Inquisitive Semantics: Attentive *might*

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based on joint work with Ivano Ciardelli

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www.illc.uva.nl/inquisitive-semantics

Overview

- Two puzzles for the standard modal account of *might*
- Attentive *might* in inquisitive semantics
- Attentive *might* in inquisitive pragmatics
- Comparison with modal and dynamic accounts

Puzzle 1: *might* meets disjunction and conjunction

Zimmermann's (2000)

The following are all equivalent:

(1) John might be in London or in Paris. $\Diamond(p \vee q)$

(2) John might be in London or he might be in Paris. $\Diamond p \vee \Diamond q$

(3) John might be in London and he might be in Paris. $\Diamond p \wedge \Diamond q$

Puzzle 1: *might* meets disjunction and conjunction

Crucially

- *Might* behaves differently in this respect from clear-cut epistemic modals
- The following are clearly not equivalent:

(4) It is consistent with my beliefs that John is in London or it is consistent with my beliefs that he is in Paris.

(5) It is consistent with my beliefs that John is in London and it is consistent with my beliefs that he is in Paris.

- This is problematic if *might* is analyzed as an epistemic modal

Puzzle 1: *might* meets disjunction and conjunction

Further observation

- For the equivalence to go through, it is crucial that John cannot be both in London and in Paris at the same time

Szabolcsi's scenario

- We need an English-French translator, i.e., someone who speaks *both* languages. In that context, (8) is perceived as a useful recommendation, while (6) and (7) are not.

(6) John might speak English or French. $\Diamond(p \vee q)$

(7) John might speak English or he might speak French. $\Diamond p \vee \Diamond q$

(8) John might speak English and he might speak French. $\Diamond p \wedge \Diamond q$

Puzzle 2: *might* meets negation

Basic observation

Standard sentential negation never takes scope over *might*

(9) John might not be in London. $\Diamond\neg p$

Crucially

Might $\neq$ 'it is consistent with my information that'

(10) It is not consistent with my information that John is in London. $\neg$ CONSISTENT p

Main point

- The notion of meaning that we are exploring in inquisitive semantics is not only suited to capture informative and inquisitive content in a uniform way, but also a sentence's potential to draw attention to certain possibilities
- This allows for a novel analysis of *might*

Driving intuition

(11) John might be in London.

(12) John is in London.

(13) Is John in London?

Main contrasts

- (11) differs from (12) in that it does not provide the information that John is in London
- (11) differs from (13) in that it does not request information
- ‘ok’ is an appropriate response to (11) but not to (13)

Main intuition

- The semantic contribution of (11) lies in its potential to draw attention to the possibility that John is in London

Attentive content in inquisitive semantics

- The conception of a proposition as a set of possibilities is ideally suited to capture attentive content
- We can simply think of a sentence φ as drawing attention to all the possibilities in $[\varphi]$
- At the same time, we can still think of φ as providing and requesting information, just as before

$\Rightarrow$ informative, inquisitive, and attentive content
are all captured by a single semantic object

A propositional language

Basic ingredients

- Finite set of atomic sentences $\mathcal{A}$
- Connectives $\neg$, $\wedge$, $\vee$, $\Diamond$

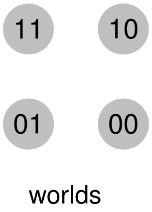
Question and assertion operators

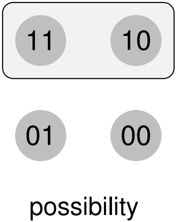
- $!\varphi := \varphi \vee \neg\neg\varphi$
- $?\varphi := !\varphi \vee \neg\varphi$

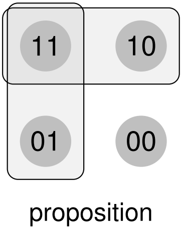
Worlds, possibilities, and propositions

- Possible worlds: functions from $\mathcal{A}$ to $\{0, 1\}$
- Possibilities: sets of possible worlds
- Propositions: sets of possibilities

Illustration



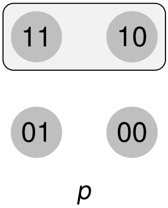




Atomic sentences

For any atomic sentence p: $[p] = \{ \{w \mid w(p) = 1\} \}$

Example:



