

Unconditional Questions are Suppositional and Independent Issues

Yurie Hara
Hokkaido Univeristy
hara@imc.hokudai.ac.jp

October 1, 2021

1 Introduction

This paper analyzes unconditional questions, constructions that have alternative- or *wh*-interrogative clauses as adjuncts and interrogative clauses as main clauses, such as (1)-(4). When an unconditional question is uttered out-of-the-blue as in (1), it is judged unacceptable. Although all the native speakers I consulted find (1) ungrammatical or infelicitous, to some consultants, it can be improved if the context is such that the questioner intends to make the two issues, whether or not the party is at Emma's place and whether or not it will be fun, *independent* as in (2). Similarly in (3), when it is clear from the world knowledge that the addressee's identity is independent of whether she is in need of help, the unconditional question is possible. (2) and (3) sharply contrast with (4), where the context suggests that the answer to the consequent question is dependent on the issue expressed by the antecedent clause.¹

- (1) a. #Whether or not the party is at Emma's place, will it be fun?
b. #Wherever the party is at, will it be fun?
- (2) A: I think that the party will be at Emma's.
B: No, didn't they agree that it will be at Luise's?
A: But Emma's place offers more space!
C: ?Now, whether or not the party will be at Emma's place, will it be fun?
- (3) Whoever you are, do you need help?
- (4) Everybody knows that concerts with Ariana Grande are great.
 - a. *Whether Ariana Grande is playing or not, do you wanna go to the concert?
 - b. *Whoever is playing, do you wanna go to the concert?

¹Examples (2)-(4) are provided by an anonymous reviewer.

The aim of the current paper is two-fold: The first goal is to provide a semantico-pragmatic analysis of unconditional questions that explain the distribution and interpretation sketched above. The second objective is to support the dynamic/suppositional semantics of conditionals (Stalnaker, 1968; Adams, 1965; Mackie, 1973; Karttunen, 1974; Heim, 1982; Gärdenfors, 1986, a.o.).

As seen in (1)-(4), there are contexts that make unconditional questions acceptable, thus they are not grammatically/syntactically ruled out. A question naturally arises as to: What do their structures and semantics look like? According to Rawlins (2008, 2013), an unconditional statement such as (5) creates a set of conditional statements and ‘merges’ them, the result of which is semantically equivalent to the conjunction of the conditional statements. As a result, the construction expresses a conjunction of multiple conditional assertions, e.g., ‘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’ and gives rise to an unconditional interpretation. That is, (5) means that the party will be fun and it does not matter whether or not it is at Emma’s place.

- (5) Whether or not the party is at Emma’s place, it will be fun.

Suppose that the unconditional question (1) has a parallel structure to its declarative counterpart (5). Then, (1) is a conjunction of two *conditional questions*, ‘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?’. This paraphrase of (1) is conceivable as its interpretation, yet it is judged unacceptable in out-of-the-blue contexts.² A satisfactory analysis of unconditional questions should explain this puzzle. This is the first goal of the current paper.

Incidentally, conditional questions such as (7) themselves have raised a number of issues regarding semantics and pragmatics of conditionals and questions in the literature (Hulstijn, 1997; Velissaratou, 2000; Isaacs & Rawlins, 2008).

- (7) If the party is at Emma’s place, will it be fun?

Isaacs & Rawlins (2008) analyze conditional questions like (7) and argues for the dynamic/suppositional semantics of conditionals. In the suppositional view, the antecedent serves to restrict the context of the consequent assertion. Thus, in the case of conditional declaratives like (8), the antecedent clause first temporarily updates the context with its propositional content. Second, the consequent clause updates the derived context with its propositional content.³

²Rawlins (2008) also acknowledges that a parallel merged structure is somehow not available when the consequent is an interrogative:

- (6) a. #Whether the party is at Alfonso or Joanna’s house, will it last a long time?
 b. #Whoever comes to the party, will it last a long time?
 c. #No matter who comes to the party, will it last a long time?
 (Rawlins, 2008, 141)

³Hereafter, I refer to this approach to conditionals as the *suppositional* analysis of conditional. Though “dynamic” semantics for conditionals may be more commonly used, it could lead to a confusion as it is conceivable to dynamically update a context with the “static”

(8) If the party is at Emma’s place, it will be fun.

A conditional interrogative like (7) can be analyzed in a parallel way as done by Isaacs & Rawlins (2008). That is, just like the conditional declarative, the antecedent clause creates a temporary context by updating the current context with its content, and then the consequent interrogative updates the temporary context with the (inquisitive) content of the consequent. Isaacs & Rawlins (2008) present a number of empirical and conceptual arguments for the suppositional approach. The analysis of unconditional questions given in the current paper serves as another piece of evidence in support of the suppositional semantics of conditionals. This is the second goal of this paper.

This paper is structured as follows. Section 2 reviews I&R’s criticism against the non-suppositional approach to conditionals based on the data of conditional questions. I&R in their paper propose their account of conditional questions by combining Kaufmann’s (2000) stack-based model of conditionals and Groenendijk’s (1999) partition semantics. As pointed out by Sano & Hara (2014) and Hara & Sano (2018), the use of partition semantics is technically problematic as it does not derive what they claim that it does. Thus, the current paper adopts inquisitive semantics (Ciardelli et al., 2015; Ciardelli & Roelofsen, 2015; Ciardelli, 2016, among others), which is reviewed in Section 3. Section 4 then points out the problem of the non-suppositional account of conditionals. In a nutshell, the non-suppositional semantics of unconditional questions is problematic in that it violates Hamblin’s (1971) picture, which dictates that the semantics of a question is an exhaustive set of possible answers. Section 5 proposes to modify I&R’s framework. More specifically, I combine Kaufmann’s (2000) stack-based model of conditionals with inquisitive semantics and show how the proposed framework derive conditional statements & questions and unconditional statements & questions. Importantly, the suppositional semantics of conditionals allows us to maintain simpler semantics for particle answers to unconditional questions as well as an intuitive interpretation procedure. Section 6 concludes the paper.

2 Conditional Questions

Semantic analyses of conditionals can be divided into two approaches, i.e., non-suppositional and suppositional approaches. In the non-suppositional approach, a conditional sentence is interpreted as logical implication $p \rightarrow q$ or universal quantification over possible worlds where the antecedent clause serves as a restrictor (Lewis, 1975; Kratzer, 1991). For a concrete example, suppose the antecedent and consequent of the conditional declarative in (9) translate to p and q , respectively. Then, (9) has the semantics specified in the truth table (10) or it is true if and only if all worlds where p is true are worlds where q is true.

(9) If the party is at Emma’s place, it will be fun.

semantic content $p \rightarrow q$.

p	q	$p \rightarrow q$
T	T	T
T	F	F
F	T	T
F	F	T

(10) Within the suppositional views (Stalnaker, 1968; Adams, 1965; Mackie, 1973; Karttunen, 1974; Heim, 1982; Gärdenfors, 1986, a.o.), on the other hand, the meaning of a conditional is characterized using a three-step update procedure. Suppose that a (stalnakerian) context C and propositions P and Q are sets of possible worlds. The conditional declarative (9) ‘If P , Q ’ is interpreted as follows:

- (11) a. A hypothetical context is created by updating the speech context with the antecedent ($C \cap P$).
 b. The hypothetical context is updated with the consequent ($C \cap P \cap Q$).
 c. The original context learns the effects of the second step ($(C \cap \bar{P}) \cup (C \cap P \cap Q)$).

In analyzing conditional questions like (12), Isaacs & Rawlins (2008) present a number of arguments for the suppositional approach. For example, it captures the intuition regarding the interpretation of a conditional question coined “the Ramsey test”:

- (12) If the party is at Emma’s place, will it be fun?
 (13) ‘Ramsey test’ intuition
 “If two people are arguing ‘If p , will q ?’ and are both in doubt as to p , they are adding p hypothetically to their stock of knowledge and arguing on that basis about q ...” (Ramsey, 1931, 247)

Isaacs & Rawlins (2008) also discuss more empirical motivations. In particular, I&R take a closer look at *responses* to conditional questions. Unlike conditional statements/declaratives, conditional questions are questions, thus they elicit responses from the addressee. To analyze the semantics of these responses, I&R argue, it is crucial to distinguish the temporary/hypothetical context from the main/utterance context created at the second step (11b).

To see this, let us first look at the following example, which I&R call “a denial of the antecedent”.

- (14) A: If the party is at Emma’s place, will it be fun?
 B: The party’s not at Emma’s place.

I&R critically review Hulstijn (1997) and Velissaratou (2000), which maintain non-suppositional analysis of conditionals and treat denials of the antecedents like (14) as complete/partial answers to conditional questions. First, Hulstijn (1997) proposes a tripartite analysis of conditional questions as depicted in Figure 1(a). Each gray circle represents a possible world and the first

and second numbers show the truth values of p and q , respectively in each world. For example, in w_{10} , p is true while q is false. Each blue block marks a set of possible worlds that counts as an answer to the question, i.e., an alternative proposition of the Hamblin (1958) set.⁴ In this framework, the denial of the antecedent is counted as a complete answer, in other words, a live alternative in the semantics of conditional questions. Velissaratou (2000) criticize Hulstijn (1997) that the denial of the antecedent cannot be a complete answer since intuitively, it does not resolve the issue raised by the conditional question. Velissaratou (2000) then proposes a modification of Hamblin semantics and relaxes the mutual exclusivity requirement of alternatives as depicted in Figure 1(b).⁵ In this way, the denial of the antecedent is now only a partial answer, thus even after the answer is accepted, the issue is not completely resolved. I&R argue, however, that Velissaratou’s analysis is still unsatisfactory, since the denial of the answer does not address the issue raised by the conditional question, but rather it only has an “issue-dispelling” effect. In short, denials of the antecedent should not be semanticized as complete nor partial answers to conditional questions, rather they should be dealt within pragmatics. More specifically, they deny a presupposition of the conditional that the antecedent is possible.

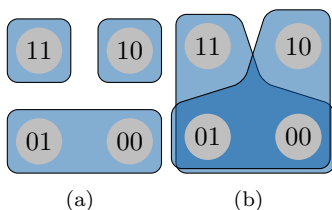


Figure 1: Previous analyses of conditional questions: (a) Hulstijn’s tripartite structure; (b) Velissaratou’s overlapping alternatives

Here I review another criticism of Hulstijn (1997) and Velissaratou (2000), by I&R that is the most relevant to the goal of the current paper. In Hulstijn’s (1997) tripartite analysis, *yes* and *no* answers correspond to the blocks that contain w_{11} and w_{10} , respectively in Figure 1(a). If the denial of the antecedent is one of the complete answers, it is mysterious why *no* cannot mean to deny the antecedent, that is, it fails to refer to the bottom block in Figure 1(a):

- (15) If the party’s at Emma’s place, will it be fun?
- a. Yes.
 - b. Yes, it will.
 - c. No.
 - d. No, it won’t.

