Conditional Questions Revisited

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Semantic Research Group

Outline

Conditional Questions and Statements

(1) a. If it is raining, the party will be cancelled.
    b. If it is raining, will the party be cancelled?

Isaacs & Rawlins (2008)

Combine

- stack-model of conditionals (Kaufmann, 2000)
- partition semantics of questions (Groenendijk, 1999)

Goal

- To show that I&R's (2008) implementation does not derive the result that they claim to.
- To amend the system by
  - employing inquisitive semantics (Ciardelli et al., 2015) and
  - redefining some notions, especially Percolation.

Outline

a context C

Context C

An equivalence relation on a fixed set W of possible worlds.

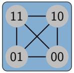


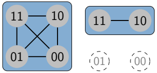
Figure: The initial ignorant and indifferent context

The initial ignorant and indifferent context is the total relation on W

Assertive Update of C

Assertive Update

$C \oplus \varphi := \{\langle w, v\rangle \in C \mid w(\varphi) = 1 \text{ and } v(\varphi) = 1\}$

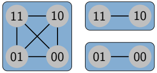


(a) C (b) $C \oplus p$

Inquisitive Update of C

Inquisitive Update

$C \oslash \psi := \{\langle w, v\rangle \in C \mid w(\psi) = v(\psi)\}$



(a) C (b) $C \oslash p$

Stack-model of conditionals

(2) a. If it is raining, the party will be cancelled.
b. If it is raining, will the party be cancelled?

"Ramsey test" intuition

When we ask 'if p, q?', we first hypothetically update our stock of beliefs with p and then entertain the truth/faulsity of q in the adjusted beliefs.

Three-step procedure

1. A hypothetical context is created by updating the speech context with the antecedent.
2. The hypothetical context is updated with the consequent.
3. The original context learns the effects of the second step.(Percolation)

Macro-contexts

macro-context τ

- a stack or list of contexts.
- $\tau = \langle C_0, \ldots, C_n \rangle$

τ_0	C_0
$\vdots$	$\vdots$
τ_n	C_n

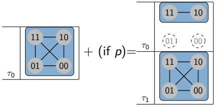
- Utterances are treated as operations on macro-contexts
- Macro-Context Change Potential (MCCP)

Antecedent

(3) If it is raining, will the party be cancelled?

Macro-Context Change Potential (MCCP) of the *if*-clause

$\tau + (\text{if } \varphi) := \langle \tau_0 \oplus \varphi, \tau \rangle$

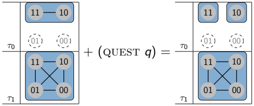


Consequent Question

(4) If it is raining, will the party be cancelled?

Macro-Context Change Potential (MCCP) of QUEST

$\langle C, \tau' \rangle + (\text{QUEST } \psi) := \langle C \oslash \psi, \tau' \rangle$.



Answer

(5) a. If it is raining, will the party be cancelled?
b. Yes(, it'll be cancelled).

Macro-Context Change Potential (MCCP) of ASSERT

$\tau + (\text{ASSERT } \psi) := \langle \tau_i[\tau_0 \vdash \psi] \rangle_{0 \leqslant i < n}$, where $|\tau| = n$.

- $C[C' \vdash \psi]$ (Percolation):
  learning in a context C that a context C' supports ψ

Percolation (I&R version)

$C[C' \vdash \psi] :=$
$\{\langle w, v \rangle \in C \mid \exists z \in W.(\langle w, z \rangle \in C' \text{ or } \langle z, v \rangle \in C') \text{ implies } \langle w, v \rangle \in C' \oplus \psi\}$

Problem 1: Conditional Statement

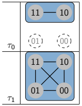
I&R's problem 1

Updating a macro-context with a conditional statement yields an inquisitive context. (pointed out by Sano & Hara, 2014)

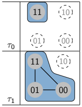
(6) If it's raining, the party will be cancelled.

(7) $\tau + (\text{if } p) + (\textsc{assert } q) = \langle \tau_i[\tau_0 \oplus p \vdash q] \rangle_{0 \leqslant i \leqslant n}$.

What Isaacs & Rawlins (2008, (59); p. 301) claim that (7) derives:

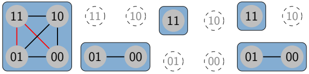


$+ (\textsc{assert } q) =$



Problem 1: Conditional Statement

(8) $C[C \oplus p \vdash q] =$
$\{\langle w, v\rangle \in C \mid \langle w, v\rangle \in C \oplus \neg p$ **or** $\langle w, v\rangle \in (C \oplus p) \oplus q\}$.

