MIGHT AS A GENERATOR OF ALTERNATIVES THE VIEW FROM REASONING

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Background

- Recent efforts to seek convergence between NL semantics and the psychology of reasoning have led to articulated theories of interpretive processes and general-purpose reasoning.

Erotetic theory of reasoning
(Koralus & Mascarenhas, 2013)

- Reasoning is partly about questions and answers.
- Some sentences raise questions in the sense of inquisitive semantics (Groenendijk, 2008; Mascarenhas, 2009).
- Pressure to reduce the number of alternatives under consideration swiftly generates fallacies.

- This theoretical work has brought to light a host of new **illusory inferences**.

John speaks English and Mary speaks French, or else Bill speaks German.
John speaks English.
Fallacious conclusion: Mary speaks French.

Some pilot writes poems.
John is a pilot.
Fallacious conclusion: John writes poems.

Current study

- We give arguments from reasoning in favor of the idea of *might* as a generator of alternatives. In the process we demonstrate the great potential of articulated interpretation-reasoning theories: semantically informed theories of reasoning make better predictions, and reasoning tasks can serve as diagnostics for narrowly semantic properties.
- Ciardelli (2009): *Might* generates a single alternative in the sense of Hamblin semantics or inquisitive semantics.
- This semantics + ETR predict novel illusory inferences.

Miranda might play the piano and be afraid of spiders.
Miranda plays the piano.
Fallacious conclusion: Miranda is afraid of spiders.

- But not for this plausibly discourse equivalent example:

Miranda plays the piano and might be afraid of spiders.
Fallacious conclusion: Miranda is afraid of spiders.

Can *might* trigger illusory inferences?

Design

- 210 participants on Amazon MechanicalTurk.
- 66% female, from 18 to 74 y.o. ($\mu = 36$, $\sigma = 11.4$).
- 18 reasoning problems to solve:
  - 6 controls, valid and invalid *modus ponens*
  - 8 targets of only one of the four following types

CANONICAL $might(a \wedge b), a \vdash b$

Miranda might play the piano and be afraid of spiders.
Miranda plays the piano.
Does it follow that Miranda is afraid of spiders?

(A) **Can *might* trigger illusory inferences?**

P1 $might(a \wedge b) \vdash b$

Miranda might play the piano and be afraid of spiders.
Does it follow that Miranda is afraid of spiders?

(B) **Is this illusory inference only due to the first premise?**

FLAT $a \wedge might(b) \vdash b$

Miranda plays the piano and might be afraid of spiders.
Does it follow that Miranda is afraid of spiders?

(C) **Is there something erotetic about the fallacy?**

REVERSED $a, might(a \wedge b) \vdash b$

Miranda plays the piano.
Miranda might play the piano and be afraid of spiders.
Does it follow that Miranda is afraid of spiders?

(D) **Is there an effect of premise order?**

Results

- *Might* triggers an illusory inference ✔
  (A) can. & rev. vs. no-controls
- not because of *might* alone ✔
  (B) can. & rev. vs. P1
- but because something erotetic happens ✔
  (C) can. & rev. vs. flat
- we did not detect an order effect ✗
  (D) can. vs. rev.

Prediction	Wilcoxon	p-value
(A)	$V = 674$	$p < 0.01$
(B)	$W = 256.5$	$p < 0.001$
(C)	$W = 281$	$p < 0.001$
(D)	$W = 533.5$	$p > 0.8$
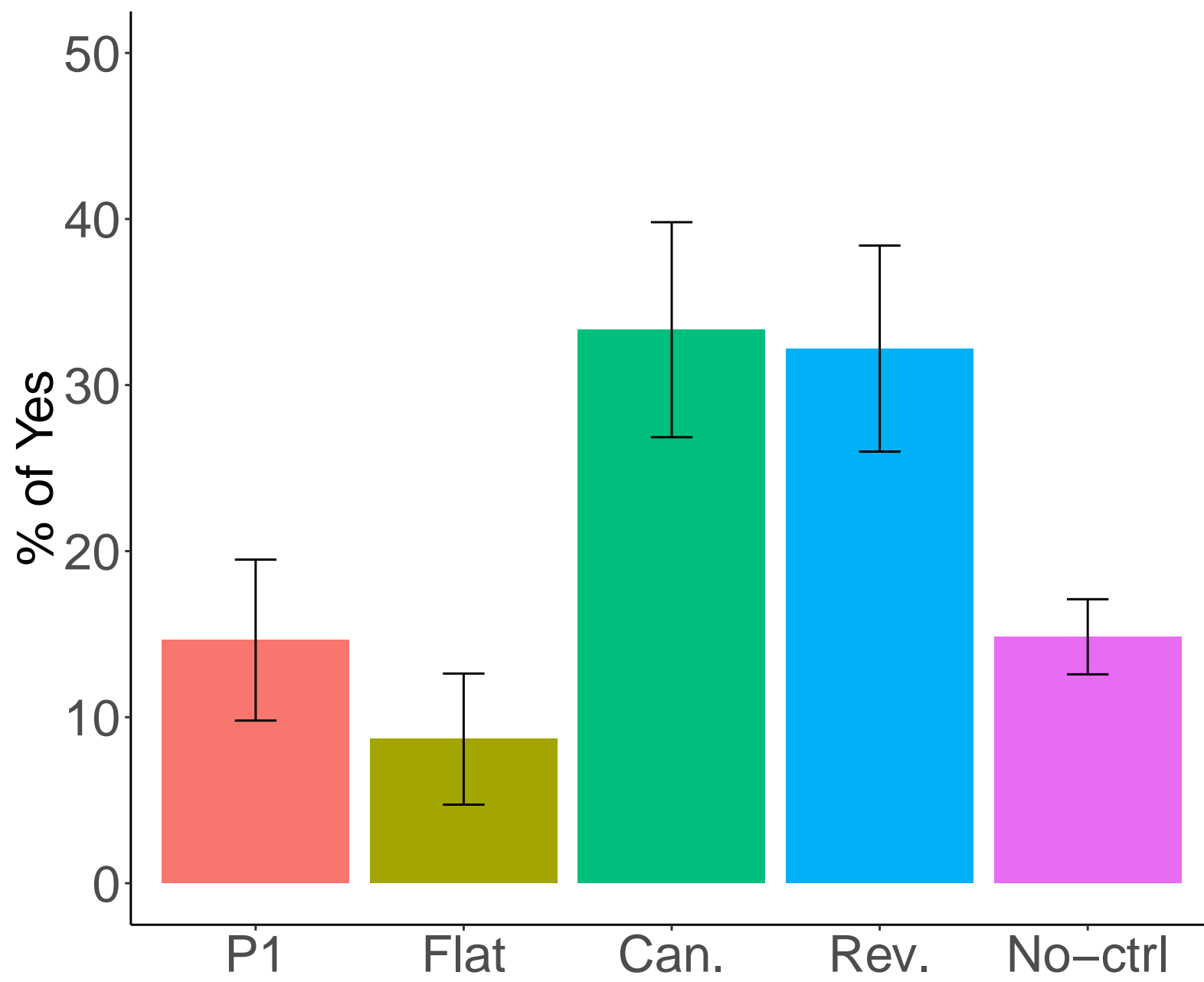
Which semantics for *might*?