⁴In Section 3, where inquisitive semantics is introduced, each *green* block marks the maximal set of sets of possible worlds.

⁵Inquisitive semantics also does not enforce mutual exclusivity to inquisitive propositions/contexts. See Section 3.

e. *No, the party’s not at Emma’s place.

I&R show that Velissaratou’s (2000) analysis also suffers regarding the semantic contents of *yes/no*. Velissaratou (2000) assumes that the denotations of *yes* and *no* are $p \rightarrow q$ and $p \rightarrow \neg q$, respectively. I&R argue that this assumption does not explain why *yes* and *no* can be followed by non-conditionalized q (15b) and $\neg q$ (15d), respectively. One could assume that the *if*-clause is elided in (15b) and (15d), though as Isaacs & Rawlins (2008, 282) puts, “this assumption seems to require justification rather than disproof”. Furthermore, some of my consultants actually expressed their strong preference toward the non-conditionalized answers, (15b) and (15d), over the conditionalized ones:

- (16) a. Yes, if it’s at her place, it will be fun.
 b. No, if it’s at her place, it won’t be fun.

The suppositional account of conditional questions like the one pursued here and by I&R can assign straightforward interpretations to *yes* and *no*. First, as sketched in (11), a hypothetical context is created by updating the main context with the semantic content of the antecedent, thus the worlds that make the antecedent false, w_{01} and w_{00} are removed. Then this hypothetical context is updated with the consequent question, which yields the bipartition as depicted in Figure 2. As can be seen, *yes* means p and maps to the block that contains w_{11} , while *no* means q and maps to the block that contain w_{10} . We do not have to worry about the third block nor overlapping alternatives as the problematic worlds do not exist in the hypothetical context.

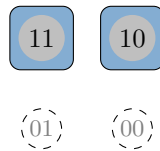


Figure 2: Partitioned hypothetical context depicted (The worlds marked with dashed lines mean that they do not exist.)

To summarize, the suppositional approach to conditionals is more suitable for conditional questions than the non-suppositional one. Since the worlds that make the antecedent false from the hypothetical context, the denial of the antecedent does not participate in the semantics of the consequent question. The analysis correctly captures the intuition that the denial of the antecedent does not answer the question but only dispels the issue by denying the presupposition of the conditional. The analysis also assigns straightforward meanings to *yes* and *no* answers. Put another way, the intermediate hypothetical context created at the second step (11b) is necessary to explain the intuitions of responses to conditional questions. See Isaacs & Rawlins (2008) for other empirical and conceptual arguments against Hulstijn (1997) and Velissaratou (2000).⁶

⁶One of I&R’s main conceptual arguments against Velissaratou (2000) is that abandoning

The need of hypothetical contexts that persist inter-sententially is independently recognized for modal subordination (Landman, 1986; Roberts, 1996; Frank, 1996; Kaufmann, 2000). In (17), (17b) affects the hypothetical context created by the antecedent of (17a), not the utterance context which includes worlds where Edna does not forget to fill the birdfeeder.

- (17) a. If Edna forgets to fill the birdfeeder, she will feel very bad.
 b. The birds will get hungry. (Roberts, 1996, 683)

Indeed, I&R and the current paper (Section 5) adopt Kaufmann’s (2000) analysis of modal subordination to analyze (un)conditional questions.

This paper shows that the interpretation and responses to unconditional questions support the suppositional account of conditionals in a similar way. That is, the hypothetical contexts created by the antecedent clause play a crucial role in understanding the semantics of unconditional questions and their answers.

3 Technical preliminaries: inquisitive semantics

In analyzing conditional questions, I&R originally combine Kaufmann’s (2000) stack-based model for conditionals with Groenendijk’s (1999) partition semantics for questions. However, as observed by Sano & Hara (2014) and Hara & Sano (2018), I&R’s original implementation does not derive the result that they claim to derive.⁷ Thus, in this paper, I employ Inquisitive Semantics (Ciardelli et al., 2015; Ciardelli & Roelofsen, 2015; Ciardelli, 2016, among others) to define the semantics of interrogative clauses.

3.1 Issues

Let \mathcal{W} be the set of all possible worlds. As with standard epistemic logic, an information state is identified with a set of possible worlds. Inquisitive semantics introduces another dimension which can characterize the issues that are entertained by the agents. An issue is defined as a set of information states:⁸

- (18) **Definition:** Issue
- a. An information state s is a set of possible worlds, i.e., $s \subseteq \mathcal{W}$.
 - b. An *issue* $I \subseteq \wp(\mathcal{W})$ is a non-empty, downward closed set of information states.

mutual exclusivity, which is a general principle of Hamblin/partition semantics, is mandated by the semantics tailored for conditional questions. This criticism is untenable under inquisitive semantics as the framework allows mutual exclusivity of alternatives/possibilities (see Section 3). Furthermore, as shown by Sano & Hara (2014) and Hara & Sano (2018), I&R’s implementation of the suppositional semantics of conditional questions has some technical yet critical problems. See Hara & Sano (2018) for details.

⁷See footnote 8 of Sano & Hara (2014, p. 97).

⁸Adapted from Ciardelli & Roelofsen (2015, 1649)

3.2 Syntax

We take the following as sentences of inquisitive semantics:

- (19) **Definition:** Syntax
 Let P be a set of atomic sentences.
- a. For any $p \in P$, $p \in \mathcal{L}$
 - b. If $\varphi, \psi \in \mathcal{L}$, $\varphi \wedge \psi \in \mathcal{L}$
 - c. If $\varphi, \psi \in \mathcal{L}$, $\varphi \vee \psi \in \mathcal{L}$
 - d. If $\varphi \in \mathcal{L}$, $\neg\varphi \in \mathcal{L}$
 - e. If $\varphi, \psi \in \mathcal{L}$, $\varphi \rightarrow \psi \in \mathcal{L}$

In inquisitive semantics, disjunction is the source of inquisitiveness (Groenendijk, 2007; Ciardelli et al., 2019). Thus, we treat a polar interrogative $?\varphi$ as an abbreviation of $\varphi \vee \neg\varphi$.

- (20) **Definition:** A polar interrogative
 $?\varphi := \varphi \vee \neg\varphi$

3.3 Semantics

Let us see how sentences are interpreted in inquisitive semantics. In standard epistemic logic, sentences are evaluated against a world in a model, since the meaning of a sentence is understood as a condition on worlds that make the sentence true. Now, the meaning of an interrogative sentence is understood as a condition on information states that resolve the issue expressed by the sentence. In the current framework, then, both declaratives and interrogatives are evaluated against information states. An inquisitive model M is defined as in (21).

- (21) **Definition:** Inquisitive Model
 An inquisitive model M for a set P of atomic sentences: $M = \langle W, V \rangle$
- a. W is a set, whose elements are called *possible worlds*.
 - b. $V : P \rightarrow \wp(W)$ is a *valuation map* that specifies for each atomic sentence in P , which set of the worlds make the sentence true.

The semantic value of a sentence φ , $\llbracket\varphi\rrbracket$, is an issue, that is, a downward-closed set of states s such that s support φ , i.e., “*established or true everywhere in s* ” (Ciardelli & Roelofsen, 2015, 1653) in case the sentence is informative and resolve the issue represented by φ in case the sentence is inquisitive. Put another way, both declarative and interrogative sentences denote a set of states, which are sets of possible worlds.

The following definition (22) defines the semantic values of an atomic sentence, a conjunction, a(n) disjunction/interrogative, a negated sentence and a conditional. The semantic value of an atomic sentence α is a set of states/propositions s such that s supports α , namely α is true in all worlds in s , as in (22a). The semantic value of a conjunction is a set of states s that supports both con-

juncts. Third, the semantic value of a disjunction is a set of states s such that at least one of the disjuncts is supported by s as in (22c). Fourth, a negative sentence $\neg\varphi$ is a set of states s such that no non-empty subset of s supports φ (22d). Finally, the semantic value a conditional $\varphi \rightarrow \psi$ is a set of states s such that all subsets of s that support φ support ψ (22e).

(22) **Definition:** Semantics

Let M be an inquisitive epistemic model, and s a state/proposition in M .

- a. $\llbracket\alpha\rrbracket := \{s \mid w \in V(\alpha) \text{ for all worlds } w \in p\}$
- b. $\llbracket\varphi \wedge \psi\rrbracket := \{s \mid s \in \llbracket\varphi\rrbracket \text{ and } s \in \llbracket\psi\rrbracket\}$
- c. $\llbracket\varphi \vee \psi\rrbracket := \{s \mid s \in \llbracket\varphi\rrbracket \text{ or } s \in \llbracket\psi\rrbracket\}$
- d. $\llbracket\neg\varphi\rrbracket := \{s \mid \text{for all non-empty } t \subseteq s, t \notin \llbracket\varphi\rrbracket\}$
- e. $\llbracket\varphi \rightarrow \psi\rrbracket := \{s \mid \text{for all } t \subseteq s : t \in \llbracket\varphi\rrbracket \text{ implies } t \in \llbracket\psi\rrbracket\}$

Note that $\llbracket\varphi\rrbracket$ is a set of propositions/states, therefore it is an issue.

Remember that we define a polar interrogative $?\varphi$ as an abbreviation of $\varphi \vee \neg\varphi$. Thus, the semantic value of polar interrogatives is the same as that of disjunction. It is the set of states s such that one of the answers is supported in s , i.e., the question is “resolved in s ” (Ciardelli & Roelofsen, 2015, 1653):

(23) **Definition:** The semantics of a polar interrogative

$$\llbracket?\varphi\rrbracket := \{s \mid s \in \llbracket\varphi\rrbracket \text{ or } s \in \llbracket\neg\varphi\rrbracket\}$$

Next, we define several notions to distinguish inquisitive sentences and statements (i.e., non-inquisitive sentences). As discussed by Ciardelli et al. (2015), a maximal state that supports a sentence φ contains all the states that support φ . These maximal states are called the possibilities:⁹

(24) **Definition:** Possibilities for a sentence φ

The maximal states that support a sentence φ are referred to as the possibilities for φ .

$$\text{possibility}(\varphi) := \{s \mid s \in \llbracket\varphi\rrbracket \text{ and there is no } t \supset s \text{ such that } t \in \llbracket\varphi\rrbracket\}.$$

(25) **Definition:** Inquisitiveness in terms of possibilities

- a. φ is inquisitive iff there are at least two possibilities for φ ,
- b. φ is a statement iff there is exactly one possibility for φ .

When a sentence φ is inquisitive, hence it is a question, the set of possibilities for φ is the set of possible answers to φ in terms of Hamblin (1958).

