



The Meanings of Epistemic Modality

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Presentation at *Sinn und Bedeutung 7*, Universität Konstanz, October 5, 2002





Outline

1. The ECP
2. *Ja*
3. The No-Binding Effect
4. Epistemic Meanings





The Epistemic Containment Principle

A quantifier cannot have scope over an epistemic modal.

Supporting Examples

??Every student_{*i*} must be home if his_{*i*} light is on.

#Every student may be the tallest person in the department.

- a. every student x (may x be the tallest) sensible, *ECP
- b. may (every student be the tallest) nonsense, ^{OK}ECP





A Suggestion

Why don't you say that epistemic modals need to take full propositions as their arguments since they signal a deduction of that proposition from the speaker's evidence base. And so they couldn't take something that has a variable in it.





That won't work!

- (a) Even clauses with variables in them denote propositions, it's just that what proposition it is varies with the variable assignment. But the modal wouldn't know about that.
- (b) The standard semantics for modal operators doesn't make one expect that one couldn't bind into the scope of such an operator.
- (c) Anyway, it just doesn't seem like that's the right generalization. The following data show that one can bind into the complement of epistemic modals.





Counterexamples

1. Every student_{*i*} thinks that Mary $\left\{ \begin{array}{l} \text{may} \\ \text{must} \end{array} \right\}$ like him_{*i*} the most.
2. It didn't take me long to find out which workers_{*i*} the boss must have reprimanded t_i .
3. The detective wants to talk to everyone who_{*i*} may t_i have seen the accident.





The ECP revised as a condition on QR

A quantifier cannot *take* scope over an epistemic modal. More precisely,

At LF, a quantifier cannot bind its trace across an epistemic modal.

* $Q_i \dots [\text{Epistemic Modal} (\dots t_i \dots)]$

Beyond that we moved on to exciting topics such as

- Scope Reconstruction in A-Movement
- Antecedent Contained Deletion and Constraints on QR





Let's Pretend

Let's pretend that the problematic data didn't exist. Could we devise an explanatory account that would predict that there could be no variable binding into the complement of an epistemic modal from the outside? That is, if the following were indeed always impossible, could we hope to be able to explain that?

* $Q_i \dots$ [Epistemic Modal ($\dots x_i \dots$)]





Kratzer on German *ja*

Mapping the Semantics-Pragmatics Boundary: Context-Dependence.
Conference held at Cornell University, March 26-28, 1999.

- David Kaplan:
The Meaning of 'Ouch' and 'Oops'
- Angelika Kratzer:
Beyond 'Ouch' and 'Oops': How Descriptive and Expressive Meaning Interact
<http://semanticsarchive.net/Archive/WEwNGUyO/>





The Meaning of *Ja*

Ja α is appropriate in a context c if the proposition expressed by α in c is a fact of w_c which — for all the speaker knows — might already be known to the addressee.

Du hast ja'n Loch im Ärmel.
You have *ja*+a hole in+the sleeve





Some more examples

Du hast ja'ne neue Frisur.

You have *ja*+a new hairdo

Who did Austin marry?

*Austin hat ja Ashley geheiratet.

Austin has *ja* Ashley married.





Expressive meaning in 2nd dimension

Discourse particles and other kinds of expressives are ignored in the computation of descriptive meanings.

Sie kann nicht kommen, weil sie ja ihre Zwillinge versorgen muß.
She cannot come because she *ja* her twins take care of must

Webster schläft ja.

Are you sure?

(= are you sure that Webster is sleeping?)

(≠ are you sure that the addressee might already know this?)





Computation of meaning⁺, first shot

Webster schläft *ja*.