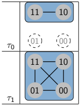


(a) C (b) $C \oplus \neg p$ (c) $(C \oplus p) \oplus q$ (d) $C[C \oplus p \vdash q]$

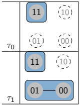
$\langle w_{11}, w_{01}\rangle$, $\langle w_{01}, w_{11}\rangle$, $\langle w_{11}, w_{00}\rangle$ and $\langle w_{00}, w_{11}\rangle$ should be removed.

Problem 1: Conditional Statement

What I&R's analysis actually derives:



$+ (\textsc{assert } q) =$



I&R's problem 1

Updating a macro-context with a conditional statement yields an inquisitive context.

Problem 2: Conditional Question

I&R's problem 2

Percolating a question yields a tripartite partition.

Macro-Context Change Potential (MCCP) of QUEST

$\langle C, \tau' \rangle + (\textsc{quest } \psi) := \langle C \oslash \psi, \tau' \rangle$.

Macro-Context Change Potential (MCCP) of ASSERT

$\tau + (\textsc{assert } \psi) := \langle \tau_i[\tau_0 \vdash \psi] \rangle_{0 \leqslant i < n}$, where $|\tau| = n$.

Why does QUEST not percolate an issue?

If it percolated, it would yield a non-partition, i.e., not a legitimate question.

Problem 2: Percolating a Question

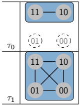
(9) If it's raining, will the party be cancelled?

If a question percolated, ...

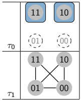
(10) $C[C' \vdash_Q \psi] :=$
$\{\langle w, v\rangle \in C \mid \exists z \in W.(\langle w, z\rangle \in C' \text{ or } \langle z, v\rangle \in C') \text{ implies } \langle w, v\rangle \in C' \oslash \psi\}$

(11) $\tau + (\text{if } p) + (\text{QUEST}'\ q) = \langle \tau_i[\tau_0 \oplus p \vdash_Q q]\rangle_{0 \leqslant i \leqslant n}$, provided $|\tau| = n$.

What I&R claim that (11) derives:

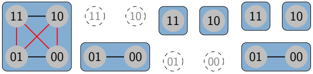


$+ (\text{QUEST}'\ q) =$



Problem 2: Percolating a Question

(12) $C[C \oplus p \vdash_Q q] =$
$\{\langle w, v\rangle \in C \mid \langle w, v\rangle \in C \oplus \neg p$ **or** $\langle w, v\rangle \in (C \oplus p) \oslash q\}$.

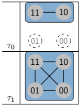


(a) C (b) $C \oplus \neg p$ (c) $(C \oplus p) \oslash q$ (d) $C[C \oplus p \vdash_Q q]$

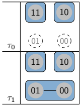
The pairs that connect w_{11} to w_{01} and w_{00}, and w_{10} to w_{01} and w_{00} should be removed.

Problem 2: Percolating a Question

What I&R actually derives:



$+ (\text{QUEST}'\ q) =$



I&R's problem 2

Percolating a question yields a tripartite partition.

- I&R's implementation fails to motivate non-percolating QUEST

Summary

I&R's problem 1

Updating a macro-context with a conditional statement yields an inquisitive context.

I&R's problem 2

Percolating a question yields a tripartite partition.

The main source of the problems:

- How Percolation is defined.
  - pair semantics

(13) $C[C \oplus p \vdash q] =$
$\{\langle w, v\rangle \in C \mid \langle w, v\rangle \in C \oplus \neg p \text{ or } \langle w, v\rangle \in (C \oplus p) \oplus q\}$.

Outline

Proposal

The problems will disappear if we

- employ inquisitive semantics for the syntax of propositional logic and
- redefine the notion of percolation

Bonus

- A single MCCP of UPDATE for statements and questions
- A unified account for conditional statements and questions

Inquisitive Semantics

Information state s

$s \subseteq W$ is a set of possible worlds

Issue I

A non-empty, downward closed set of information states.

- An inquisitive model M for a set P of atomic sentences: $M = \langle W, V \rangle$
  - W is a set of *possible worlds*,
  - $V : P \to \wp(W)$ is a *valuation map* that specifies for each atomic sentence in P, which worlds make the sentence true.