Negation, disjunction, conjunction, and *might*

- We will consider here a straightforward analysis of $\neg$, $\vee$, $\wedge$, and $\Diamond$ that solves the puzzles we started out with

  (from Ciardelli, Groenendijk and Roelofsen, SALT 2009)

- It must be noted, however, that the analysis has certain undesirable consequences

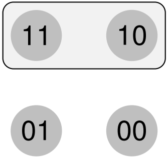
- We are currently working on a more principled account that avoids these problems

Negation

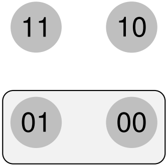
Definition

- $[\neg\varphi] = \{\, \overline{\bigcup[\varphi]} \,\}$
- Take the union of all the possibilities for φ; then take the complement

Example, φ classical:



$[p]$



$[\neg p]$

Negation

Definition

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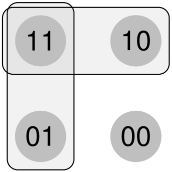
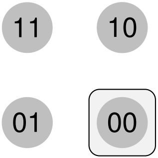
- Take the union of all the possibilities for φ; then take the complement

Example, φ inquisitive:



$[\varphi]$



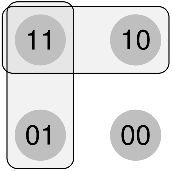
$[\neg\varphi]$

Disjunction

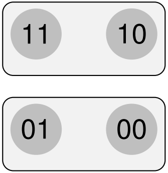
Definition

- $[\varphi \vee \psi] = [\varphi] \cup [\psi]$

Examples:



$p \vee q$



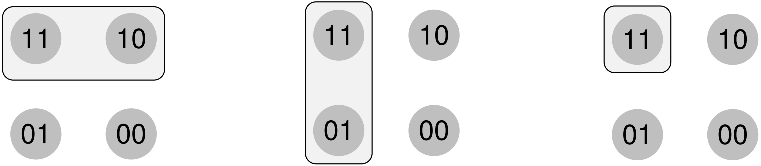
$?p \;\; (= p \vee \neg p)$

Conjunction

Definition

- $[\varphi \wedge \psi] = \{\alpha \cap \beta \mid \alpha \in [\varphi] \text{ and } \beta \in [\psi]\}$
- Pointwise intersection

Example, φ and ψ classical:



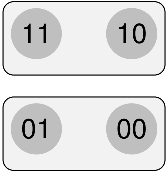
p $\qquad$ q $\qquad$ $p \wedge q$

Conjunction

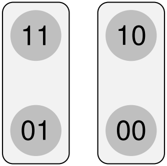
Definition

- $[\varphi \wedge \psi] = \{\alpha \cap \beta \mid \alpha \in [\varphi] \text{ and } \beta \in [\psi]\}$
- Pointwise intersection

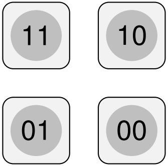
Example, φ and ψ inquisitive:



$?p$



$?q$

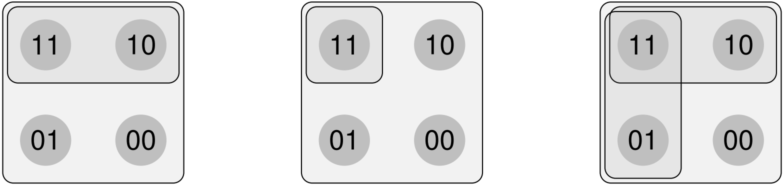


$?p \wedge ?q$

Might

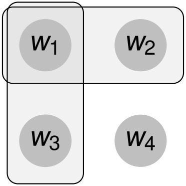
- $[\Diamond\varphi] = [\varphi] \cup \{W\}$
- Intuition: $\Diamond\varphi$ proposes exactly the same updates as φ, but also offers the option to keep the common ground just as it is

Examples



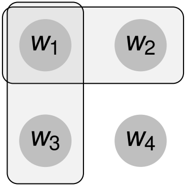
$\Diamond p$ $\Diamond(p \wedge q)$ $\Diamond(p \vee q)$

