{\begin{array}{c} \text{If } \phi, \psi \\ \neg(\text{Probably } \phi) \end{array}}{\neg(\text{Probably } \psi)}$$

V10 Conditional to Comparative

$$\frac{\text{If } \phi, \psi}{\psi \text{ is at least as likely as } \phi}$$

Problems for Kratzer’s Analysis of Probability Operators

- Despite the impressive results of Kratzer’s analysis and its elegant integration of modals and conditionals, there are a number of intuitively valid inferential patterns that it fails to validate, e.g.

V11 Positive Form Transfer (not validated by Kratzer’s analysis)

$$\frac{\begin{array}{c} \psi \text{ is at least as likely as } \phi \\ \text{Probably } \phi \end{array}}{\text{Probably } \psi}$$

Countermodel: Imagine a total (and infinite) order where there is a world w in the chain such that for every world w' : $w' \in \phi \wedge w' \geq w$. Suppose further that as we ascend, every world in the chain alternates between ψ -worlds and $\neg\psi$ -worlds.

I1 Union Property Pattern (validated by Kratzer's analysis)

$$\frac{\begin{array}{l} \phi \text{ is at least as likely as } \psi \\ \phi \text{ is at least as likely as } \chi \end{array}}{\phi \text{ is at least as likely as } (\psi \vee \chi)}$$

Consider: Drawing the ace of spades is as likely as drawing the ace of hearts. Drawing the ace of spades is also as likely as drawing the ace of diamonds. But drawing the ace of spades is clearly not as likely as drawing either the ace of hearts or the ace of diamonds.

- An alternative version:

$$\frac{\begin{array}{l} \phi \text{ is at least as likely as } \phi \\ \phi \text{ is at least as likely as } \neg\phi \end{array}}{\phi \text{ is at least as likely as } \top}$$

- And from this Kratzer then validates I2.

I2 Collapse of Equiprobability into Certainty (validated by Kratzer's analysis)

$$\frac{\phi \text{ is at least as likely as } \neg\phi}{\phi \text{ is at least as likely as } \psi}$$

- Obviously, this is insane.

Quantitative Expressions

- Although the inferences patterns validated above are sufficiently damning to Kratzer's analysis, there is a further problem, namely that there is no obvious way on Kratzer's analysis to deal with explicitly quantitative expressions such as (271) and (272):

(271) There's a 0.5 chance of drawing a red card.

(272) There's a 60% probability that it's raining.

Probability Spaces

- For ease of exposition, assume that the space of all possible worlds, W , is finite.
- An **epistemic possibility space**, $\langle E, Pr \rangle$, is a pair of a subset of W , $E \subseteq W$, and a function Pr which assigns a real number $i \in [0,1]$ to each subset of W , and which satisfies the following conditions:

$$\text{i. } Pr(E) = 1$$

$$\text{ii. } Pr(p \cup q) = Pr(p) + Pr(q), \text{ if } p \text{ and } q \text{ are disjoint.}$$

- Assume further that context supplies a function:

$$g^c: W \mapsto \langle E, Pr \rangle$$

This function can be thought of as a probabilistic conversational background.

- So, context determines a probability space, and the preorder “is at least as likely as” is then straightforwardly determined by Pr :

$$p \succeq q \quad \text{iff} \quad Pr(p) \geq Pr(q)$$

- And we can define ‘... is probable’ in the usual way:

$$p \text{ is probable} \quad \text{iff} \quad Pr(p) > Pr(\neg p) \quad \equiv \quad Pr(p) > .5$$

- And necessity and possibility:

$$\begin{aligned} p \text{ is epistemically possible} & \quad \text{iff} \quad \exists w \in E: p(w) = 1 \\ p \text{ is epistemically necessary} & \quad \text{iff} \quad \forall w \in E: p(w) = 1 \end{aligned}$$

- I.e.

$$(273) \quad \llbracket \text{MIGHT } \phi \rrbracket^{w,e} = 1 \text{ iff } \exists w' \in E_{e(w)}: \llbracket \phi \rrbracket^{w',e} = 1$$

$$(274) \quad \llbracket \text{MUST } \phi \rrbracket^{w,e} = 1 \text{ iff } \forall w' \in E_{e(w)}: \llbracket \phi \rrbracket^{w',e} = 1$$

$$(275) \quad \llbracket \text{PROBABLY } \phi \rrbracket^{w,e} = 1 \text{ iff } Pr_{e(w)}(\{w': \llbracket \phi \rrbracket^{w',e} = 1\}) > .5 \\ 1 \text{ iff } Pr_{e(w)}(\{w': \llbracket \phi \rrbracket^{w',e} = 1\}) > Pr_{e(w)}(\{w': \llbracket \neg \phi \rrbracket^{w',e} = 1\})$$

- On this semantics, **V1-V7** above are validated. It also validates (V11) and (V12).
- Moreover, on this semantics, Union Property Pattern (I1) is invalidated.
- Finally, the account avoids **Conjunctivis** — see below.

