

## On the processing of epistemic modals

Dimka Atanassov, Florian Schwarz, & John Trueswell (University of Pennsylvania)  
dimka@ling.upenn.edu

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**Summary.** This study examines the processing of the implicature of *might* ( $\approx$  NOT *must*). Our results show that the implicature does not emerge until 800ms after *might* is heard, and hence support the view that implicature processing is delayed.

**Introduction and Methods.** The literature on implicatures contains both studies that suggest rapid computation of scalar implicatures (Sedivy et al., 1999; Grodner et al., 2010), and studies that provide evidence for extra processing costs in generating them (Noveck & Posada, 2003; Huang & Snedeker, 2011). The present study extends existing work by comparing *might* to *must*, and by adapting a paradigm that integrates experimental sentences into a natural discourse within a game.

The experiments employed the visual world paradigm, using a guessing game with a confederate. In critical trials subjects had full access to a visual display of 9 colored shapes, while the confederate had only partial access (two of the shapes were hidden). The shapes were arranged according to 2 rules (1), based on which the confederate had to “guess” the hidden shapes. Critical trials were scripted for maximal experimental control. The subjects’ task was to verify the guesses.

Eye movements of 12 participants were recorded while the confederate made guesses regarding the hidden shapes, which used either *must* or *might*, depending on whether the rules provided certainty about the shape in question (2, 3). Up to the location phrase (*upper right/ bottom left*), nothing but the choice of modal provided information about which of the two hidden shapes the statement was about. Guesses for *must* sentences were always correct, while guesses for *might* sentences were incorrect (but consistent with the rules) half of the time.

**Results.** Target advantage scores (looks to target minus looks to competitor) were computed for the experimental conditions, split by whether the guess was correct or not. The target was the shape that could be guessed with certainty, and the competitor the shape that could not be guessed with certainty. For items for which the guess was correct, eye movements for *might* and *must* pattern together with a preference for the target (i.e., the *must*-shape, which can be guessed with certainty), until 1 second after their onset. Only after that point is there a relative increase in looks to the competitor (i.e., the *might*-shape, which cannot be guessed with certainty) when hearing *might*. This is reflected in a significant interaction between time window (1<sup>st</sup> second vs. the rest of ambiguous period) and *must/might*. If the pragmatic implications of *might* were directly accessed and were part of its meaning, “might” should have blocked eye movements to the *must* shape, and triggered eye movements to the *might* shape. Our results however show a delay in selecting the *might* shape, hence suggesting that uncertainty is an implication of *might*. The delay in incorporating the ‘not *must*’ implicature of *might* is comparable in size to previous studies finding delays in implicature computation and thus provides further support for the notion that implicatures incur processing cost, based on different implicature triggers and using an experimental paradigm based on natural dialogue.

- (1) **Rules:** Rows: 3 alike shapes or all different; **Columns:** 3 same color shapes or all different
- (2) There **must be** a red square located in the upper right.
- (3) There **might be** a red square located in the bottom left.

### Selected References

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