'Might' as a generator of alternatives: The view from reasoning

Summary. We argue that the epistemic modal 'might' is a generator of alternatives in the sense of Hamblin semantics (Kratzer and Shimoyama, 2002) or inquisitive semantics (Ciardelli et al., 2009). Building on methodologies from the psychology of reasoning, we show that 'might' patterns with disjunctions and with indefinites in giving rise to a particular kind of illusory inference. The best extant accounts of these illusory inferences crucially involve alternatives, paired with matching strategies (Walsh and Johnson-Laird, 2004) or with question-answer dynamics (Koralus and Mascarenhas, 2013). We present experimental evidence that 'might' is a generator of alternatives much like disjunctions and indefinites. We argue that these alternatives have important functions above and beyond those identified in linguistic semantics, as ways of structuring mental representations of information by drawing attention to specific subparts of the representations.

Introduction and background. The semantics of epistemic modals has puzzled linguists and philosophers for decades. Here we address a debate that hasn't been under the spotlight in recent years: the role of 'might' as a means of directing hearer attention by generating a single alternative in the sense of Hamblin semantics or inquisitive semantics.

Disjunction and indefinites are generators of alternatives *par excellence*. They induce illusory inferences as in (1), first discovered by Walsh and Johnson-Laird (2004). Formalizing mental models theory of reasoning (Johnson-Laird, 1983) and enriching it with linguistic insights, the erotetic theory of reasoning (ETR) of Koralus and Mascarenhas (2013) proposes that a question-answer dynamic is at the core of these fallacies. For the disjunction problem in (1a), the first premise gives the reasoner two alternatives, schematically $a \wedge b$ and c, as a result of an inquisitive-like semantics for disjunction. The reasoner is now entertaining a question in the formal sense, and wants to resolve it. Information in the second premise (a) *matches* one alternative under consideration ($a \wedge b$) rather than the other (c), and our reasoner takes the question to be solved in the $a \wedge b$ direction, whence b follows. More recent variants of ETR (Mascarenhas and Sablé-Meyer, 2018, in prep.) argue for a hypothesis-testing mechanism instead of a matching one: the first premise introduces a question in the form of two *hypotheses*, and the second premise provides *evidence* in favor of one hypothesis rather than the other. Experimental evidence from indirect illusory inferences from disjunction (2) corroborates this confirmation-theoretic approach as these data points cannot be accounted for with matching mechanisms.

All of these theories agree on one prediction: linguistic elements that generate alternatives induce questions, and it should be possible to find analogues of these kinds of illusory inferences with those elements.

'Might' as an alternative generator. Ciardelli et al. (2009) argue that the epistemic modal 'might' generates alternatives in the relevant sense. In a nutshell, they propose an inquisitive semantics for 'might' where $might(\varphi)$ is roughly equivalent to $\varphi \vee \top$. With their non-classical disjunction, this formula corresponds to an informationally idle but inquisitive meaning that generates two alternatives, one that includes the entire space of possibilities, the other restricted to φ. Taking φ to be $a \wedge b$, we get structurally a special case of the pattern in (1), so we predict the possibility of illusory inferences as in (3), schematized in (4a).

This prediction is most clearly made on the hypothesis-testing version of ETR. Given two alternative hypotheses $a \wedge b$ and $\top$, and a piece of evidence a, the theory instructs us to look for

the hypothesis that is best confirmed by the evidence, following Bayesian confirmation strategies. Informally, $a \wedge b$ is a better "theory" of the evidence a than its alternative $\top$ because $a \wedge b$ generates the evidence, while $\top$, despite having a higher prior probability than $a \wedge b$, does not predict the observed evidence, it is merely compatible with it. Consequently, ETR predicts that, after hearing a, reasoners should conclude that $a \wedge b$ is true, whence b would follow.

Crucially, the theory does not make the same prediction for (4d), which is plausibly truth-conditionally equivalent to (4a) but lacks the required question-answer configuration.