Informative, inquisitive, and attentive content



- A sentence φ draws attention to all the possibilities in $[\varphi]$
- Moreover, it provides the information that the actual world is contained in at least one of the possibilities in $[\varphi]$
- and it requests a response that provides enough information to establish at least one of these possibilities

Informative, inquisitive, and attentive content

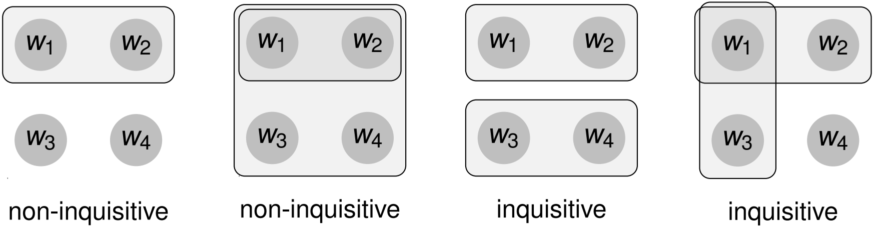


- A sentence φ draws attention to all the possibilities in $[\varphi]$
- Moreover, it provides the information that the actual world is contained in at least one of the possibilities in $[\varphi]$
- and it requests a response that provides enough information to establish at least one of these possibilities

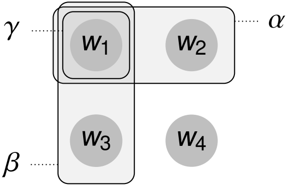
$\Rightarrow$ a single semantic object embodies informative, inquisitive, and attentive content

Inquisitive content

- φ requests a response that provides enough information to establish at least one of the possibilities in $[\varphi]$
- Sometimes, it suffices to accept the information that φ itself already provides
- If additional information is required, we call φ inquisitive



Alternative and residual possibilities

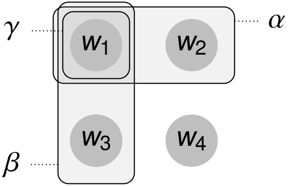


Three possibilities:

$$\alpha = \{w_1, w_2\}$$
$$\beta = \{w_1, w_3\}$$
$$\gamma = \{w_1\}$$

- Providing the information that at least one of $\{\alpha, \beta, \gamma\}$ contains the actual world is the same as providing the information that at least one of $\{\alpha, \beta\}$ contains the actual world
- Requesting a response that establishes at least one of $\{\alpha, \beta, \gamma\}$ is the same as requesting a response that establishes at least one of $\{\alpha, \beta\}$
- So γ does not play a role in determining the informative or inquisitive content of this proposition

Alternative and residual possibilities



Three possibilities:

$$\begin{aligned} \alpha &= \{w_1, w_2\} \\ \beta &= \{w_1, w_3\} \\ \gamma &= \{w_1\} \end{aligned}$$

- In general, for any proposition $[\varphi]$, we can distinguish:
- Alternative possibilities
  - not properly contained in a maximal possibility in $[\varphi]$
  - completely determine the informative & inquisitive content of φ
- Residual possibilities
  - properly contained in a maximal possibility in $[\varphi]$
  - only play a role in capturing the attentive content of φ

Inquisitive, informative, and attentive sentences

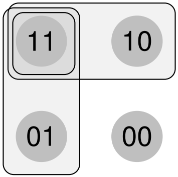
Definitions

- φ is informative iff it eliminates at least one world, i.e., $\bigcup[\varphi] \neq W$
- φ is inquisitive iff $[\varphi]$ contains at least two alternative possibilities
- φ is attentive iff $[\varphi]$ contains at least one residual possibility

Example

- $p \vee q \vee (p \wedge q)$ "p or q or both"

  informative, inquisitive, and attentive

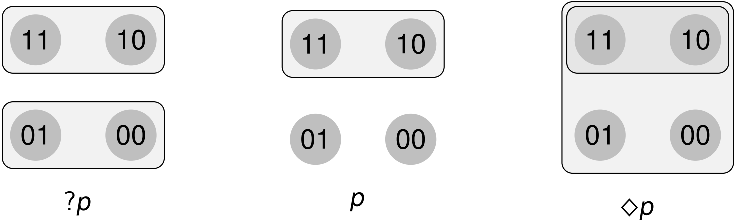


Questions, Assertions, and Conjectures

Definitions

- φ is a question iff it is neither informative nor attentive
- φ is an assertion iff it is neither inquisitive nor attentive
- φ is a conjecture iff it is neither informative nor inquisitive

