Inferential Conditionals and the Meaning of Some Epistemic Modals

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A puzzle about "Must"

Prima facie, "must" seems to indicate the necessity of whatever it precedes, and hence, it is supposed to quantify over all possible worlds. Yet, it seems perfectly appropriate to assert:

"It **must** be raining"

when we only see people carrying around wet umbrellas, but not when we have a direct perceptual evidence, that is, when we can actually see that it is raining. This observation motivated the view that preceding an assertion with "must" makes it **weaker,** that is *Must p* does not entail *p*. See *e.g.*:

Karttunen, L. [1972], "Possible" and "Must", in J. Kimball, ed., 'Syntax and Semantics', Vol. 1, New York: Academic Press, New York, pp. 1–20.
Kratzer, A. [1977], 'What "must" and "can" must and can mean', Linguistics and Philosophy 1(3), 337–355.

By contrast, von Fintel and Gillies argued that "must" functions as an **evidential marker** signaling the presence of an inference. According to those authors, what has been erroneously taken as weakness is simply **indirectness** of the evidence, and hence there is no reason to doubt that "must" is a strong necessity modal.

von Fintel, K. and Gillies, A. S. [2010], 'Must . . . stay . . . strong!', Natural Language Semantics 18(4), 351–383.
von Fintel, K. and Gillies, A. S. [2007], An Opinionated Guide to Epistemic Modality. Oxford Studies in Epistemology 2, 32–63.

What to expect from "Should"

The verb "Should" - so called "a weak necessity modal" - in its epistemic reading could also be understood as an evidential marker conveying a presence of an (uncertain) inference, for instance:

"Susan studied philosophy. She **should** know who Hegel was."

The Questions

1. Are epistemic modal verb "should" and "must" evidential markers indicating that the evidence is indirect and that the content of the assertion has been inferred?
2. If so, do they mark **any** inference? Or do they indicate specific **types** of inferences?
3. How does adding "should" or "must" to an **inferential conditional**'s consequent affect its assertability?

Inferential Conditionals

A sentence "If *p*, then *q*" is a deductive inferential (DI, for short) / inductive inferential (II) / abductive inferential (AI) conditional iff *q* is a deductive / inductive / abductive consequence of *p*.

A sentence "If *p*, then *q*" is a contextual DI / II / AI conditional iff *q* is a deductive / inductive / abductive consequence of $\{p, p_1, \ldots, p_n\}$, with $p_1, \ldots, p_n$ being background premises salient in the context in which "If *p*, then *q*" is asserted or being evaluated.

Igor Douven and Sara Verbrugge (2010), The Adams family. Cognition 117, 302–318.

Example Stimuli

Context: Bernard is a bit of an irregular student: sometimes he works hard, but he can also be lazy. So far he had excellent grades for most courses for which he had worked hard.

How assertable are the following conditionals given this context?

If Bernard works hard for the linguistics course, then he will get an excellent grade for it.
If Bernard works hard for the linguistics course, then he should get an excellent grade for it.
If Bernard works hard for the linguistics course, then he must get an excellent grade for it.
If Bernard works hard for the linguistics course, then he will probably get an excellent grade for it.

Context: Nelly lives on the sixth floor of an apartment building. The elevator has been broken since earlier this morning. A good friend of Nelly's who lives on the third floor of the same building hears someone rushing down the stairs. She knows that Nelly tends to avoid exercise as much as possible.

How assertable are the following conditionals given this context?

If that's Nelly rushing down the stairs, then she is in a hurry.
If that's Nelly rushing down the stairs, then she should be in a hurry.
If that's Nelly rushing down the stairs, then she must be in a hurry.
If that's Nelly rushing down the stairs, then she probably is in a hurry.

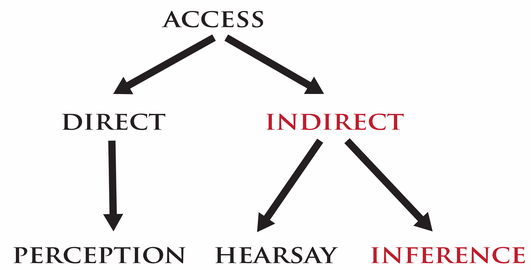
Context: All students in class 6C have at least a B for their math test paper.