Study and results. We tested this hypothesis in a between-subjects design, due to the high degree of similarity between our target inference patterns in (4). We recruited 210 subjects on Amazon MechanicalTurk, 66% were female and their mean age was 36 (ranging from 18 to 74, $\sigma = 11.4$). Participants were assigned to one of four target conditions, according to the schemata in (4). Participants solved 14 reasoning problems, 8 targets (4) and the rest controls (5). In each case they were given two premises and a proposed conclusion, and asked whether the conclusion followed from the premises. We predicted that (A) canonical and reversed (C&R) targets (4a) (4c) should be accepted significantly more than the baseline for mistakes established by invalid controls (5). The acceptance of C&R targets (4a)(4c) should depend on the presence of the second premise, so that premise 1 alone should not explain the fallacy. This means that (B) P1 targets (4b) should be lower than C&R targets (4a)(4c). Additionally, (C) the plausibly equivalent but "flat" targets (4d) should be much lower than C&R targets (4a)(4c) as well. Finally, (D) order effects have been observed with these kinds of illusory inferences (Koralus and Mascarenhas, 2018), readily explained by question-answer dynamics, so we expected canonical targets (4a) to be somewhat more attractive than reversed targets (4c). The results of the study are summarized in the figure in the appendix. Most of our predictions were borne out: (A), (B), and (C) all yielded significant effects with a Wilcoxon test (table in the appendix). But we did not find an effect of premise order (D).

Discussion and conclusions. We have shown that 'might' induces illusory inferences much like other alternative generators in the literature (disjunction and indefinites). These inferences seem to be the result of a dynamic process, as shown by the absence of illusions in flat targets (4d). The absence of an order effect isn't particularly damning, as previous studies in other illusory inferences showed a small effect size that required very large samples.

These results offer an argument in favor of an alternative-generating semantics for 'might'. Taken together, recent discoveries about illusory inferences suggest that linguistic alternatives play an important part in reasoning as attention mechanisms. These facts must now be incorporated by theories of 'might'. In some cases this will be straightforward: for an update semantics like that of Veltman (1996) all one needs to do is build a structure of alternatives on top of it, along the lines of Mascarenhas's (2009) update inquisitive semantics. The way to proceed is less clear for probabilistic or ordering-source semantics for 'might', but there is no in-principle reason to think alternative or inquisitive semantics is incompatible with these approaches.

This result and others cited here suggest an interesting avenue of research for alternative and inquisitive semantics: using reasoning, and in particular illusory inferences, as diagnostic tools for the presence of alternatives.

In ongoing and future work, we are investigating other elements that have been argued to generate alternatives and be question-like, such as if-clauses (Starr, 2014). We are also expanding the study to weak modals beyond the epistemic 'might'.

Numbered examples.

(1) a. John speaks English and Mary speaks French, or else Bill speaks German.
John speaks English.
Fallacious conclusion: **Mary speaks French.** (adapted from Walsh and J-L, 2004)

b. Some pilot writes poems.
John is a pilot.
Fall. concl.: **John writes poems.** (Mascarenhas and Koralus, 2017)

(2) The gun fired and the guitar was out of tune, or else someone was in the attic.
The trigger was pulled.
Fall. concl.: **The guitar was out of tune.** (Mascarenhas and Sablé-Meyer, 2018, in prep.)

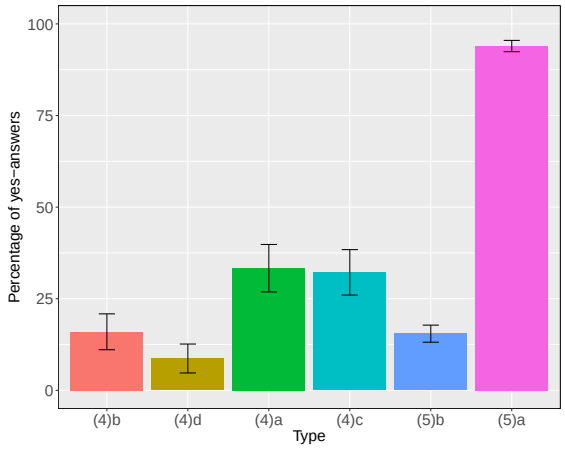
(3) Miranda might play the piano and be afraid of spiders.
Miranda plays the piano.
Fall. concl.: **Miranda is afraid of spiders.**

(4) a. **Canonical:** $might(a \wedge b), a \vdash b$
b. **P1:** $might(a \wedge b) \vdash b$
c. **Reversed:** $a, might(a \wedge b) \vdash b$
d. **Flat:** $a \wedge might(b) \vdash b$

(5) a. **Valid MP:** if a then b, $a \vdash b$
b. **Invalid MP:** if a then b, $c \vdash b$

Tables and figures.

Prediction	Statistic	P-value
(A)	$W = 237.5$	$p < 0.001$
(B)	$W = 260$	$p < 0.01$
(C)	$W = 281$	$p < 0.001$
(D)	$W = 533.5$	$p > 0.8$



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