Webster sleeps *ja*

Descriptive meaning: $p = \lambda s (\text{sleep}(\text{Webster})(s))$

Expressive meaning contributed by *ja* (roughly):

$\lambda s (p(w_s) \ \& \ \text{might}(s)(\lambda s'(\text{knows}(s')(p)(\iota x(\text{addressee}(s)(x))))))$





The No-Binding Effect

“Since the scope of a discourse particle has to express a proposition, the scope of a discourse particle cannot include pronouns that are bound from outside. That is, no discourse particle can intervene between a bound variable and its binder.”

Jeder von diesen Arbeitern_{*i*} hat seinen Job verloren, weil er_{*i*} (*ja) in der Gewerkschaft war.

Each of these workers has his job lost because he *ja* in the union was





Principled Exception: Reported Speech

Jeder der Zeugen_{*i*} behauptete, er_{*i*} habe *ja* mit eigenen Augen gesehen, daß ...

Each of the witnesses claimed he had *ja* with own eyes seen that ...





Beyond *ja*

Very similar data involving (i) no effect on descriptive meaning, (ii) impossibility of binding can be found with other elements. Relevant here is much work on discourse particles, sentence adverbials, parentheticals, *since*-clauses, etc.

Das Spiel wird abgesagt, weil es bekanntlich regnet.
the game is cancelled because it as-is-known rains

Das Spiel wird abgesagt, weil es bekannt ist, daß es regnet.
the game is cancelled because it is known that it rains
[from Irene Heim's MA thesis]





No Binding

?Jeder Spieler_{*i*} wurde ausgepiffen, weil er_{*i*} bekanntlich zuviel verdient.
every player was booed because he as-is-known too much earns.





Some English examples

You should be ashamed, because obviously you did something wrong.

You should be ashamed, because it is obvious that you did something wrong.

?Every player_{*i*} was booed because he_{*i*} obviously makes too much money.

John stayed home because, as Mary had suspected, it rained hard.

?Every boy_{*i*} cried because, as Mary had predicted, he_{*i*} didn't like his_{*i*} present.





The No-Binding Effect

Question. Why should elements like ja block binding of variables across them and how does that actually get implemented?

There are two possible kinds of answers.

- No tolerance for bound variables: ja is unhappy
- No access to bound variable: quantifier is unhappy





No tolerance for bound variables: *ja* is unhappy

Kratzer: “Since the scope of a discourse particle has to express a proposition, the scope of a discourse particle cannot include pronouns that are bound from outside. That is, no discourse particle can intervene between a bound variable and its binder.”

Immediate Problem: Under the variable assignment $g^{x/i}$ that is passed down into the scope of the quantifier Q_i , the complement of the *ja*-element will in fact supply a proposition.

$$\llbracket \text{he}_i \text{ left} \rrbracket^{g^{x/i}} = \lambda w. g^{x/i}(i) \text{ left in } w = \lambda w. g(x) \text{ left in } w.$$





No access to bound variable: quantifier is unhappy

- Quantifier cannot bind across dimensions.
- Quantifier cannot bind into non-truthconditional meaning.





Option 1: No binding across dimensions?

Chris Potts (UC Santa Cruz, p.c.):

Exploit the well-known technical problem with cross-dimensional quantification in a two-dimensional system.

Turn Karttunen & Peters' *Binding Problem* into a *No-Binding Virtue*





Karttunen & Peters' Problem Sentence

!!Somebody managed to succeed George IV.

Two Dimensions of Meaning:

Meaning: *Someone succeeded George IV.*

Meaning⁺: *Someone found it difficult to succeed George IV.*





Possible Problem

Other constructions that may plausibly be analyzed as two-dimensional do not block binding.

At least one boy_{*i*} claimed (that he_{*i*} was sick) but (that he_{*i*} would come to school anyway).





Option 2: Merely Presuppositional Items Block Binding?

Potts' intuitive claim in his recent papers on *as*-parentheticals:

A quantifier cannot bind into the complement of an element that has no effect on the descriptive meaning.

Counterexample

Every boy_{*i*} claimed that even his_{*i*} mother hates him_{*i*}.





Option 3: Unembeddable Meanings?