Let us illustrate the semantics of basic sentences in inquisitive semantics with diagrams in Figure 3. For simplicity, in the following illustrations we suppose $W = \{w_{11}, w_{10}, w_{01}, w_{00}\}$ and we have only two sentences p and q . The valuations of the sentences are as follows: $V(p) = \{w_{11}, w_{10}\}$ and $V(q) = \{w_{11}, w_{01}\}$. A word of caution is in order: Each green block now represents the maximal element of each issue, i.e., the possibility. Figure 9(a) illustrates the semantic

⁹Possibilities for φ are called *alternatives* for φ in some literature of inquisitive semantics (see Ciardelli, 2016).

value of p , i.e., $\llbracket p \rrbracket = \{\{w_{11}\}, \{w_{10}\}, \{w_{11}, w_{10}\}\}$. Similarly, $\llbracket p \wedge q \rrbracket = \{\{w_{11}\}\}$ (Fig. 3(b)), $\llbracket p \vee q \rrbracket = \{\{w_{11}\}, \{w_{10}\}, \{w_{11}, w_{10}\}, \{w_{01}\}, \{w_{11}, w_{01}\}\}$ (Fig. 3(c)), $\llbracket \neg p \rrbracket = \{\{w_{01}\}, \{w_{00}\}, \{w_{01}, w_{00}\}\}$ (Fig. 3(d)), $\llbracket p \rightarrow q \rrbracket = \{\{w_{11}\}, \{w_{01}\}, \{w_{00}\}, \{w_{11}, w_{01}\}, \{w_{01}, w_{00}\}, \{w_{11}, w_{00}\}, \{w_{11}, w_{01}, w_{00}\}\}$ (Fig. 3(e)). Among the five sentences, only $p \vee q$ is inquisitive as it has two possibilities.

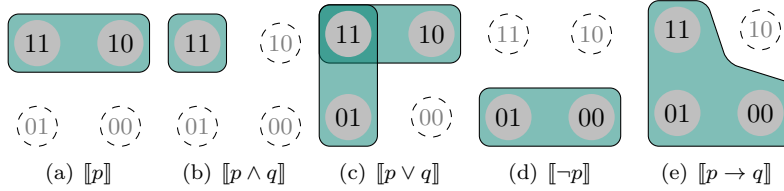


Figure 3: Examples of issues (Following Ciardelli & Roelofsen (2015), only the possibility, i.e., the maximal element of each issue, is shown for readability.)

Finally, we regard a set $\mathcal{C} \subseteq \wp(W)$ as the speaker’s epistemic context. When we add an update operation to the system in Section 5.1, this is the context to be updated.

(26) **Definition:** Context \mathcal{C}
A context \mathcal{C} is an issue, a downward closed set of information states.

We say that a context is inquisitive when there are at least two possibilities (maximal states) in the context.

(27) **Definition :** Inquisitiveness of contexts
a. \mathcal{C} is inquisitive iff there are at least two possibilities in \mathcal{C}
b. \mathcal{C} is non-inquisitive iff there is at most one possibility in \mathcal{C}

4 Unconditional statements/questions in (non-suppositional) inquisitive semantics

Armed with inquisitive semantics, we are ready to address the problems of the non-suppositional approach in analyzing unconditional questions. We first translate Rawlins’ (2013) (non-suppositional) analysis of unconditional statements into inquisitive semantics. We then see why a parallel analysis cannot be applied to unconditional questions.

Rawlins (2013) proposes that an unconditional construction ‘*whether or not* p , q ’ like (28) semantically encodes a conjunction of ‘if p , q ’ and ‘if not p , q ’. Since the content of the main clause stays constant, the choice among possible answers does not affect the value of the main clause. As a result, the construction entails q , though Rawlins (2013) explicitly claims that the consequent entailment itself is not lexically encoded in the construction but simply arises as a result of semantic composition.

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

Given the framework of inquisitive semantics discussed in the previous section, the semantic value of the sentences $p \rightarrow q$ and $\neg p \rightarrow q$ can be depicted as in Figures 4(a) and 4(b), respectively. Since the semantics of ‘whether or not p , q ’ is a conjunction of $p \rightarrow q$ and $\neg p \rightarrow q$, i.e., $(p \rightarrow q) \wedge (\neg p \rightarrow q)$, we can take an intersection of the two issues (sets of sets of possible worlds) $\llbracket p \rightarrow q \rrbracket \cap \llbracket \neg p \rightarrow q \rrbracket$, resulting in the issue depicted in Figure 4(c).

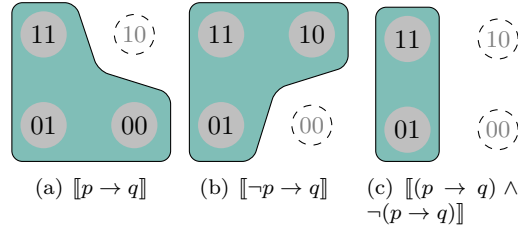


Figure 4: Two conditionals merge into an unconditional

Note that the resulting issue is equivalent to $\llbracket q \rrbracket$, hence we obtain the consequent entailment.

Before turning to unconditional questions, let us compute the semantic value of a conditional question in (non-suppositional) inquisitive semantics. As shown in (29), $p \rightarrow ?q$ is equivalent to $(p \rightarrow q) \vee (p \rightarrow \neg q)$.¹⁰

(29)

$$\begin{aligned}
 \llbracket p \rightarrow ?q \rrbracket &= \{s \mid \text{for all } t \subseteq s : t \in \llbracket p \rrbracket \text{ implies } t \in \llbracket ?q \rrbracket\} \\
 &= \{s \mid \text{for all } t \subseteq s : t \in \llbracket p \rrbracket \text{ implies } t \in \llbracket q \vee \neg q \rrbracket\} \\
 &= \{s \mid \text{for all } t \subseteq s : t \in \llbracket p \rrbracket \text{ implies } (t \in \llbracket q \rrbracket \text{ or } t \in \llbracket \neg q \rrbracket)\} \\
 &= \{s \mid \text{for all } t \subseteq s : t \in \llbracket p \rrbracket \text{ implies } t \in \llbracket q \rrbracket\} \\
 &\quad \cup \{s' \mid \text{for all } t' \subseteq s' : t' \in \llbracket p \rrbracket \text{ implies } t' \in \llbracket \neg q \rrbracket\} \\
 &= \llbracket p \rightarrow q \rrbracket \cup \llbracket p \rightarrow \neg q \rrbracket \\
 &= \llbracket (p \rightarrow q) \vee (p \rightarrow \neg q) \rrbracket
 \end{aligned}$$

As graphically shown in Figure 5, the semantic value of $p \rightarrow q$ is the union of $\llbracket p \rightarrow q \rrbracket$ and $\llbracket p \rightarrow \neg q \rrbracket$. Since it has two possibilities, the sentence is inquisitive. The diagram 5(c) resembles Velissaratou’s (2000) overlapping alternatives in Figure 1(b). The difference is that the green blocks in Figure 5(c) represent sets of states, which are in turn sets of possible worlds, while the blue ones in Figure 1(b) represent sets of possible worlds.

¹⁰See also Theorem 3 in Groenendijk (2007, 12) and page 138 of Ciardelli et al. (2019).

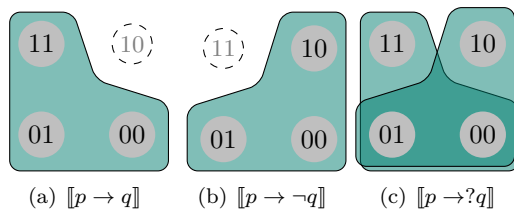


Figure 5: Conditional question as a union of two conditionals

Recall from Section 2 that I&R criticize Velissaratou (2000) (as well as Hulstijn (1997)) that the structure with overlapping alternatives assigns counter-intuitive semantics to the responses to conditional questions. That is, the denial of the antecedent would be a partial answer, and *yes* and *no* answers are necessarily translated to $p \rightarrow q$ and $p \rightarrow \neg q$. The same criticism applies to the inquisitive-semanticized structure in Figure 5(c).

Now, as introduced in Section 1 unconditional questions are unacceptable in out-of-the-blue contexts as in (30) while they are judged better when the two issues expressed by the antecedent and consequent are independent as in (31) and (32).

- (30) *Whether or not the party is at Emma’s place, will it be fun?
- (31) A: I think that the party will be at Emma’s.
 B: No, didn’t they agree that it will be at Luise’s?
 A: But Emma’s place offers more space!
 C: ?Now, whether or not the party will be at Emma’s place, will it be fun?
- (32) Whoever you are, do you need help?

Let us ignore the independence condition for a moment and see what the semantic value of an unconditional question looks like. Adopting Rawlins’ (2013) analysis of unconditional statements, an unconditional question ‘*whether or not p, ?q*’ should denote a conjunction of two conditional questions, i.e., ‘if *p*, *?q*’ and ‘if not *p*, *?q*’. The semantic values of $p \rightarrow ?q$ and $\neg p \rightarrow ?q$ are depicted as in Figures 6(a) and 6(b), respectively. Now let us try to conjoin $p \rightarrow ?q$ and $\neg p \rightarrow ?q$, i.e., $(p \rightarrow ?q) \wedge (\neg p \rightarrow ?q)$. That is, we take the intersection of the two issues $\llbracket p \rightarrow ?q \rrbracket \cap \llbracket \neg p \rightarrow ?q \rrbracket$ and end up with the issue $\llbracket (p \rightarrow ?q) \wedge (\neg p \rightarrow ?q) \rrbracket = \{\{w_{11}, w_{01}\}, \{w_{10}, w_{00}\}, \{w_{11}, w_{00}\}, \{w_{01}, w_{10}\}, \{w_{11}\}, \{w_{10}\}, \{w_{01}\}, \{w_{00}\}\}$ depicted in Figure 6(c).

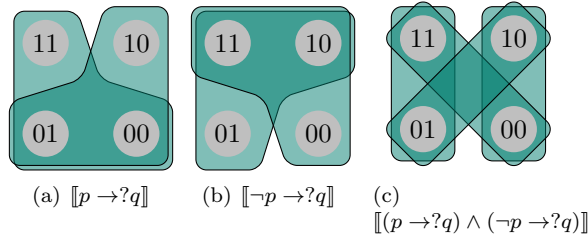


Figure 6: Two conditional questions merge into an unconditional question

Overlapping issues are allowed in inquisitive semantics, unlike partition semantics (Groenendijk, 1999). Thus, the issue depicted in 6(c) is a theoretically legitimate one. What is illegitimate about Figure 6(c), I argue, is that the number of blocks in the semantics of the question does not match the number of possible answers to the question. To be more concrete, as Isaacs & Rawlins (2008, 277) state, “[*yes*] and *no* are in some sense privileged answers that are only available to polar questions [...] But these privileged answers are still usable with [conditional questions] formed out of an interrogative that has the syntactic characteristics of a polar question”. As in (33), *yes* and *no* are also usable as answers to an unconditional question like (31) “with the syntactic characteristics of a polar question”.