Inquisitive Semantics

The satisfaction relation $s \models \varphi$ is defined inductively:

$$\begin{array}{lcl}
s \models p & \iff & s \subseteq V(p), \\
s \models \varphi \vee \psi & \iff & s \models \varphi \text{ or } s \models \psi, \\
s \models \varphi \to \psi & \iff & \text{for all } t \subseteq s\text{: } t \models \varphi \text{ implies } t \models \psi, \\
s \models \neg\varphi & \iff & \text{for all non-empty } t \subseteq s\text{: } t \not\models \varphi.
\end{array}$$

Inquisitive Semantics

The proposition expressed by a sentence φ

$[\varphi]_M := \{s \subseteq W \mid s \models \varphi\}$

- $[\varphi]_M$ is an issue.

Interrogative sentence

$?\varphi := \varphi \vee \neg\varphi,$

Adding updates

Context $\mathcal{C}$

An issue, a downward closed set of information states.

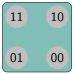


Figure: The initial ignorant context

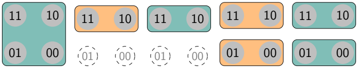
The initial ignorant context is a trivial issue $\wp(W)$.

Adding updates

- Declarative and interrogative updates are uniformly defined as intersection.

Update

$\mathcal{C} \star \varphi := \mathcal{C} \cap [\varphi]_M.$



(a) $\mathcal{C}$ (b) $[p]_M$ (c) $\mathcal{C} \star p$ (d) $[?p]_M$ (e) $\mathcal{C} \star ?p$

Stack-model conditionals

(14) a. If it's raining, the party will be cancelled.
b. If it's raining, will the party be cancelled?

macro-context

- $\tau = \langle \mathcal{C}_0, \ldots, \mathcal{C}_n \rangle$

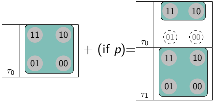
τ_0	$\mathcal{C}_0$
$\vdots$	$\vdots$
τ_n	$\mathcal{C}_n$

Conditional Statement

(15) If it's raining, the party will be cancelled.

MCCP of an *if*-clause

$\tau + (\text{if } \varphi) := \langle \tau_0 \star \varphi, \tau \rangle$



Redefining Percolation

(16) If it's raining, the party will be cancelled.

MCCP of UPDATE

$\tau + (\text{UPDATE } \psi) := \langle \tau_i[\tau_0 \vdash \psi] \rangle_{0 \leqslant i < n}$

Percolation (InqSem version)

$\mathcal{C}[\mathcal{C}' \vdash \psi] := \{ s \in \mathcal{C} \mid \text{ for all } t \subseteq s,\ t \in \mathcal{C}' \text{ implies } t \in \mathcal{C}' \star \psi \}$

- a natural extension of Kaufmann's Percolation (Conclude).

Compare:

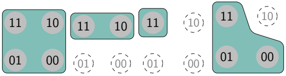
Percolation (I&R version)

$C[C' \vdash \psi] :=$
$\{ \langle w, v \rangle \in C \mid \exists z \in W.(\langle w, z \rangle \in C' \text{ or } \langle z, v \rangle \in C') \text{ implies } \langle w, v \rangle \in C' \oplus \psi \}$

Consequent Assertion

(17) If it's raining, the party will be cancelled.

(18) $\mathcal{C}[\mathcal{C} \star p \vdash q] =$
$\{ s \in \mathcal{C} \mid \text{ for all } t \subseteq s,\ t \in \mathcal{C} \star p \text{ implies } t \in \mathcal{C} \star p \star q \}$



(a) $\mathcal{C}$ (b) $\mathcal{C} \star p$ (c) $\mathcal{C} \star p \star q$ (d) $\mathcal{C}[\mathcal{C} \star p \vdash q]$

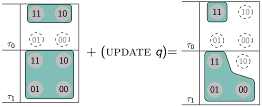
- All and only sets that contain w_{10} are removed.
- $\{w_{11}, w_{01}\}, \{w_{11}, w_{00}\}, \{w_{11}, w_{01}, w_{00}\}$ are NOT removed.

(18) $= \mathcal{C} \star (p \to q)$

Consequent Assertion

(19) If it's raining, the party will be cancelled.

(20) $\tau + (\text{if } p) + (\text{UPDATE } q) = \langle \tau_i[\tau_0 \star p \vdash q] \rangle_{0 \leqslant i \leqslant n}$



I&R's problem 1 solved

Updating a macro-context with a conditional statement correctly yields a non-inquisitive context.