Idea

The *ja*-items have *procedural* rather than descriptive meanings. They are speech act markers. But then the meaning of the whole expression is not based on truth-values anymore and thus not a meaning that can enter into the recursive semantics anymore \Rightarrow *unembeddable meanings!*





Lewis (1970)

(...) the entire apparatus of referential semantics pertains to sentence radicals and constituents thereof. The semantics of mood is something entirely different. It consists of rules of language use such as (...): React to a sentence representing the mood imperative with an S-meaning m (...) by acting in such a way as to make m true (...)





Problem: Embedding is Possible

Sie kann nicht kommen, weil sie ja ihre Zwillinge versorgen muß.
She cannot come because she *ja* her twins take care of must

It is obviously true that if, *as John claims*, snow is white, then grass is green. (Mitch Green, *L&P*)





Problem: Krifka

Krifka's argument for quantifying into questions:

What did everyone buy?

= For everyone_{*i*}, I'm asking the question what x_i bought.





Conjecture

Elements like ja have procedural/non-truthconditional meanings but only in the dimension of expressive meaning (meaning^+).

Only embedding constructions that need access to meaning^+ will not be able to embed ja . Those are the quantifier variable constructions.





Understanding Kratzer's Exception

Every witness_{*i*} said that he_{*i*} *ja* had seen . . .

Possible Explanation: The pronoun is not bound directly by the quantifier. It is a logophoric pronoun whose reference is the “I” of the reported speech act.





Conclusion

We will be able to explain the no binding effect either once the cross-dimensional system has been developed in full or by positing that the relevant operator creates unembeddable meanings in the expressive dimension.

So now, can we subsume the ECP under such a picture? That is, can one plausibly argue that epistemic modality is similar to *ja* and other discourse operators?





Epistemic Modality as Expressive Meaning

Drubig, Hans Bernhard (2001):

On the Syntactic Form of Epistemic Modality

<http://www.sfb441.uni-tuebingen.de/b2/papers/DrubigModality.pdf>





A popular characterization

Epistemic modals serve as a signal of the strength and/or source of the speaker's commitment to the underlying proposition.

- “indication by the speaker of his (lack of) commitment to the truth of the proposition being expressed” (Palmer: 1986, 51).
- “In its most normal usage, epistemic *must* conveys the speaker's confidence in the truth of what he is saying, based on a deduction from facts known to him (which may or may not be specified)” (Coates:1983, 41)
- “*May* and *might* are the modals of epistemic possibility, expressing the speaker's lack of confidence in the proposition expressed” (Coates:1983, 131)





Westmoreland 1995, 1998

Epistemic *must* (in contrast to root modals) is not a modal but must be analyzed as an evidential marker labelling the proposition in its scope as a deduction. It relates a proposition ϕ to some other information that serves as evidence for ϕ . An epistemic modal is part of the metalogical vocabulary, i.e. not equivalent to the square \square but more like the sign \therefore marking the deduction of an inference. In contrast to root modals with a deontic or dynamic reading, the epistemic modals *must* and *may/might* are evidential markers which do not contribute to the informative proposition, but disclose the source of information. The semantic content of epistemic/evidential modals forces them to operate from an extrapositional position at least at LF.





Standard Modal Semantics

$$\llbracket \text{must} \rrbracket(p) = \lambda w. \forall w' : w R_{\text{epist}} w' \rightarrow p(w') = 1$$

Must p asserts that *p* is true in all worlds compatible with the evidence.

No reason to expect embedding or binding problems.

Note: the standard semantics does not do justice to the fact that *must* clearly signals deduction rather than direct observation. This remains to be accounted for.





Relevant Data about Epistemic Modals

- Embedding
- Negation
- Questions
- (Tense) → see Iatridou 1990, Eide (SuB7, 11:45am today)





Embedding under Attitudes

So, she began. “O Mouse, do you know the way out of this pool?”
(Alice thought this *must* be the right way of speaking to a mouse)

Alice thought “O Mouse” must be the right way of speaking to a mouse.