- (33) A and/or B answering the unconditional question (31)
- a. Yes. (=whether or not it’s at her place, it will be fun).
 - b. No. (=whether or not it’s at her place, it won’t be fun).
 - c. *Yes/No, if it’s at her place, it will be fun and if it’s not at her place, it won’t be fun.
 - d. *Yes/No, if it’s at her place, it won’t be fun and if it’s not at her place, it will be fun.

Yes and *no* in (33) apparently map to the left and right vertical blocks, respectively. It is unclear why neither can refer to either of the diagonal blocks in Figure 6(c). Furthermore, the fact that there are no linguistic expressions that correspond to the diagonal blocks (possibilities) goes against the general principle in the semantics of questions, namely, the Hamblin’s (1958) picture, which dictates that the semantics of a question is a set of possible answers.

This paper argues that the suppositional semantics of conditionals allows us to assign the correct semantics to the answers to unconditional questions as well as unconditional questions themselves by making use of hypothetical contexts. To preview the analysis, let us consider *whether-or-not-p*, $?q$ and the diagrams in Figure 7. The unconditional antecedent creates two hypothetical contexts ($\mathcal{C} \star p$ and $\mathcal{C} \star \neg p$), each of which is updated with p or $\neg p$. Thus, the worlds that make p and $\neg p$ false are removed from $\mathcal{C} \star p$ and $\mathcal{C} \star \neg p$, respectively as in 7(a) and 7(b). The consequent question $?q$ then renders the hypothetical contexts inquisitive as in as in 7(c) and 7(d). As can be seen, *yes* and *no* answers

straightforwardly map to the blocks (possibilities) in the hypothetical contexts.

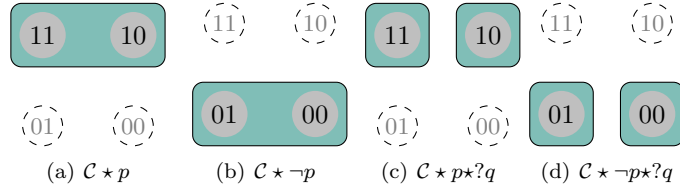


Figure 7: Hypothetical contexts

The next section provides a formal implementation of the suppositional semantics of conditionals as well as the creation of multiple hypothetical contexts and walks through how unconditional questions and their answers are dynamically interpreted. The analysis ends with an answer to the remaining question: Why unconditional questions are gravely deteriorated when two issues are not independent? My answer in a nutshell is: When the two issues are not independent, at least one of the conditional questions will be superfluous, violating Searlean (1969) felicity condition of question act.

5 Suppositional analysis of (un)conditionals using stacks

As discussed in Section 2, the semantics of a conditional has a three-step update procedure in the suppositional view of conditionals (Stalnaker, 1968; Adams, 1965; Mackie, 1973; Karttunen, 1974; Heim, 1982; Gärdenfors, 1986, a.o.):

- (34)
- a. A hypothetical context is created by updating the speech context with the antecedent ($C \cap P$).
 - b. The hypothetical context is updated with the consequent ($C \cap P \cap Q$).
 - c. The original context learns the effects of the second step ($(C \cap \bar{P}) \cup (C \cap P \cap Q)$).

In implementing these steps, I&R employ Kaufmann’s (2000) stack-based implementation of the suppositional semantics of conditionals. Kaufmann (2000) proposes a stack-based model of hypothetical contexts to analyze modal subordination (Landman, 1986; Roberts, 1996; Frank, 1996). As mentioned in Section 2, modal subordination and conditional questions are similar in that both require hypothetical contexts that persist inter-sententially. The subsequent sentences/answers may refer back to those hypothetical contexts rather than the utterance contexts.

In the current paper, I combine the stack-based model with the inquisitive semantics sketched above instead of partition semantics (Groenendijk, 1999), which was originally used by Isaacs & Rawlins (2008). See footnote 6 and Sano

& Hara (2014); Hara & Sano (2018) for why partition semantics is not suitable for (un)conditional questions.

5.1 Updates and stacks

In standard Stalnakerian (1978) update semantics, a context is a set of possible worlds. An assertion updates the context by taking an intersection of the context and the propositional content of the assertion, which is also a set of possible worlds. In the current setting, the proposition of a sentence is a set of information states, thus a context to be updated is also a set of information states. i.e., an issue, as defined above in (18).

At the initial stage, the conversational agent is ignorant about the context. That is, the agent has no pre-existing commitments about information or issues. Reflecting this state of the context, there is only one maximal element, $W = \{w_{11}, w_{10}, w_{01}, w_{00}\}$. In other words, the initial ignorant context is a trivial issue $\wp(W)$ and is diagrammatically depicted in Figure 8.

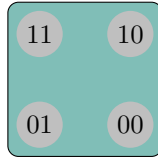


Figure 8: The initial ignorant context

Declaratives, interrogatives and contexts all have the same semantic type; that is, they are all issues, i.e., sets of states (sets of possible worlds). Thus, declarative and interrogative updates are uniformly defined as intersection of the context and the semantic value of the sentence:

$$(35) \quad \textbf{Definition: } \mathcal{C} \star \varphi := \mathcal{C} \cap \llbracket \varphi \rrbracket.$$

To illustrate, the update of \mathcal{C} with a declarative p , $\mathcal{C} \star p$, intersects \mathcal{C} with the proposition $\llbracket p \rrbracket$ (Fig. 9(a)) resulting in the context depicted in Fig. 9(b). Similarly, the update of \mathcal{C} with an interrogative $?p$, $\mathcal{C} \star ?p$, intersects \mathcal{C} with the proposition $\llbracket ?p \rrbracket$ (Fig. 9(c)) resulting in the context depicted in Fig. 9(d).

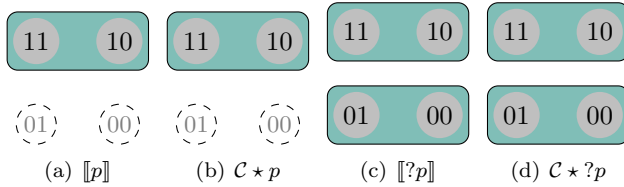


Figure 9: Propositions and updated contexts

The next step is to add stacks to model conditionals. Following Kaufmann (2000) and Isaacs & Rawlins (2008), utterances are treated as operations on a *macro-context*, which is a stack or list of contexts as defined in (36).

(36) **Definition:** macro-context
 $\tau = \langle \mathcal{C}_0, \dots, \mathcal{C}_n \rangle$

As depicted in Figure 10, each member of macro-context τ represents a context $\tau_n = \mathcal{C}_n$. We say that the topmost context $\tau_0 = \mathcal{C}_0$ is the currently active context.

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

Figure 10: macro-context τ

Let us first look at how a conditional statement is interpreted and turn to the meaning of a conditional question.

5.2 Conditionals

5.2.1 Conditional Statements

In interpreting the antecedent of the conditional in (37), a temporary context is created by making a copy of the initial context \mathcal{C} . More precisely, a temporary context is pushed onto the stack:

(37) If the party is at Emma’s place, it will be fun.

(38) **Definition:** push operator
 For any macro-context τ and context \mathcal{C} :
 $\text{push}(\mathcal{C}, \tau) := \langle \mathcal{C}, \tau \rangle$

The temporary context is updated by an update operation, i.e., intersecting the input context with the propositional content of the sentence. The function of the *if*-clause is defined as the macro-context change potential (MCCP) which creates a temporary context that is updated by the propositional content of the *if*-clause, as in (39):¹¹

(39) **Definition:** MCCP of an *if*-clause
 For any macro-context τ and *if*-clause ‘if φ ’:
 $\tau + \text{if}(\varphi) := \text{push}(\tau_0 \star \varphi, \tau)$
 Admittance condition: $\text{if}(\varphi)$ is admissible in a macro-context τ iff $\tau_0 \star \varphi \neq \emptyset$

¹¹The admittance condition encodes the presupposition that the propositional content of the antecedent is possible, which is often assumed since Stalnaker (1968).

All the states that do not support the antecedent clause, that is, the sets that contain the worlds that make the antecedent false, i.e., w_{01} and w_{00} , are removed from the temporary context, as shown in Figure 11.

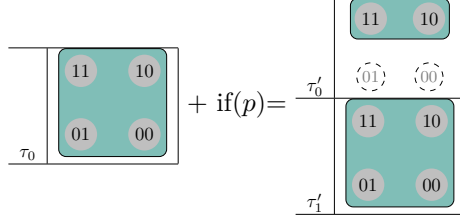


Figure 11: $\tau + \text{if}(p)$

Next, the consequent declarative clause updates the temporary context, $\tau'_0 \star q = \tau'_0 \cap \llbracket q \rrbracket$. Since $w_{10} \notin V(q)$, the update removes all the sets that contain w_{10} .

Now, this update by the declarative clause affects not only the temporary context but also the other members in the stack. That is, the information brought by a declarative percolates down the stack. In characterizing this percolation of information, the current framework defines the notion of percolation \vdash as follows:

- (40) **Definition:** Percolation \vdash
 $\mathcal{C}[\mathcal{C}' \vdash \psi] := \{s \in \mathcal{C} \mid \text{for all } t \subseteq s, t \in \mathcal{C}' \text{ implies } t \in \mathcal{C}' \star \psi \}$

This is a reformulation of Isaacs and Rawlins' (2008) 'support' (46, p. 293) and a natural extension of Kaufmann's (2000) Conclude. $\mathcal{C}[\mathcal{C}' \vdash \psi]$ can be read as 'Discourse participants learn in a context \mathcal{C} that another context \mathcal{C}' supports ψ '.¹² To be more concrete, let us calculate a context $\mathcal{C}[\mathcal{C} \star p \vdash q]$.

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

Let our context \mathcal{C} to be the trivial issue as in Figure 12(a). All and only states that contain w_{10} , i.e., $\{w_{10}, w_{01}\}, \{w_{10}, w_{00}\}, \{w_{10}, w_{01}, w_{00}\}$, are removed, which gives us the context depicted in 12(d). Note in particular that this context $\mathcal{C}[\mathcal{C} \star p \vdash q]$ is equivalent to the context obtained by updating \mathcal{C} with a non-stack version of conditional $p \rightarrow q$: $\mathcal{C}[\mathcal{C} \star p \vdash q] = \mathcal{C} \star (p \rightarrow q)$.¹³

¹²As pointed out by Sano & Hara (2014), Isaacs and Rawlins' original definition of 'support' does not derive the semantics that they claim to derive.

¹³See (22e) for the definition of \rightarrow .

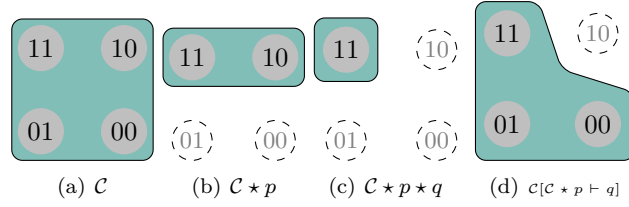


Figure 12:

With this notion of percolation \vdash , Isaacs and Rawlins' (2008) assertive update on macro-contexts (47, p. 293) is also carried over to the current framework as in (42). Note that unlike Isaacs & Rawlins (2008), who make a distinction between assertive and inquisitive updates on MCCP, I simply call it MCCP of UPDATE. In inquisitive semantics, updates by declarative and interrogative sentences are uniformly treated as intersection of the input context and the propositional content of the sentence (see (35) above), thus we only need a single MCCP of UPDATE. We will see how (42) works for questions in the next section.