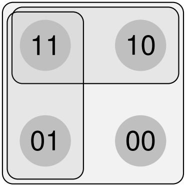
Examples



Might and conjectures

Every *might* sentence is a conjecture

- $\Diamond\varphi$ is never informative
- $\Diamond\varphi$ is never inquisitive
- So $\Diamond\varphi$ is always a conjecture



$\Diamond(p \vee q)$

Every conjecture can be expressed by a *might* sentence

- φ is a conjecture if and only if $\varphi \equiv \Diamond\varphi$

Closure properties of conjectures

For any φ and ψ:

- $\Diamond\varphi$ is a conjecture;
- if φ and ψ are conjectures, then so is $\varphi \wedge \psi$;
- if at least one of φ and ψ is a conjecture, so is $\varphi \vee \psi$;

Examples

(14)	John might be in London.	$\Diamond p$
(15)	John might be in London and Bill in Paris.	$\Diamond p \wedge \Diamond q$
(16)	John is in London, or he might be in Paris.	$p \vee \Diamond q$

Might meets disjunction and conjunction

Zimmermann's (2000)

The following are all equivalent:

(1) John might be in London or in Paris. $\Diamond(p \vee q)$

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(3) John might be in London and he might be in Paris. $\Diamond p \wedge \Diamond q$

Might meets disjunction and conjunction

Further observation

- For the equivalence to go through, it is crucial that John cannot be both in London and in Paris at the same time

Szabolcsi's scenario

- We need an English-French translator, i.e., someone who speaks *both* languages. In that context, (8) is perceived as a useful recommendation, while (6) and (7) are not.

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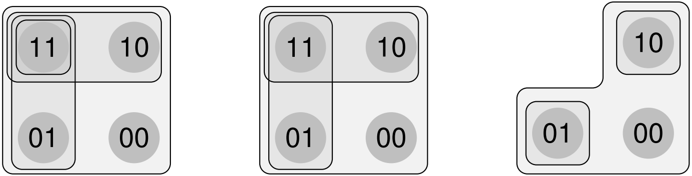

(a) $\Diamond p \wedge \Diamond q$

(b) $\Diamond p \vee \Diamond q$
$\equiv \Diamond(p \vee q)$

(c) $\Diamond p \wedge \Diamond q$
$\equiv \Diamond p \vee \Diamond q$
$\equiv \Diamond(p \vee q)$

- Whenever the disjuncts are mutually exclusive, as in (c), all three sentences are indeed equivalent
- If the disjuncts are not mutually exclusive, then $\Diamond p \wedge \Diamond q$ differs from the other two in that it draws attention to the possibility that p and q both hold.
- This is what makes $\Diamond p \wedge \Diamond q$ a useful recommendation in Szabolcsi's scenario

Might meets negation

Basic observation

Standard sentential negation never takes scope over *might*

(17) John might not be in London. $\Diamond\neg p$

Crucially

Might $\neq$ 'it is consistent with my information that'

(18) It is not consistent with my information that John is in London. $\neg$ CONSISTENT p

Explanation

$\neg\Diamond\varphi$ is always a contradiction

See the paper for similar, but more complex effects in conditionals

Pragmatics

- Gricean pragmatics generally assumes a truth-conditional semantics, which captures only informative content
- Gricean pragmatics is a pragmatics of providing information
- Inquisitive semantics enriches the notion of semantic meaning
- This requires an enrichment of the pragmatics as well
- We need not just a pragmatics of providing information, but rather a pragmatics of exchanging information

Inquisitive pragmatics (sketch)

Quality

Maintain the common ground and your own information state.

- Be sincere (speaker oriented)
  - Only assert what you take yourself to know
  - Only ask what you don't know
  - Only draw attention to 'live' possibilities
- Be transparent: signal inconsistency (hearer oriented)
  Reject an update if it is inconsistent
  with your information state

Inquisitive pragmatics (sketch)

Relatedness/compliance

- The semantics naturally gives rise to a formal notion of relatedness/compliance

Quantity

- Among all the compliant and sincere responses to a given (possibly implicit) question under discussion, there is a general preference for more informative responses

Back to *might*: three basic observations

(11) John might be in London.