Conditional Question

(21) If it's raining, will the party be cancelled?

I&R's argument

- A root-level question only affects the topmost context
- The effect of the update does not percolate down the stack.
- If it percolated, it yields a non-partition.

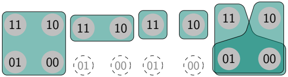
MCCP of UPDATE

$\tau + (\text{UPDATE } \psi) := \langle \tau_i[\tau_0 \vdash \psi] \rangle_{0 \leqslant i < n}$

Percolating a question?

What would happen if the effect of QUEST percolated?

(22) $\mathcal{C}[\mathcal{C} \star p \vdash ?q] =$
$\{ s \in \mathcal{C} \mid$ for all $t \subseteq s$, $t \in \mathcal{C} \star p$ implies $t \in \mathcal{C} \star p \star ?q \}$



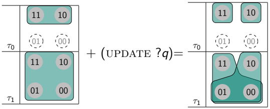
(a) $\mathcal{C}$ (b) $\mathcal{C} \star p$ (c) $\mathcal{C} \star p \star ?q$ (d) $\mathcal{C}[\mathcal{C} \star p \vdash ?q]$

All and only sets that contain $\{w_{11}, w_{10}\}$ as their subsets are removed.

(22) $= \mathcal{C} \star (p \rightarrow ?q)$

Percolating a question?

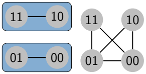
(23) $\tau + (\text{if } p) + (\text{UPDATE } ?q) = \langle \tau_i[\tau_0 \star p \vdash ?q] \rangle_{0 \leqslant i \leqslant n}$



I&R's problem 2 solved

Percolating a question correctly yields a non-partition (an overlapping issue).

- So, we have the result that I&R wanted.
- We can motivate non-percolating QUEST.
- However, ...



(a) $C \oslash p$ (b)

- In I&R's system, prohibiting overlapping issues was a technical need.
- A question was defined as a partition over context.

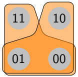


Figure: $[p \to ?q]_M$

InqSem does not rule out an overlapping issue as illegitimate.

Issue I

A non-empty, downward closed set of information states.

$[p \to ?q]_M =$
$\{\{w_{11}, w_{01}, w_{00}\}, \{w_{10}, w_{01}, w_{00}\},$
$\{w_{11}, w_{01}\}, \{w_{11}, w_{00}\}, \{w_{01}, w_{00}\}, \{w_{10}, w_{01}\}, \{w_{10}, w_{00}\},$
$\{w_{10}\}, \{w_{01}\}, \{w_{00}\}\}$

Furthermore, ...

I&R's problem 3 (conceptual)

We need three MCCPs.

- $\tau + (\text{ASSERT } \psi) := \langle \tau_i[\tau_0 \vdash \psi] \rangle_{0 \leqslant i < n}$, where $|\tau| = n$.
- $\langle C, \tau' \rangle + (\text{QUEST } ?\psi) := \langle C \oslash ?\psi, \tau' \rangle$.
- $\tau + (\text{QUEST}' \ \psi) := \langle \tau_i[\tau_0 \vdash_{\text{Q}} \psi] \rangle_{0 \leqslant i < n}$, where $|\tau| = n$.

(24) Embedded CQs
  a. Alfonso knows whether the party will happen if it rains.
  b. Alfonso wonders whether the party will happen if it rains.

I&R's problem 3 (empirical)

Percolation of *yes*-answer to the non-percolating QUEST yields an illegitimate issue.

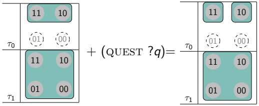
Non-percolating QUEST

MCCP of QUEST (non-percolating QUEST parallel to I&R's)

$\langle \mathcal{C}, \tau' \rangle + (\text{QUEST } ?\psi) := \langle \mathcal{C} \star ?\psi, \tau' \rangle$.

(25) If it's raining, will the party be cancelled?

(26) $\tau + (\text{if } p) + (\text{QUEST } ?q) = \langle \tau_0 \star p \star ?q, \tau_1 \rangle$

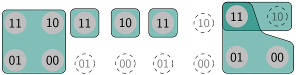


(27) a. If it's raining, will the party be cancelled?
  b. Yes.