(42) **Definition** MCCP of UPDATE
 $\tau + \text{UPDATE}(\varphi) := \langle \tau_i[\tau_0 \vdash \varphi] \rangle_{0 \leq i < n}$

The effect of MCCP of UPDATE is depicted in Figure 13 and the process so far is summarized in (43).

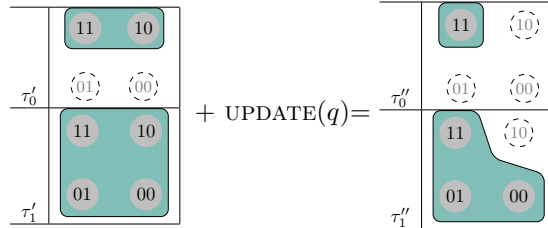


Figure 13: Update of the consequent declarative

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

Finally, unless the subsequent discourse refers to the temporary context as in modal subordination like (17b), the temporary context will no longer be necessary. In that case, the pop operation will discard the temporary context:¹⁴

(44) **Definition:** pop operator
 $\langle \mathcal{C}, \tau \rangle + \text{pop} := \tau$ if $\tau \neq \langle \rangle$; \mathcal{C} otherwise.

¹⁴See Isaacs & Rawlins (2008, (45), p. 292).

The only member of the final macro context τ_0''' has the same structure as the context that is updated with $p \rightarrow q$, i.e., $\mathcal{C} \cap \llbracket p \rightarrow q \rrbracket$:

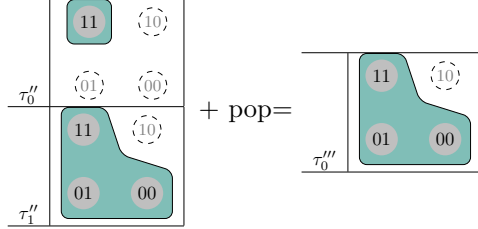


Figure 14: Popping

5.2.2 Conditional Questions

Let us now turn to the conditional question:

(45) If the party is at Emma’s place, will it be fun?

The first step is the same as the conditional declarative: The MCCP of an *if*-clause pushes a temporary context on top of the macro-context and updates it with the propositional content of the antecedent.

The next step should update this temporary context with the consequent interrogative. Unlike Isaacs & Rawlins (2008), who propose distinct MCCPs for assertions and questions, I claim that the same MCCP of UPDATE carries over to question acts. Thus, as is the case with assertions, issues raised by questions also percolate down the stack:¹⁵

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

Remember that the party is fun in w_{11} , and the party is not fun in w_{10} . Since w_{11} and w_{10} resolve the question in different ways, the two worlds are disconnected. In other words, $\{w_{11}, w_{10}\} \notin \llbracket ?q \rrbracket$, thus $\{w_{11}, w_{10}\} \notin \tau_0 \star p \star ?q$. Therefore, the state that contains the two worlds, $\{w_{11}, w_{10}\}$, is removed, and the temporary context τ_0'' is *partitioned* into two maximal elements as can be seen in Figure 15.

¹⁵Note further that in Isaacs & Rawlins (2008), the distinction between assertive and inquisitive updates is already made at the level of (non-macro) context. In contrast, in inquisitive semantics, the update procedure, i.e., non-macro CCP, for interrogative and declarative clauses is the same, that is, the update intersects the input context set \mathcal{C} with the propositional content of the clause.

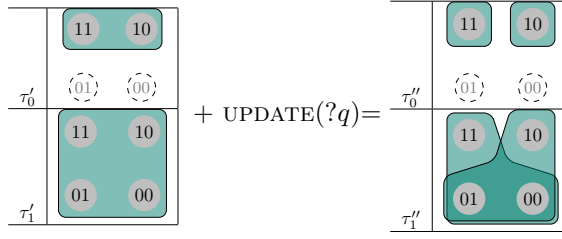


Figure 15: $\tau + \text{if}(p) + \text{UPDATE}(?q)$

The effect also percolates down the stack, thus all the states that contain $\{w_{11}, w_{10}\}$ as their subsets are removed from the bottom context. In effect, the bottom context has overlapping possibilities:

$$(47) \quad \mathcal{C}[\mathcal{C} \star p \vdash ?q] = \{s \in \mathcal{C} \mid \text{for all } t \subseteq s, t \in \mathcal{C} \star p \text{ implies } t \in \mathcal{C} \star p \star ?q\}$$

In I&R's system, the effect of question update should not percolate down the stack since they define the semantics of an interrogative clause as a partition on a set of possible worlds, hence overlapping possibilities would be an illegitimate question. In inquisitive semantics, on the other hand, overlapping possibilities are not problematic.

Now, at this moment, our active topmost context is inquisitive, that is, the questioner is waiting for an answer. In the current model, particle answers *yes* and *no* simply map to q and $\neg q$, respectively. That is, updating τ_0'' with q (or $\neg q$) will resolve the issue. Recall from Section 4 that Velissaratou (2000) has to stipulate that *yes* and *no* mean $p \rightarrow q$ and $p \rightarrow \neg q$.

The utterance of the answer is the MCCP of UPDATE with percolation, which removes all the states that do not support the answer in the temporary context, i.e., $\{w_{10}\}$ and the effect percolates down the stack.

$$(48) \quad \tau + \text{if}(p) + \text{UPDATE}(?q) + \text{UPDATE}(q) = \langle \tau_i[\tau_0 \star p \star ?q \vdash q] \rangle_{0 \leq i \leq n}$$

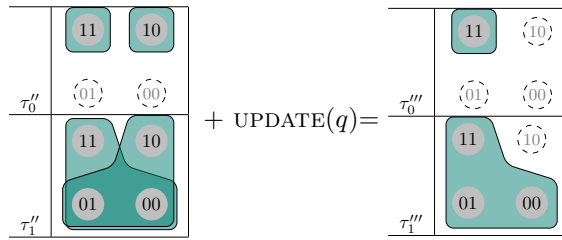


Figure 16: A *yes* answer given to the conditional question

After the question is resolved, both the temporary and main contexts are no longer inquisitive. Unless it is needed by the subsequent utterance (e.g., modal subordination), the temporary context can be popped off the stack according to the pop operation (44).

In general, derived contexts are discarded after the interpretation of *declarative* conditionals. Subsequent utterances do not refer back to the temporary contexts unless they are modally subordinates sentences. In contrast, I&R propose that derived contexts are not discarded after the interpretation of *interrogative* conditionals, since the derived contexts are still inquisitive, that is, they contain at least two maximal elements. This requirement is formulated as the INQUISITIVE CONSTRAINT.

- (49) INQUISITIVE CONSTRAINT
 A macro-context may not be popped if the top element is inquisitive.
 (Isaacs & Rawlins, 2008, (49), p. 294)

5.3 Unconditionals

Let us now turn to unconditionals. In order to derive the meanings of unconditional statements/questions, this section provides an extension of the model and notions introduced in Section 5.2. In particular, I introduce the notion of *multi-stack* and the operators *n-copy*, *merge*, *MSUPDATE* and *MSPop* in order to handle the multiple contexts.

5.3.1 Unconditional statements

In the stack-based framework adopted in this paper, an *if*-clause restricts the context for the update of the consequent clause. Now, according to Rawlins' (2008, 2013) (non-suppositional) analysis of unconditionals summarized in Section 1, an unconditional statement like (50) is a collection of alternative conditional statements.

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

Taken together, I propose that *whether-or-not*-adjuncts create multiple temporary contexts, and the *UPDATE* operation updates those multiple contexts with the content of the consequent declarative.

In implementing this proposal, I introduce the notion of multi-stack, as in (52). A multi-stack is a sequence of stacks.¹⁶

- (52) **Definition:** multi-stack
 $\mathcal{T} := \langle \tau^{(0)}, \tau^{(1)}, \tau^{(2)}, \dots, \tau^{(n)} \rangle$ is a multi-stack, where $\tau^{(i)}$ is a macro-context and $|\tau^{(0)}| = \dots = |\tau^{(n)}|$.

¹⁶The notion of multi-stack is useful for a phenomenon of modal splitting which is a kind of modal subordination discussed by Landman (1986). As can be seen in (51), multiple hypothetical contexts are required for the subsequent update of the disjunctive declarative:

- (51) a. You will stay unmarried or you will marry a trump. You'll become a nun, or the trump will beat you regularly. Either way, you'll have a miserable life.
 b. Call this number. The phone will be answered by either a doctor or a secretary. The doctor can tell you right away what's the matter with you, or the [secretary] can make an appointment for you. (Landman, 1986, 205)

The context can be rendered into a multi-stack by using the n -copy operator (53) when necessary, i.e., when multiple updates are performed on multiple contexts.

- (53) **Definition:** n -copy operator
 For any macro-context τ :
 $\tau + n\text{-copy} := \langle \tau^{(0)}, \dots, \tau^{(n-1)} \rangle$, where $\tau = \tau^{(0)} = \dots = \tau^{(n-1)}$.

This n -copy operation can be understood as playing the role of the F-feature in Rooth (1985, 1992) or the [Q] operator in Rawlins (2008, 2013). Like them, it generates a set of Hamblin alternatives, $\text{Alt}(\varphi)$. When this alternative-generating F-feature (or the [Q] operator) takes scope over a speech act operator such as asserting or questioning (Krifka, 2001), a multi-stack \mathcal{T} is created ($|\mathcal{T}| = |\text{Alt}(\varphi)|$) and each member of the alternative set creates a hypothetical context on top of each stack in \mathcal{T} :

- (54) **Definition:** MCCP of an unconditional antecedent φ
 For a macro-context τ and each $\alpha_n \in \text{Alt}(\varphi)$, where $0 < n \leq |\text{Alt}(\varphi)|$:
 $\tau + \text{unconditional}(\varphi) := \langle \tau^{(0)} + \text{if}(\alpha_0), \dots, \tau^{(n-1)} + \text{if}(\alpha_{n-1}) \rangle$,
 where $\langle \tau^{(0)}, \tau^{(1)} \rangle = \tau + n\text{-copy}$.

If the unconditional antecedent is a polar question, *whether-or-not-p*, $n = 2$, thus (54) reduces to (55):

- (55) **Definition:** MCCP of an *whether-or-not* φ
 For a macro-context τ and an unconditional antecedent (whether or not φ):
 $\tau + \text{whether-or-not}(\varphi) := \langle \tau^{(0)} + \text{if}(\varphi), \tau^{(1)} + \text{if}(\neg\varphi) \rangle$,
 where $\langle \tau^{(0)}, \tau^{(1)} \rangle = \tau + 2\text{-copy}$.