Possibility

- (11) signals that the speaker considers it possible that John is in London

  $\Rightarrow$ point of departure for a modal analysis of *might*

Back to *might*: three basic observations

(11) John might be in London.

Consistency test

- (11) imposes a consistency test on the hearer: if her information state is inconsistent with John being in London, she must report this

  $\Rightarrow$ point of departure for Veltman's update semantics of *might*

Back to *might*: three basic observations

(11) John might be in London.

Ignorance

- (11) typically signals that the speaker is ignorant as to whether John is in London or not

  ⇒ typically analyzed as a Gricean implicature

The inquisitive account

(11) John might be in London.

Possibility

- (11) signals that the speaker considers it possible that John is in London
- Follows directly from sincerity
- Unlike the modal analysis, this account directly extends to:

(1) John might be in London or in Paris.

The inquisitive account

(11) John might be in London.

Consistency test

- (11) imposes a consistency test on the hearer: if her information state is inconsistent with John being in London, she must report this
- Follows directly from transparency
- Unlike update semantics, this account directly extends to:

(1) John might be in London or in Paris.

The inquisitive account

(11) John might be in London.

Ignorance

- (11) typically signals that the speaker is ignorant as to whether John is in London or not
- Follows from the quantitative preference for more informative compliant moves

Division of labor

Inquisitive semantics

- Specifies which proposals are expressed by which sentences

Inquisitive pragmatics

- Specifies what a context—in particular, the common ground and the speaker's information state—must be like in order for a certain proposal to be made
- . . . and how a hearer is supposed to react to a given proposal, depending on the common ground and her own information state.

Final remarks

- The idea that the core semantic contribution of *might*-φ lies in its potential to draw attention to certain possibilities has been entertained before
- For instance, Groenendijk, Stokhof, and Veltman (1996) write:

> *"in many cases, a sentence of the form might-φ will have the effect that one becomes aware of the possibility of φ."*

- Similar ideas can be found in more recent work: e.g. Swanson (2006), Franke and de Jager (2008), Brumwell (2009), Dekker (2009)
- Related ideas in the literature on evidentials (Murray, 2010; Faller, 2002)

Final remarks

- However, Groenendijk, Stokhof, and Veltman continue to point out that their framework

> *"is one in which possible worlds are total objects, and in which growth of information about the world is explicated in terms of elimination of worlds. Becoming aware of a possibility cannot be accounted for in a natural fashion in such an eliminative approach. It would amount to extending partial worlds, rather than eliminating total ones. To account for that aspect of the meaning of might a constructive approach seems to be called for."*

Final remarks

- We have taken a different route
- Possible worlds are still total objects
- Growth of information still amounts to eliminating worlds
- What has changed is the very notion of meaning
- No truth-conditions, no information change potential,
  but rather information *exchange* potential
- This shift in perspective immediately facilitates a perspicuous account of *might*, and of attentive content more generally

Appendix: A problem and a solution

The problem of Idempotency

Conjunction as pointwise intersection

- $[\varphi \wedge \psi] = \{\alpha \cap \beta \mid \alpha \in [\varphi] \text{ and } \beta \in [\psi]\}$

Is not idempotent

- $(p \vee q) \wedge (p \vee q) \not\equiv p \vee q$
- $(p \vee q) \wedge (p \vee q) \equiv p \vee q \vee (p \wedge q)$

A solution: cautious conjunction

Definition

$$[\varphi \wedge \psi] = \bigcup_{\alpha \in [\varphi]} \textsc{Alt}\{\alpha \cap \beta \mid \beta \in [\psi]\} \;\cup\; \bigcup_{\beta \in [\psi]} \textsc{Alt}\{\beta \cap \alpha \mid \alpha \in [\varphi]\}$$

- What makes the difference with the earlier definition is the occurrence of ALT, which selects the maximal elements of a set of possibilities. (Without ALT it is just a cumbersome reformulation of the other definition.)