Inquisitive semantics & ETR

Ciardelli (2009)

$might(\varphi) \Leftrightarrow \varphi \vee \top$

- Feeding this interpretation into ETR derives the fallacy.

$$\{0\}[\{a \sqcup b, 0\}]^{\mathsf{Up}} = \{a \sqcup b, 0\}$$
$$[\{a\}]^{\mathsf{Up}} = \{a \sqcup b\}$$
$$[\{b\}]^{\mathsf{MR}} = \{b\}$$

1. We start with a blank state. We update with the meaning of $might(a \wedge b)$.
2. We keep only the alternatives that have something in common with a.
3. Finally we check if b follows.

- Hypothesis testing formulation of ETR:
  1. The first premise provides a *hypothesis* to test: $a \wedge b$.
  2. The second premise a provides some *evidence*.
  3. The evidence *confirms* the hypothesis (e.g. Bayesian confirmation theory), so the hypothesis is taken to follow.

Scalar implicatures

- To explain away the fallacy as a scalar implicature (SI), we would need to strengthen the first premise into:

$$\Diamond(a \wedge b) \wedge \neg\Diamond(a \wedge \neg b) \Leftrightarrow \Diamond(a \wedge b) \wedge \Box(a \to b)$$

- This is not an intuitive inference from *might*.
- To our knowledge, no theory of SI derives it.

Relational semantics

Kratzer (1991)

With the limit assumption,
$might(\varphi)$ is true iff **there is** a φ-world among the best ranked worlds

REQUIRED ASSUMPTIONS

- When asserting a proposition φ, a speaker says that φ is true in the actual world.
- The modal base is reflexive.
- The existential quantifier in the lexical entry for *might* is inquisitive.
- Reasoning is erotetic.

ACCOUNT

- The first premise $might(a \wedge b)$ asks "which best-ranked $a \wedge b$-world are we talking about?"
- The second premise says "the actual world is an a-world."
- Erotetic mechanisms predict a conclusion of "the actual world is a best-ranked $a \wedge b$-world!"

Conjunction is not enough

- Does **any** non-asserted conjunction $a \wedge b$ imply $a \leftrightarrow b$?
- No: in a related study we looked at antecedents and consequents of conditionals (1) *if $a \wedge b$ then c*; (2) *if c then $a \wedge b$*.
- We found no fallacy for antecedents (1), though there was an effect for consequents (2).

Probabilistic semantics

- For Oaksford and Chater (2007), reasoners accept φ on the grounds of Γ only if

$$P(\varphi|\Gamma) > \tau$$

Lassiter (2016)

$might(\varphi)$ is true iff $P(\varphi) > \theta$

- For our items, this means:

CANONICAL $P(b|a \ \& \ P(a \wedge b) > \theta) > \tau$
REVERSED $P(b|a \ \& \ P(a \wedge b) > \theta) > \tau$
FLAT $P(b|a \ \& \ P(b) > \theta) > \tau$

- The probabilistic semantics predicts:
  - no difference between canonical and reversed ✔
  - Canonical $\Rightarrow$ Flat, because $P(b) \geq P(a \wedge b)$ ✗

Conclusions & open questions

- *Might* triggers illusory inferences because it is a generator of alternatives.
- Reasoning can diagnose semantic alternatives.
- Every extant theory of *might* needs to be extended to account for these facts, but some more than others.
- What about other weak modals (e.g. deontics)?

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