Drubig reporting Westmoreland: “It is important to see that *must* ϕ is not the proposition which functions as the complement of the propositional attitude verb *think*. The propositional complement of *think* is ϕ . In other words, *must* ϕ does not affect the context; rather, stating *must* ϕ makes ϕ available to the context.”





A Technicality

If accessibility relation is transitive and euclidean, there is an equivalence between $\Box\Box p$ and $\Box p$.

So, if epistemic accessibility is transitive and euclidean, and if both *think* and *must* are necessity modals, one could not tell whether *must* is part of the embedded proposition.

Alice thought that the Mouse must be arrogant. ($\Box\Box p = \Box p$)

Alice thought that the Mouse might be arrogant. ($\Box\Diamond p = \Diamond p$)

Alice was convinced that the Mouse $\left\{ \begin{array}{l} \text{must} \\ * \text{might} \end{array} \right\}$ be arrogant.





Counterexamples

It must be raining.

Are you sure?

(= are you sure that it is raining?)

(≠? are you sure that the evidence entails that it is raining?)

It might be raining.

Are you sure?

(≠? are you sure that it is raining?)

(= are you sure that it is compatible with the evidence that it is raining?)



Because

I'm going home because the package may have been delivered today.



41/50





Negation

Drubig's Claim: negation cannot have scope over epistemic modals.

John must not be at home. ($\Box\neg$)

John may not be at home. ($\Diamond\neg$)

cf. John may not leave. (deontic: $\neg\Diamond$)

But

John does not have to be at home. ($\neg\Box$) He might be at work.





Specialized Modals for Negation

John *need not* be home. ($\neg\Box$) He might be at work.

John *can't* be at home. ($\neg\Diamond$) He must be at work.





Questions

Drubig's Claim: Epistemic modals cannot occur in *nonassertive* sentences.

Yes/No Questions

?Must John have cancer?

Might John have cancer?

Might your keys be at Jack's house? (Brennan 1993: 24)





wh-Questions

Drubig's Claim: Epistemic modals cannot occur in *wh*-questions.

Why must/may John leave early tonight?

Who must/may leave early tonight?





The Right Examples

All from Brennan (1993: 24)

What may he have done?

Where must the murder weapon be hidden, in your view?

Who can have left this baby on my doorstep?





Summary

- Epistemic modals are syntactically high.
- Therefore, some embedding is difficult.
- Other embeddings are semantically odd.
- But, most of the time, controlling for those factors, epistemic modals can be embedded and contribute to the descriptive meaning.





Something to Explore

At least for the acceptable cases of embedding, the standard semantics for epistemic modals is correct and adequate.

We might want to explore the idea that the epistemic modals *must* and *may/might* have two meanings. One like *ja* where they add an expressive non-truth-conditional meaning (and block binding), and one which is the standard modal logic meaning at the descriptive level.

$\text{must}_1 \approx \textit{obviously}$

$\text{must}_2 \approx \textit{it is obvious that}$

Uncertainties of judgment might be predicted correctly.





Alas

If there is a correlation between (i) low position and thus embeddability and (ii) absence of no-binding effect, we would expect ECP effects to go away, for example here:

Every student can't be home. $*\forall\neg\diamond$, only $\neg\diamond\forall$

Every student need not be home. $*\forall\neg\square$, only $\neg\square\forall$

So: it appears that the ECP is a real syntactic residue, not to be derived from semantics.





Plan for this Research Project

- Cross-linguistic investigation of embedding and quantificational properties of particles, parentheticals, evidentials (mentioned by Drubig, see also Izvorski), and epistemic modals.
- Indicative conditionals: there is a very widespread philosophical doctrine that indicative conditionals have a non-truthconditional meaning. How do they fit into the picture we are developing?

— The End —