E1 Conjunctivitis

Slightly confusing, Yalcin refers to this function as g^c in his definition, but uses e , as in $\llbracket \cdot \rrbracket^e$, in the rest of paper.

$$\frac{\text{Probably } \phi \\ \text{Probably } \psi}{\text{Probably } (\phi \wedge \psi)}$$

- Why is this inference bad? Suppose we're speculating what the next card in a fair deck of cards is. While (276) and (277) both seem true, (278) seems clearly false.

(276) Probably the card isn't a face card. (i.e. Jack, Queen, King)

(277) Probably the card isn't low enough to complete a wheel. (i.e. Ace-to-5)

(278) Probably the card isn't a face card nor low enough to complete a wheel.

- In order to validate (V8)-(V10), Yalcin needs an account of conditionals that can deal with probability expressions.
- Yalcin amends Kratzer's analysis of conditionals in the following way:

$$\llbracket \text{If } \phi, (\text{must}) \psi \rrbracket^{w,e} = \llbracket (\text{must}) \psi \rrbracket^{w,e^\phi}$$

- I.e. the antecedent is still treated as a domain restrictor (on worlds), which essentially shifts e to a set of ϕ -worlds in E . That is:

$$e^\phi(w) =_{\text{def}} \langle E^\phi, Pr^\phi \rangle$$

- Here E^ϕ is defined as the set of ϕ -worlds in E , and Pr^ϕ is defined as Pr conditionalized on ϕ .

The basic idea here is simple. What indicative *if*-clauses did before was restrict the quantificational domain for an epistemic modal. They will still do that here, by shifting the sample space E given by $e(w)$ to the subset of that space wherein the antecedent is true. But now they do one more thing: they shift the probability measure supplied by $e(w)$, by conditionalizing on the antecedent. One rough way to think of it: the *if*-clause shifts e to the nearest epistemic probability space that includes the information in the antecedent. Another: it shifts e to the minimal revision of e that would include the antecedent (albeit adopting a substantive view here about what 'minimal' amounts to).

(Yalcin, 2010, 928)

- **Semantics**

(279) $\llbracket \text{If } \phi, \text{ must } \psi \rrbracket^{w,e} = 1$ iff $\forall w' \in E_{e^\phi(w)}: \llbracket \psi \rrbracket^{w',e^\phi} = 1$

(280) $\llbracket \text{If } \phi, \text{ probably } \psi \rrbracket^{w,e} = 1$ iff $\Pr_{e^\phi(w)}(\{w': \llbracket \psi \rrbracket^{w',e^\phi} = 1\}) > .5$

- This analysis now validates (V8), (V9), and (V10).

Context-Sensitivity Probability Talk

- **Gradable Adjectives**

- On the standard treatment of gradable adjectives (or gradable predicates), these are analyzed in terms of scales of degrees: A scale is analyzed as a triple of a set of degrees, a total order on that set, and a property along which the degrees vary (i.e. height, weight, speed, etc.).

(281) Adam is taller than Eve.

- So, (281) is standardly predicted to be true if and only if the degree associated with Adam on the relevant scale is higher than the degree assigned to Eve.

Relative and Absolute Adjectives

- Some adjectives appear to have context-sensitive interpretations, i.e. where the relevant points of comparison on the scale in question are relative to some contextual question. For example, (282) is standardly analyzed as (283).

(282) Adam is tall.

(283) $\text{height}(\text{Adam}) > h_c$.

- What point Adam's height must exceed in order to be true seems to depend crucially on what background assumptions are in play, i.e. are we considering Adam's height relative to the average basketball player in the NBA, relative to an average person, relative to a toddler, etc.
- In other words, 'tall' is a *relative* gradable adjective; what counts as tall depends on the context.
- **Is 'probably' and 'it's likely that' like relative adjectives?**
- In the proposals discussed above, 'probable' and 'likely' were treated as absolute:

p is probable iff $\text{Pr}(p) > \text{Pr}(\neg p)$

– or equivalently

p is probable iff $\text{Pr}(p) > .5$

- In general, there are reasons to think that in order to count something as probable, it must be appreciably more probable than just ever so slightly over 0.5.
- Imagine a lottery with 1.000.001 tickets. Suppose *A* has bought 500.000 tickets and that *B* has bought 500.001 tickets. It seems incorrect to say (284) here.