Cautious conjunction is idempotent

- $(p \vee q) \wedge (p \vee q) \equiv p \vee q$
- $(p \vee q) \wedge (p \vee q) \not\equiv p \vee q \vee (p \wedge q)$

Cautious conjunction

Definition

$$[\varphi \wedge \psi] = \bigcup_{\alpha \in [\varphi]} \textsc{Alt}\{\alpha \cap \beta \mid \beta \in [\psi]\} \cup \bigcup_{\beta \in [\psi]} \textsc{Alt}\{\beta \cap \alpha \mid \alpha \in [\varphi]\}$$

- $\textsc{Alt}$ selects the maximal elements of a set of possibilities
- In case $W \in [\psi]$, then $\textsc{Alt}\{\alpha \cap \beta \mid \beta \in [\psi]\} = \{\alpha\}$

Cautious conjunction

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- $\textsc{Alt}$ selects the maximal elements of a set of possibilities
- In case $W \in [\psi]$, then $\textsc{Alt}\{\alpha \cap \beta \mid \beta \in [\psi]\} = \{\alpha\}$
  whence $\bigcup_{\alpha \in [\varphi]} \textsc{Alt}\{\alpha \cap \beta \mid \beta \in [\psi]\} = [\varphi]$

Cautious conjunction

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- ALT selects the maximal elements of a set of possibilities
- In case $W \in [\psi]$, then $\textsc{Alt}\{\alpha \cap \beta \mid \beta \in [\psi]\} = \{\alpha\}$ whence $\bigcup_{\alpha \in [\varphi]} \textsc{Alt}\{\alpha \cap \beta \mid \beta \in [\psi]\} = [\varphi]$
- Since $W \in [\Diamond\varphi]$ and $W \in [\Diamond\psi]$ we obtain the result that:

Cautious conjunction of *might*-sentences

$$[\Diamond\varphi \wedge \Diamond\psi] = [\Diamond\varphi] \cup [\Diamond\psi] = [\Diamond\varphi \vee \Diamond\psi]$$

Cautious conjunction and meet

- If conjunction is interpreted cautiously, we get a very direct solution for Zimmermann's puzzle.

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- Furthermore, it can be shown that moving to cautious conjunction is not an *ad hoc* move.
- There is an algebraic motivation for it.
- If we order propositions not only under informative and inquisitive content, but take attentive content into consideration as well, then cautious conjunction (and not full pointwise intersection) corresponds to the meet of two propositions.

Cautious conjunction and meet

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- Furthermore, it can be shown that moving to cautious conjunction is not an *ad hoc* move.
- There is an algebraic motivation for it.
- If we order propositions not only under informative and inquisitive content, but take attentive content into consideration as well, then cautious conjunction (and not full pointwise intersection) corresponds to the meet of two propositions.
- There is a drawback: we have to find another explanation for Szabolcsi's observation

Szabolcsi's scenario

- We need an English-French translator, i.e., someone who speaks *both* languages. In that context, (8) is perceived as a useful recommendation, while (6) and(7) are not.

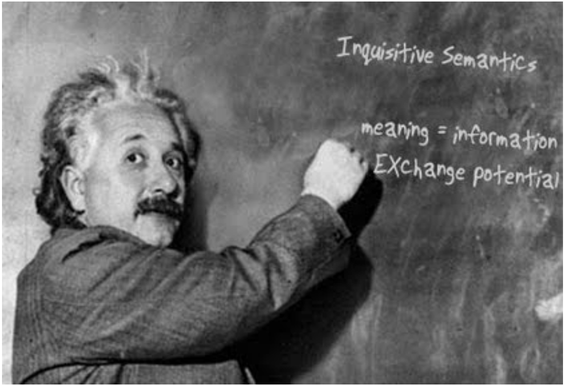
(6) John might speak English or French. $\Diamond(p \vee q)$

(7) John might speak English or he might speak French. $\Diamond p \vee \Diamond q$

(8) John might speak English and he might speak French. $\Diamond p \wedge \Diamond q$

- One way to go is to argue that in Szabolcsi's scenario (8) receives the interpretation $\Diamond(p \wedge q)$.
- It should be possible to look upon the two occurrences of *might* as surface manifestations of a single semantic operation.

Thank you



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