Let us derive (50) with the same model as before: $V(p) = \{w_{11}, w_{10}\}$, and $V(q) = \{w_{11}, w_{01}\}$, where p = ‘The party is at Emma’s place’ and q = ‘It will be fun’.

The initial context has the form of a single stack. When the *whether-or-not*-adjunct is processed, the interpreter realizes that two stacks will be created. In other words, a *whether-or-not*-adjunct denotes a macro-context change potential which creates a multi-stack and performs an update over the created multi-stack. Thus, the main macro-context is first rendered into a sequence of macro-contexts and (55) performs the MCCP of an *if*-clause (39) in each of the macro-contexts. The definitions of an *if*-clause (39) and the push operator (38) are directly carried over to the current framework. In effect, one temporary context is created in each stack, the top member $\tau_1^{(0)}$ of $\tau^{(0)}$ is updated with p , and $\tau_1^{(1)}$ is updated with $\neg p$:

	$\tau^{(0)}$	$\tau^{(1)}$
τ'_0		
τ'_1		

Figure 17: $\tau + \text{whether-or-not}(p)$

The consequent of (50), ‘it will be fun’, operates over this multi-stack. Thus, we need MCCP of MSUPDATE, which performs UPDATE on each stack of multi-stack \mathcal{T} :

(56) **Definition:** MSUPDATE (multi-stack UPDATE)
 For any multi-stack \mathcal{T} :
 $\mathcal{T} + \text{MSUPDATE}(\varphi) := \langle \tau^{(0)} + \text{UPDATE}(\varphi), \dots, \tau^{(n)} + \text{UPDATE}(\varphi) \rangle$.

MSUPDATE(q) removes all the states that contain w_{10} from $\tau_1^{(0)}$ and the states that contain w_{00} from $\tau_1^{(1)}$. This information can percolate down to the original member of the stack by the operation of the MCCP of UPDATE (42), That is, the states that contain w_{10} are removed from both $\tau_1^{\prime(0)}$ and $\tau_0^{\prime(0)}$, and the states that contain w_{00} are removed from both $\tau_1^{\prime(1)}$ and $\tau_0^{\prime(1)}$.

	$\tau^{\prime\prime(0)}$	$\tau^{\prime\prime(1)}$
τ''_0		
τ''_1		

Figure 18: $\tau + \text{whether-or-not}(p) + \text{MSUPDATE}(q)$

After the percolation, i.e., the UPDATE on the entire macro-context, the temporary contexts are popped from the multi-stack. I now define MSpop, an operator which performs the pop operation (44) on each member of the multi-stack.

- (57) **Definition:** MSpop (multi-stack pop)
 For any multi-stack \mathcal{T} :
 $\mathcal{T} + \text{MSpop} := \langle \tau^{(0)} + \text{pop}, \dots, \tau^{(n)} + \text{pop} \rangle$.

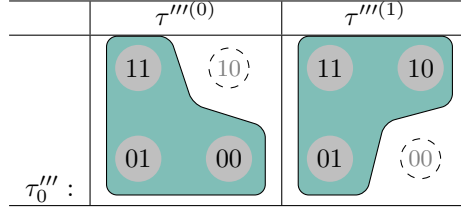


Figure 19: $\tau + \text{whether-or-not}(p) + \text{MSUPDATE}(q) + \text{MSpop}$

In Rawlins' (2008, 2013) non-suppositional analysis, the unconditional or independence meaning of unconditionals comes from universal quantification over the alternative conditional statements. In the current stack-based framework, the same effect is obtained from a merge operator defined in (59) on the basis of (58).

- (58) **Definition:** stack intersection \sqcap
 For any stacks τ, v , $\tau \sqcap v$ is defined if $|\tau| = |v|$.
 If defined, $\tau \sqcap v := \chi$ such that for all χ_i and $0 \leq i \leq |\tau|$,
 $\chi_i := \tau_i \sqcap v_i = \{s | s \in \tau_i \wedge s \in v_i\}$
- (59) **Definition:** merge operator
 For a multi-stack $\langle \tau^{(0)}, \tau^{(1)} \rangle$:
 $\langle \tau^{(0)}, \tau^{(1)} \rangle + \text{merge} := \tau^{(0)} \sqcap \tau^{(1)}$

The merge operator collapses the sequence of macro-contexts into a single one as depicted in Figure 20.

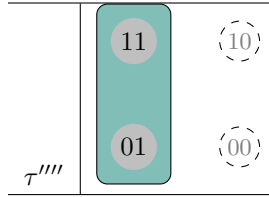


Figure 20: $\langle \tau'''(0), \tau'''(1) \rangle + \text{merge}$

As a result, we end up with the same information state as the case where the initial context simply updated with the simple declarative q , i.e., (60), since the UPDATE removes all the sets that contain w_{10} and w_{00} which make the sentence false.

- (60) The party will be fun.

This is as desired. The unconditional *whether-or-not* p, q entails q , hence the consequent entailment.

5.3.2 Unconditional questions

We finally turn to the unconditionals with question consequents. We first look at how the proposed system works when unconditional questions are felicitous, that is, when the questioner expects an unconditional answer. The analysis assigns straightforward semantics to the interpretation process of and the answers to the unconditional question. Next, the fact that some speakers dislike unconditional questions regardless of contexts is explained in terms of pragmatic competition. Third, when the antecedent p and the consequent $?q$ are not independent, the unconditional question becomes a superfluous question, which accounts for the native speakers' intuition that they are seriously degraded in those contexts.

Unconditional questions and unconditional answers Recall that an unconditional question '*whether-or-not* $p, ?q$ ' becomes acceptable to some speakers when it is clear from the context/background knowledge that the issues p and q are independent of each other:

- (61) A: I think that the party will be at Emma's.
B: No, didn't they agree that it will be at Luise's?
A: But Emma's place offers more space!
C: ?Now, whether or not the party will be at Emma's place, will it be fun?

Put another way, when C asks an unconditional question in (61), she expects an unconditional answer as observed in (31), repeated here as (62):

- (62) A and/or B answering the unconditional question (61)
a. Yes. (=whether or not it's at her place, it will be fun).
b. No. (=whether or not it's at her place, it won't be fun).
c. *Yes/No, if it's at her place, it will be fun and if it's not at her place, it won't be fun.
d. *Yes/No, if it's at her place, it won't be fun and if it's not at her place, it will be fun.

The *whether-or-not*-clause creates a sequence of stacks in the same fashion as depicted in Figure 17 for the assertion case. The MSUPDATE of the consequent then operates over those contexts. Figure 21 illustrates the creation of temporary contexts and how the entire multi-stack is updated:

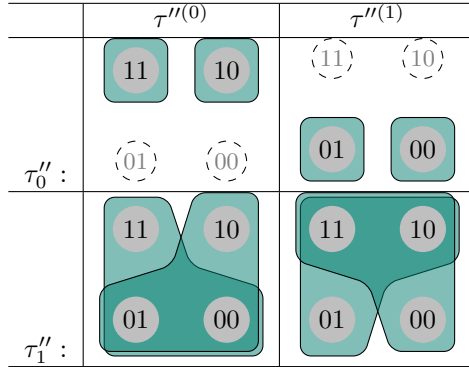


Figure 21: $\tau + \text{whether-or-not}(p) + \text{MSUPDATE}(?q)$

In the processing of unconditional statements demonstrated in the previous section, we apply MSpop to pop off the temporary contexts and merge the multi-stack. In the processing of unconditional questions, however, since the temporary contexts are inquisitive, they cannot be popped off due to the INQUISITIVE CONSTRAINT (49). In other words, an answer has to be given for the discourse to proceed. As with the case of conditional questions shown in Section 5.2.2, hypothesizing that particle answers *yes* and *no* mean q and $\neg q$ gives us the correct result. Let us say that the answer is *yes*, i.e., q . Then, $\text{MSUPDATE}(q)$ applied to \mathcal{T}'' (Figure 21) removes the states that contain w_{10} from $\tau_0''(0)$ and $\tau_1''(0)$ and w_{00} from $\tau_0''(1)$ and $\tau_1''(1)$, resulting in the multi-stack depicted in Figure 22.

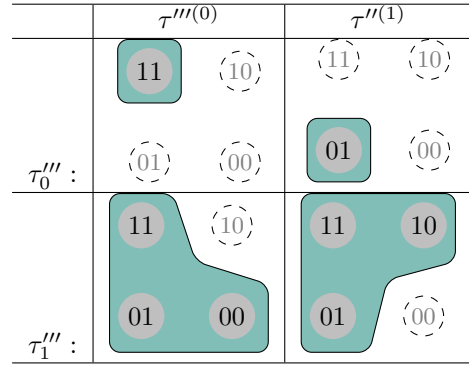


Figure 22: A *yes* answer is given. (\mathcal{T}'' (Figure 21) + $\text{MSUPDATE}(q)$)

Notice that overlapping issues in the non-topmost contexts $\tau_1''(0)$ and $\tau_1''(1)$ are also resolved by percolation. This is the advantage of the suppositional account over the non-suppositional one discussed in Section 4. There are no overlapping issues in the hypothetical contexts, thus we can maintain the intuitive semantics for particle answers while percolation takes care of the overlapping

issues in the non-hypothetical contexts.

Now, the multi-stack depicted in Figure 22 is exactly the same as Figure 18, the multi-stack derived from the unconditional statement, *whether-or-not-p, q*. Thus, the rest of the interpretation process is the same: pop and merge. The resulting macro-context supports q ($\llbracket q \rrbracket \in \tau''''$). Similarly, the *no* answer yields the context that supports *whether-or-not-p, $\neg q$* , which in turn is semantically equivalent to $\neg q$. Indeed as observed in (61), particle answers to unconditional questions are only interpreted as unconditional answers.

Pragmatic competition between unconditional and unmodified questions

Since the semantics of the answers to the unconditional question *whether-or-not-p, ?q* with independence assumption are equivalent to those to the unmodified *?q*, *whether-or-not-p, ?q* has the same semantic effect as *?q*.¹⁷ I argue that this is why unconditional questions are marked out of the blue by all native speakers, and some reject (61) even when two issues are apparently independent. That is, since they have the same semantics, the shorter one, i.e., *?q*, is preferred over *whether-or-not-p, ?q* as a result of pragmatic competition.

One may ask then why an unconditional statement *whether-or-not-p, q*, which entails its consequent q , is not ruled out. An unconditional statement, as discussed by Rawlins (2008, 2013) in details, implies independence between two issues p and q (what Rawlins (2013) calls “relational indifference”). This independence is not lexically encoded in the unconditional construction but derived from its semantic composition, yet it gives rise to a discourse effect of “not mattering” (Rawlins, 2013, 112) that is lacking in a simple assertion of q . Unlike unconditional questions, thus, unconditional statements do not lose out in the pragmatic competition with unmodified counterparts.