How assertable are the following conditionals given this context?

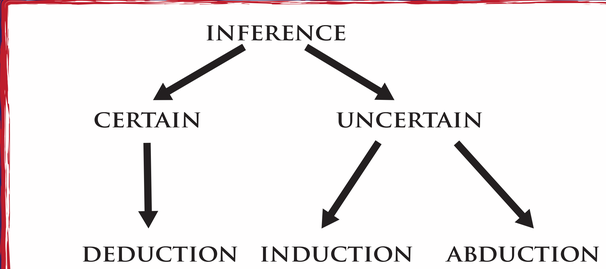
If Ben is in class 6C, then he has at least a B for his math test paper.
If Ben is in class 6C, then he should have at least a B for his math test paper.
If Ben is in class 6C, then he must have at least a B for his math test paper.
If Ben is in class 6C, then he probably has at least a B for his math test paper.

Evidentiality

The source or quality of information on which an assertion is made can be encoded in language either grammarically or by means of lexical markers.



Thomas Willett (1988), A cross-linguistic survey of the grammaticization of evidentiality. Studies in Language *12(1), 51–97.*

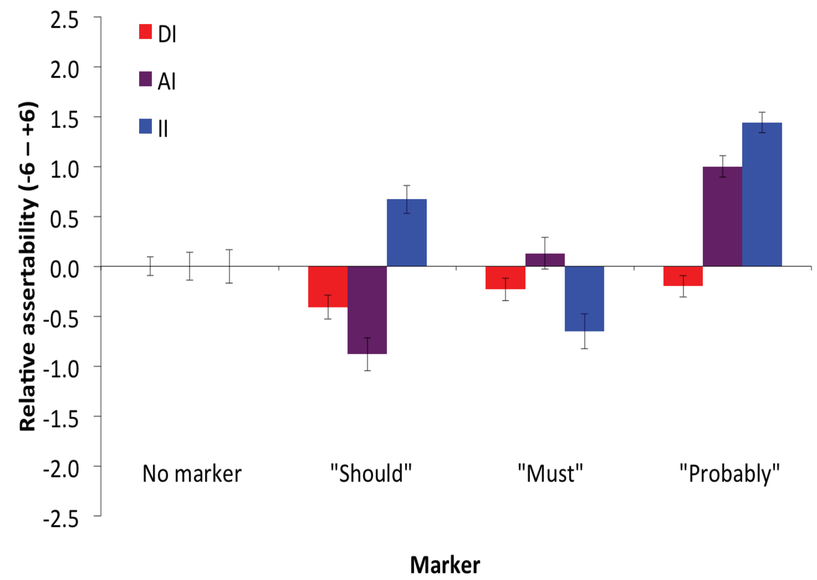


Method

- All participants (N=68) were native English speakers recruited via CrowdFlower (http://www.crowdflower. com).
- The type of conditional (DI / II / AI) as well as lexical markers were manipulated within subjects.
- Each participant were presented with 15 contexts: 5 involved deductive inference, 5 involved inductive inference, and 5 involved abductive inference.
- Each context was followed by 4 conditional sentences: one without any marker, one with "should," one with "must," and one with "probably."
- We asked participants to rate the assertability of all four conditionals on the 7-point Likert scale.

Conclusions

1. Epistemic modals signal the presence of a specific, rather than any, type of inference.
2. "Must" can be thought of as an evidential marker of abductive inference. It does not appear to weaken the assertion: its positive effect on the assertability ratings of AI conditionals is not significant.
3. Given that abduction is a type of uncertain inference, it is difficult to maintain the view that "must" is a strong necessity modal.
4. English "should" seems to indicate the presence of an inductive inference. Additionaly, it seems to make the assertion weaker.
5. Unsurprisingly, "probably" has a strong positive effect on all uncertain conditionals.
6. All markers, including "must," have negative effect on the assertability ratings of DI conditionals. It is possible that very easy deductive inferences with straightforward conclusions were not percieved as indirect inferences at all, but rather as something close to a direct access.



Relative Assertability = assertability with a marker minus assertability without a marker. Error bars represent 95% confidence intervals.