(28) $\tau + (\text{if } p) + (\text{QUEST } ?q) + (\text{UPDATE } q) = \langle \tau_i[\tau_0 \star p \star ?q \vdash q] \rangle_{0 \leqslant i \leqslant n}$

(29) $\mathcal{C}[\mathcal{C} \star p \star ?q \vdash q] = \{s \in \mathcal{C} \mid \text{ for all } t \subseteq s,\ t \in \mathcal{C} \star p \star ?q \text{ implies } t \in \mathcal{C} \star p \star ?q \star q\ \}$

All the states that contain $\{w_{10}\}$ except for $\{w_{11}, w_{10}\}$ are removed, since $\{w_{11}, w_{10}\} \notin \mathcal{C} \star p \star ?q$.



(a) $\mathcal{C}$ (b) $\mathcal{C} \star p \star ?q$ (c) $\mathcal{C} \star p \star ?q \star q$ (d) $\mathcal{C}[\mathcal{C} \star p \star ?q \vdash q]$

Figure: InqSem Percolation of a yes-answer to a non-percolating QUEST

Answering to a Non-Percolating question posed by QUEST

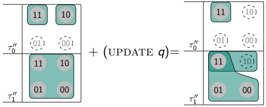
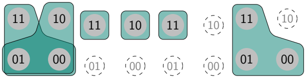


Figure: τ + (if p) + (QUEST ?q) + (UPDATE q)

Answering to a percolating question posed by UPDATE

(30) $\tau + (\text{if } p) + (\text{UPDATE } ?q) + (\text{UPDATE } q) = \langle \tau_i[\tau_0 \star p \star ?q \vdash q] \rangle_{0 \leqslant i \leqslant n}$

(31) $\tau_1''[\tau_0'' \vdash q] = \{ s \in \tau_1'' \mid \text{ for all } t \subseteq s, \ t \in \tau_0'' \text{ implies } t \in \tau_0'' \star q \ \}$



(a) τ_1'' (b) τ_0'' (c) $\tau_0'' \star q$ (d) $\tau_1''[\tau_0'' \vdash q]$

Figure: InqSem Percolation of a yes-answer to a percolated question

- UPDATE removes $\{w_{10}\}$
- Percolation removes every set that contains $\{w_{10}\}$ as its subset.

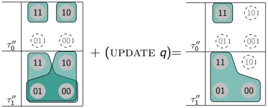


Figure: τ + (if p) + (UPDATE ?q) + (UPDATE q)

I&R's problem 3 solved

- We only need one single MCCP of UPDATE with percolation.
- Answering to a conditional question yields a legitimate issue.

Summary

We amended I&R's analysis of conditional questions by

- employing inquisitive semantics (Ciardelli et al., 2015) and
- redefining some notions, especially Percolation.

I&R's problem 1 solved

Updating a macro-context with a conditional statement correctly yields a non-inquisitive context.

I&R's problem 2 solved

Percolating a question correctly yields a non-partition (overlapping issues).

I&R's problem 3 solved

- We only need one single MCCP of UPDATE with percolation.
- Answering to a conditional question yields a legitimate issue.

Outline

Inquisitive Semantics allows overlapping issues and the result is the same as non-suppositional semantics of conditionals (Velissaratou, 2000).

Why do we need to use a stack?

Intuition

- Capture the "Ramsey test" intuition.
- Overlapping issues seem to be dispreferred.

Motivation 1: the Ramsey test and Modal Subordination

"Ramsey test" intuition

When we ask 'if p, q?', we first hypothetically update our stock of beliefs with p and then entertain the truth/faulsity of q in the adjusted beliefs.

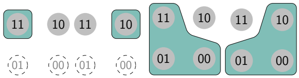
Modal Subordination:

(32) If a thief comes in, would he steal a silver? Would you be upset?

Motivation 2: Short answers

(33) If it's raining, will the party be cancelled?

a. Yes, it will.
b. No, it won't.
c. Yes, if it's raining, it will be cancelled.
d. No, if it's raining, it won't be cancelled.



(a) $\mathcal{C}\star p\star ?q\star q$ (b) $\mathcal{C}\star p\star ?q\star\neg q$ (c) $\mathcal{C}\star(p\to ?q)\star(p\to q)$ (d) $\mathcal{C}\star(p\to ?q)\star(p\to\neg q)$

Motivation 2: Unconditional Questions

- Hara (2018) "Questions are Hamblin-issues" *under review*.