Violation of Searlean felicity conditions

The remaining question is: Why does q 's dependence on p demote unconditional questions? As seen in (4) in Section 1 above, when the context suggests that the consequent q is dependent on the value of the antecedent p , an unconditional question ‘*whether or not p, ?q*’ is rejected by all native speakers. Let us consider (63), a simplified version of (4).

- (63) Everybody knows that concerts with Ariana Grande are fun.
*Whether Ariana Grande is playing or not, will the concert be fun?

We start with the pre-update context which already supports ‘If Ariana Grande is playing, the concert will be fun,’ $\tau_0 \in \llbracket p \rightarrow q \rrbracket$ as in Figure 23.

¹⁷A formal proof is given in Appendix A.

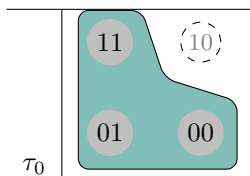


Figure 23: The pre-update context τ supporting $p \rightarrow q$

The unconditional antecedent *whether-or-not-p* then creates a multi-stack, pushes a hypothetical context in each member and UPDATES the hypothetical contexts with p , yielding the multi-stack \mathcal{T}' on the left in Figure 24. Next, the consequent question $?q$ MSUPDATES \mathcal{T}' . That is, each topmost context is intersected with $?q$ and the effect percolates down the stack, which results in the multi-stack on the right in Figure 24.

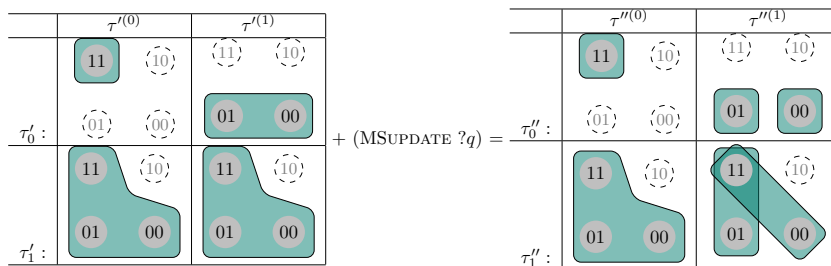


Figure 24: $\tau + \text{whether-or-not}(p) + \text{MSUPDATE}(?q)$

As can be seen, $\text{MSUPDATE}(?q)$ only affects $\tau'^{(1)}$ and does not change either $\tau'^{(0)}$ or τ'_1 . This is because $\tau'^{(0)}$ already supports $?q$ ($\tau'^{(0)} \in \llbracket ?q \rrbracket$). In other words, $?q$ is a superfluous question in $\tau'^{(0)}$: We already know that in the hypothetical context where Bruno Mars is playing, the answer is yes. In view of Sealean (1969) theory of speech acts, the felicity conditions of questioning can be formulated as follows:

- (64) The speaker S questions the hearer H about φ is felicitous iff:
- a. S does not know the truth about φ ,
 - b. S wants to know the truth about φ , and
 - c. S believes that H may be able to supply the information about φ that S wants.

That is, the act of questioning is felicitous when the speaker is ignorant hence requests information about φ . In the context $\tau'^{(0)}$, the speaker already knows q is true thus no need to request information about $?q$. In other words, when q is dependent on p , *whether-or-not-p*, $?q$ violates the felicity conditions of questioning.¹⁸

¹⁸See also Groenendijk (1999), who explains the infelicity of superfluous questions as the

Interim Summary The stack-based account of conditionals correctly derives the interpretations and distributions of unconditional questions. First, when an unconditional question is felicitous, its answer is either an unconditional *yes* or an unconditional *no*. Having hypothetical contexts on a multi-stack allows us to have simple semantics for the particle answers, *yes* means q and *no* means $\neg q$ and need not deal with the diagonal possibilities that violates Hamblin’s picture (see Figure 6(c)). Furthermore, percolation resolves the overlapping issues in the non-hypothetical contexts. The current framework also explains why some speakers reject *whether or not p*, $?q$ all together: Since *whether or not p*, $?q$ with independence assumption has the same semantic value as $?q$, the shorter one, i.e., $?q$ wins the pragmatic competition. Finally, when q is not independent of p , *whether or not p*, $?q$ is severely rejected by all speakers. This is because one of the conditional questions becomes a superfluous question that violates Sealean felicity conditions of questioning. Note that the last two points can be explained by the non-suppositional account of conditionals as well. However, the suppositional account provides a simpler semantics for particle answers as well as an intuitive interpretation procedure of unconditional questions. Together with other arguments based on the data of conditional questions provided by I&R, the suppositional account of conditionals is superior.

5.3.3 *Wh*-Q antecedent unconditional questions

Before concluding the paper, let us look at the unconditional questions with *wh*-antecedents as in (65). The procedure is essentially the same as the one given for *whether-or-not* antecedents except that it generates more than two macro-contexts.

- (65) Who is playing at the concert doesn’t affect whether or not it will be fun.
 ?Whoever is playing, will the concert be fun?

Let us say that $\text{Alt}(p) = \{\text{Ariana is playing, Bruno is playing, Christine is playing}\}$. The initial macro-context τ is depicted in Figure 25. The first letter of the world circle shows which sentence in $\text{Alt}(p)$ is true in each world. In w_{A1} , for example, Ariana is playing and the concert will be fun.

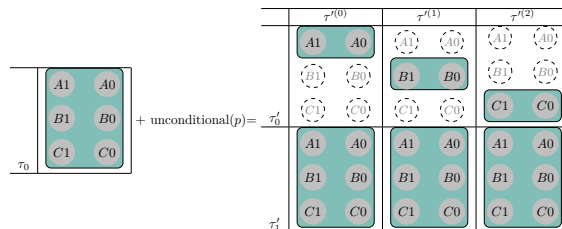


Figure 25: $\tau + \text{unconditional}(p)$

violation of Gricean (1975) maxim of Quantity.

The MCCP of an unconditional antecedent (54), repeated here as (66), creates a multi-stack with three macro-contexts. The MCCP of *if*-clause operates on each of the macro-contexts and creates a hypothetical context that has been updated with each sentence in $\text{Alt}(p)$ as shown on the right diagram in Figure 25.

- (66) **Definition:** MCCP of an unconditional antecedent φ
 For a macro-context τ and each $\alpha_n \in \text{Alt}(\varphi)$, where $0 < n \leq |\text{Alt}(\varphi)|$:
 $\tau + \text{unconditional}(\varphi) := \langle \tau^{(0)} + \text{if}(\alpha_0), \dots, \tau^{(n-1)} + \text{if}(\alpha_{n-1}) \rangle$,
 where $\langle \tau^{(0)}, \tau^{(1)} \rangle = \tau + n\text{-copy}$.

Next, the consequent question $?q$ performs MSUPDATE on the multi-stack \mathcal{T}' and renders the topmost contexts inquisitive and the effect percolates down each macro-context as shown in the diagram on the left in Figure 26. Now, suppose that the answer is *yes*, then the states that contain w_{A0} , w_{B0} and w_{C0} are removed and the information percolates down each macro-context again as in the right-hand-side diagram in Figure 26:

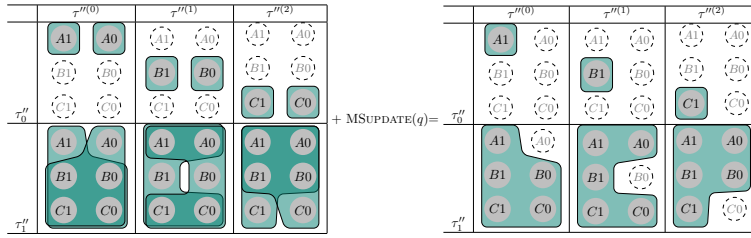


Figure 26: an *yes* answer given to $\mathcal{T}' + \text{MSUPDATE}(?q)$

After an answer is given, the topmost contexts of the multi-stack are popped off the stacks and the multi-stack is merged back to a single macro-context as in Figure 27:

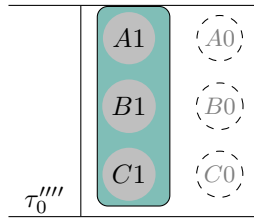


Figure 27: $\mathcal{T}'' + \text{pop} + \text{merge}$

As with the case of *whether-or-not* unconditionals, the resulting macro-context is the same as the one that is simply updated with q . In turn, unconditional questions have the same semantics as unmodified $?q$. As I argued in the previous section, this is why some speakers refute unconditional questions even with independence assumption: Unconditional questions are pragmatically

not optimal given that they are longer and have the same semantics as unmodified ones. However, (3) introduced in Section 1, repeated here as (67), is judged acceptable by every speaker I consulted including those who hesitate to accept (61) and (65). Furthermore, as noted by an anonymous reviewer, searching Internet for the string “Whoever you are, do you” returns millions of results. I speculate that in cases like (67), the unconditional antecedent is conventionalized to function as a discourse marker that means “it doesn’t matter (who you are)”.

(67) Whoever you are, do you need help?

Finally, as with the case of *whether-or-not*-unconditionals, when the value of the consequent depends on that of the antecedent, unconditional questions are severely deteriorated:

(68) Everybody knows that concerts with Ariana Grande are great.
*Whoever is playing, will the concert be fun?

The explanation is exactly the same as the case of *whether-or-not*-unconditionals. The initial macro-context τ on the left in Figure 28 supports $A \rightarrow q$ ‘If Ariana is playing, the concert will be fun’.

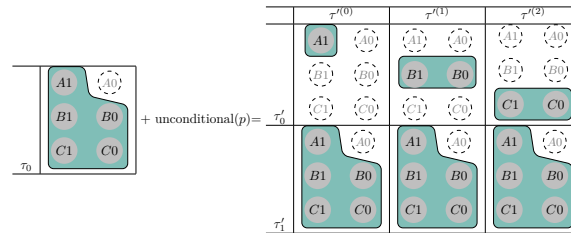


Figure 28: $\tau + \text{unconditional}(p)$

Since w_{A0} is already removed, updating $\tau^{(0)}$ with $?q$ has no effect as shown in Figure 29. That is, the question is superfluous, thus violates the felicity conditions of questioning.