(284) Probably, *B* won the lottery.

- A couple of ways of making the relevant threshold for probability claims context-sensitive:

$$p \text{ is probable iff } Pr(p) >_c Pr(\neg p)$$

— where ‘ $>_c$ ’ is interpreted as an ‘appriably greater than’-relation and where what counts as *appriably greater* is a function of the context. Alternatively,

$$p \text{ is probable iff } Pr(p) > n_c$$

— where context determines a relevant number n .

- Note, for the latter suggestion, that if no constraints are imposed on n , then it’s possible for a probability claim to be true even if what is predicated to be probable has a probability below .5.
- This would then threaten to invalidate (V1).

$$\text{Probably } \phi \Rightarrow \neg \text{Probably } \neg \phi$$

- However, there is empirical evidence that people will accept “Probably ϕ ” as true even when ϕ has a probability considerably lower than .5.
- For example, intuitions about (285a) and (286a) seem to diverge based on relevant background facts.

(285) **Background:** *Bloggs has bought 420 tickets and the other 580 players have one ticket each.*

a. Probably, Bloggs will win the lottery.

(286) **Background:** *Bloggs has bought 420 tickets and another player, Smith, has the remaining 580 tickets.*

a. Probably, Bloggs will win the lottery.

- This seems to suggest that the *absolute* analysis of probability talk is inadequate.

The obvious question to turn to now is, how is the relative contrast value for probably determined in context? Is it something like the mean of the probabilities of the live or salient alternatives? No, for consider Background *C*:

Background *C*: Bloggs has 420 tickets, Smith has 520 tickets, and 60 other players have one ticket each.

Here the chance that Bloggs is the winner is appreciably greater than the mean of the salient alternatives, but we are not inclined to judge [(285a)] true; we are inclined instead to say that Smith is probably the winner. Perhaps then we should say that the contrast value to ϕ is simply the alternative to ϕ with the greatest probability. But this too seems to be inadequate, at least without refinement. Suppose instead that the lottery is out of a million tickets; that Bloggs buys 300 tickets, and Smith buys 100; and that the other 999,600 tickets each go to 999,600 distinct players. Even though Bloggs is the most likely to win, and is well ahead of the next most likely alternative, native speakers will not enjoy affirming [(285a)] against such a background. The big picture information that Bloggs's overall chances of winning are slim seems to swamp judgments. (Yalcin, 2010, 931)

- However, despite this interesting data about judgments about probability talk, (287) is clearly marked:

(287) # Bloggs will probably win the lottery even though it is more likely than not that he'll lose.

- This is hard to reconcile with the other data points, since this seems to suggest that we should not give up the inference from 'Probably ϕ ' to ' \neg Probably $\neg\phi$ '.

Probability and Scope

- Surprisingly, it turns out that quantifying into the scope of a probability operator is harder than one would immediately think. For example, (288) is intuitively false.

(288) Everyone probably lost the lottery.

- One can force narrow-scope readings of the probability operator though (by e.g. placing operator inside a scope island.)

(289) There is somebody from NY who is likely to win the lottery.

- Similarly, the wide scope reading of the probability expression in (290) yields a reading not actually available.

(290) Apple selected an unlikely design for their new phone.

- # It was unlikely that Apple selected a design for their new phone.
- The design that Apple selected for their new phone was unlikely to be selected.

- Given this data, one might be tempted to question the assumption that embedded occurrences of 'likely' and 'probably' should be treated as sentence level operators.

Embedding Potentials

- Consider (291) and (292) below.

(291) John imagines that it's raining but that he doesn't know that it's raining.

(292) #John imagines that it's raining but that it is not likely that it's raining.

- On the standard relational semantic considered here, 'likely' and 'probably' are treated like propositional attitude verbs — hence, these expressions should be capable of shifting the evaluation world.
- However, if this was the right analysis, it's surprising that (292) sounds infelicitous.
- **Yalcin's Solution:** A domain semantics where the probability space is a function of context directly—and not a function of the evaluation world.
- By adjusting the semantics for various propositional attitude verbs, one can then predict why (292) is marked.

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