Unconditional statement:

(34) Whether or not the party is at Emma's place, it will be fun.

Rawlins (2013)

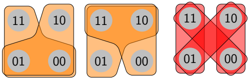
An unconditional construction '*whether or not p, q*' semantically encodes a conjunction of 'if *p*, *q*' AND 'if not *p*, *q*'.

([If the party is at Emma's place, it will be fun.]
AND
[If the party is not at Emma's place, it will be fun.])

Unconditional Questions

(35) *Whether or not the party is at Emma's place, will it be fun?

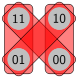
([If the party is at Emma's place, will it be fun?]
AND
[If the party is not at Emma's place, will it be fun?])



(a) $[p \to ?q]_M$ (b) $[\neg p \to ?q]_M$ (c) $[p \to ?q]_M \cap [\neg p \to ?q]_M$

Hamblin Issue 1

(36) *Whether or not the party is at Emma's place, will it be fun?



- InqSem allows overlapping possibilities.
- Thus, there is a linguistic constraint that disallows overlapping possibilities:

Hamblin-Issue 1

A question is an exhaustive set of mutually exclusive possibilities.

A complication

- Some people accept an unconditional question if it presupposes an unconditional answer.

(37) A: I don't think whether the party will be fun or not depends on whether it is at Emma's place or not.
?Now, whether or not the party is at Emma's house, will it be fun?
B1: ?Yes, whether or not it is at her house, it will be fun.
B2: ?No, whether or not it is at her house, it won't be fun.
B3: # If it is at her place, it will be fun. If it is not at her place, it won't be fun.

There are two groups of English speakers:

- Group 1 Always reject unconditional questions.
- Group 2 Accept unconditional questions only if the antecedent and consequent propositions are independent.

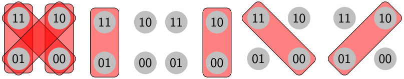
Independence Assumption

(38) p is consistent ($\Diamond p$, in short) in $\mathcal{C}$ if $\mathcal{C} \cap [p]_M \neq \emptyset$.

We say that p and q are *independent* in $\mathcal{C}$ if

$$\Diamond x \text{ and } \Diamond y \text{ in } \mathcal{C} \text{ imply } \Diamond([x]_M \cap [y]_M) \text{ in } \mathcal{C},$$

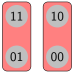
for all $x \in \{p, \neg p\}$ and $y \in \{q, \neg q\}$.



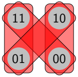
(a) (b) ind. (c) ind. (d) not ind. (e) not ind.

Uncod. with Independence Assumption

(39) A: I don't think whether the party will be fun or not depends on whether it is at Emma's place or not.
?Now, whether or not the party is at Emma's house, will it be fun?
B1: ?Yes, whether or not it is at her house, it will be fun.
B2: ?No, whether or not it is at her house, it won't be fun.
B3: # If it is at her place, it will be fun. If it is not at her place, it won't be fun.



Hamblin Issue 2



Hamblin-Issue 2

A question is an exhaustive set of possible answers.
A polar question is an exhaustive set of *yes* and *no* answers.

There are two groups of English speakers.

Group 1 always use stacks to process conditionals.

- Observe the mutual exclusivity of questions.
- Observe Hamblin-Issue 1
- disallow overlapping possibilities
- always reject unconditional questions
- do not accept unconditional questions even with independence assumption

Group 2 can process conditionals without using stacks.

- Relax the mutual exclusivity of questions
- Observe Hamblin-Issue 2
- allow overlapping possibilities.
- accept unconditional questions with independence assumption
- do not accept unconditional questions without independence assumption

Summary

- Although an overlapping issue (possibilities) are not disallowed in InqSem,
- the stack-based suppositional analysis of conditional questions is motivated.
    1. Modal-subordinated questions
    2. Short answers to conditional questions
    3. Unconditional questions

Overlapping issues are linguistically ruled out by HAMBLIN-ISSUE 1.

Outline

I&R's problems solved

I&R's problem 1 solved

Updating a macro-context with a conditional statement correctly yields a non-inquisitive context.

I&R's problem 2 solved

Percolating a question correctly yields a non-partition (an overlapping issue).

I&R's problem 3 solved

- We only need one single MCCP of UPDATE with percolation.
- Answering to a conditional question yields a legitimate issue.

- Overlapping issues are linguistically ruled out by HAMBLIN-ISSUE 1.

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