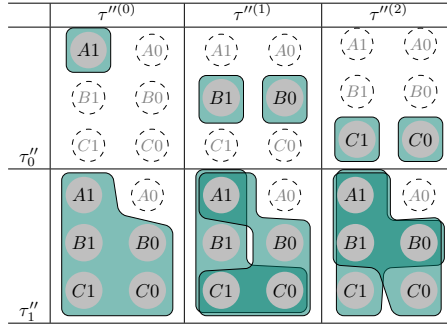


Figure 29: $\mathcal{T}' + \text{MSUPDATE } ?q$

6 Conclusion

6.1 Summary

This paper offered a framework that combines inquisitive semantics with Kaufmann’s (2000) stack-based semantics of conditionals and analyze conditional statements, conditional questions, unconditional statements and unconditional questions. In particular, the analysis demonstrates how unconditional questions are dynamically interpreted and explains why some speakers find the construction illicit regardless of contexts as well as why dependence between the antecedent and consequent issues deteriorates the acceptability of the construction. First, when the speaker asks an unconditional question, she expects the hearer to give an unconditional answer, namely either *yes, whether or not p , q* or *no, whether or not p , $\neg q$* . The current step-wise semantics straightforwardly accounts for this intuition. First, when an unconditional question is posed, a multi-stack with multiple hypothetical contexts are created. Crucially, the multiple hypothetical contexts pushed onto the multi-stack are partitioned, i.e., there are no overlapping issues. When an answer is given, it simultaneously updates the multiple hypothetical contexts as well as main contexts by percolation. Merging the multiple contexts in the multi-stack into a single macro-context results in the interpretation equivalent to the unconditional statement: If the answer was *yes*, the post-answer context entails *whether or not p , q* . Second, the analysis accounts for the general dispreference toward unconditional questions. An unconditional question *whether or not p , $?q$* loses a pragmatic competition with its unmodified counterpart *?q*, which has the same semantic effect but is shorter. Finally, when q is not independent of p , *whether or not p , $?q$* is severely rejected by all speakers. This is because one of the conditional questions becomes a superfluous question that violates Sealean felicity conditions of questioning.

In addition, the paper supports for the suppositional semantics of conditionals. Thanks to the stack-based system, as already discussed by Isaacs & Rawlins (2008), conditional questions are processed without dealing with over-

lapping possibilities in the non-top context. Furthermore, it provides straightforward interpretations for particle answers: Intuitively, the *yes*-answer to ‘If the party’s at Emma’s place, will it be fun?’ means ‘Yes, it will’. The analysis of unconditional questions offered in the current paper also shows that step-wise treatment of conditionals is desirable. The semantic value of unconditional questions derived by the non-suppositional system contains diagonal overlapping possibilities which do not correspond to any of the linguistic answers, violating the Hamblin’s picture. On the other hand, the stack-based system can readily identify the particle answer as one of the blocks in each of the topmost active contexts of the multi-stack.

6.2 Future directions

There are several future directions for research related to this analysis. First, it would be fruitful to investigate the Hamblin’s picture cross-linguistically. In particular, the current paper treats English *if*-clauses as context-shifters, i.e., Austinian (1950) topics. When a language has overt topic-marking, do we observe a similar interaction with question acts? The answer is yes. Just like English *if*-sentences, the Japanese topic-marking *wa* serves to shift the context. For instance, the assertion of the non-*wa*-marked (69a) could be about a general situation in an airport, so the sentence is pragmatically implausible because it expresses a requirement that everyone at the airport has to be a dog-carrier. In contrast, the phrase *inu-wa* in (69b) restricts the context of the assertion to cases where there is a dog, so the sentence can reasonably be used in (for example) a sign in the airport.

- (69) a. Inu-o kakae nakerebanaranai.
 dog-ACC carry must
 ‘You must carry a dog.’
 b. Inu-wa kakae nakerebanaranai.
 dog-TOP carry must
 ‘As for dogs, you must carry them.’≈‘If there is a dog, you must carry it.’

Wa-marked declaratives can be rendered into interrogatives without any problem as in (70).¹⁹

- (70) a. Inu-wa kakae nakerebanarimasen-ka?
 dog-TOP carry must.HON-Q
 ‘If there is a dog, do I have to carry it?’
 b. John-wa ki-masi-ta-ka?
 John-TOP come-HON-PAST-Q
 ‘As for John, did he come?’

But a familiar asymmetry obtains when another particle *dake* ‘only’ is added to the *wa*-marked noun phrase. Following Rooth (1995), *dake* can be analyzed

¹⁹Honorific forms are added in order to make the examples pragmatically more natural.

as a focus particle which generates a Hamblin set of alternative propositions and denies the truth of the alternatives except for the asserted one:

- (71) John-dake-ga kita.
 John-only-TOP came
 ‘Only John came.’ (Others didn’t come. \approx {Mary didn’t come, Bill didn’t come,... })

When *dake* is used with *wa*, what is being denied is not alternative propositions but alternative assertion acts. That is, multiple contexts varying the value of the sentence topic are created, and by using *dake*, the speaker makes it explicit that among the alternative acts, the one with the preadjacent topic is the only assertion that the speaker is willing to make. Thus, the whole construction seems to express exhaustification over possible assertion acts, as illustrated in (72).

- (72) John-dake-wa ki-masi-ta.
 John-only-TOP come-HON-PAST
 ‘Only as for John, he came.’ (I don’t make assertions about other individuals; only>assertion)

As can be seen, an assertion with *dake-wa* involves the creation of multiple contexts and denial of the rest of the alternative acts. (73) shows that this complicated operation over speech acts is not available for questions:

- (73) *John-dake-wa nani-o kai-masi-ta-ka?
 John-only-TOP what-ACC buy-HON-PAST-Q

Although there is a difference between merging and denial of the alternative acts, the parallel between English unconditional adjuncts and Japanese *dake-wa* constructions suggests that the Hamblin’s picture is one of the universal principles of questionhood.

The treatment of commands is also an important outstanding issue within this approach to the dynamics of speech acts and clause types. A command can co-occur with unconditional adjuncts (74) and the *dake-wa* construction (75b).

- (74) a. Whether the sign says it’s OK or not, smoke outside!
 b. Whenever you leave, remember to call me.
 c. Whenever you have the time, come over and help us.
- (75) a. Eigo-dake-o benkyo-siro!
 English-only-ACC study-do.IMP
 ‘Study only English!’ (Don’t study other subjects; command>only)
 b. Eigo-dake-wa benkyo-siro!
 English-only-CON study-do.IMP
 ‘Study at least English!’ (I don’t make orders about other subjects; only>command)

Also, if the question is not an information-seeking one, it is possible to have

an interrogative with an unconditional adjunct (76), and a question with wide-scope exhaustification as in (77). Here, the question is interpreted as a request for action (like an imperative) rather than a request for information. Note also that the two issues, what the sign says and whether you are allowed to smoke, are intuitively dependent on each other.

- (76) a. Whether the sign says it’s OK or not, can you smoke outside, please?
 b. Whenever you leave, can I ask you to turn off the lights?
- (77) Denki-dake-wa keshi teoite-kure-masu-ka?
 light-only-TOP off leave-BEN-HON-Q
 ‘Could you make sure that at least lights are off?’
 (I don’t make other requests; only>request)

This data suggests that commands and requests should be treated as analogous to assertions. Future research on this topic will shed new light on the taxonomy of speech acts.

A A formal proof of the equivalence between *whether-or-not-p*, $?q$ and $?q$ given independence

This appendix section gives a formal proof of the intuition that given independence between p and q , an unconditional question *whether or not p*, $?q$ is equivalent $?q$. Let us borrow the notion of contextual independence defined by Franke (2007, 2009).²⁰ We consider a context $\mathcal{C} \subseteq \wp(W)$ as the speaker’s epistemic context as defined in (26). Let p, q be sentences of \mathcal{L} . Following Franke (2009), we introduce the following definitions.

- (78) **Definition:** Entailment and Consistency
- a. A context \mathcal{C} entails a sentence p ($\mathcal{C} \Rightarrow p$, in short) in \mathcal{C} if $\mathcal{C} \cap \llbracket p \rrbracket = \mathcal{C}$.
- b. p is consistent ($\Diamond p$, in short) in \mathcal{C} if $\mathcal{C} \cap \llbracket p \rrbracket \neq \emptyset$.

Intuitively, sentences p and q are independent in \mathcal{C} when learning that p or q is true or false does not decide whether the other sentence is true or false:

- (79) **Definition:** Contextual Independence
 Let $\mathcal{C} \subseteq \wp(W)$ be an epistemic state and p, q sentences. We say that p and q are *contextually independent* in \mathcal{C} if

$$\Diamond x \text{ and } \Diamond y \text{ in } \mathcal{C} \text{ imply } \Diamond(x \wedge y) \text{ in } \mathcal{C},$$

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

²⁰See also Sano & Hara (2014) who provide a dynamic extension of Franke’s definition. Note also that in Franke (2009) and Sano & Hara (2014), the notion equivalent to (79) is called “conditional independence”.

Sano & Hara (2014, 88) rephrase the notion of contextual independence in terms of entailment ‘ \Rightarrow ’ as follows:

(80) **Proposition:**

Let $\mathcal{C} \subseteq \wp(W)$ be an epistemic context and p, q sentences. Then, the following are equivalent:

- (i) p and q are contextually independent in \mathcal{C} ,
- (ii) if x is consistent in \mathcal{C} , then

$$\mathcal{C} \Rightarrow y \text{ is equivalent to } \mathcal{C} \cap \llbracket x \rrbracket \Rightarrow y,$$

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

Taken together we obtain the following theorem. If we already know that p and q are independent and p is consistent in the context, it follows that $p \rightarrow ?q$ is equivalent to $?q$. That is, $\mathcal{C} \Rightarrow (p \rightarrow ?q) \wedge (\neg p \rightarrow ?q)$ implies $\mathcal{C} \Rightarrow ?q$ and $\mathcal{C} \Rightarrow ?q$ implies $\mathcal{C} \Rightarrow (p \rightarrow ?q) \wedge (\neg p \rightarrow ?q)$.

(81) **Theorem:**

Let p and q are independent in \mathcal{C} and p be consistent in \mathcal{C} . Then, $\mathcal{C} \Rightarrow (p \rightarrow ?q) \wedge (\neg p \rightarrow ?q)$ is equivalent to $\mathcal{C} \Rightarrow ?q$

(82) *Proof*

- a. ($\mathcal{C} \Rightarrow (p \rightarrow ?q) \wedge (\neg p \rightarrow ?q)$ implies $\mathcal{C} \Rightarrow ?q$)
 Assume that $\mathcal{C} \Rightarrow (p \rightarrow ?q) \wedge (\neg p \rightarrow ?q)$. That is, $\mathcal{C} \cap \llbracket p \rightarrow ?q \rrbracket = \mathcal{C}$ and $\mathcal{C} \cap \llbracket \neg p \rightarrow ?q \rrbracket = \mathcal{C}$. Thus, $\mathcal{C} \subseteq \{s \in \mathcal{C} \mid \text{for any non-empty } t \subseteq s \text{ if } t \in \llbracket p \rrbracket, \text{ then } t \in \llbracket ?q \rrbracket\}$. We show that $\mathcal{C} \cap \llbracket ?q \rrbracket = \mathcal{C}$. Given independence, it suffices to show that $\mathcal{C} \cap \llbracket p \rrbracket \cap \llbracket ?q \rrbracket = \mathcal{C} \cap \llbracket p \rrbracket$. Since we already know $\mathcal{C} \cap \llbracket p \rrbracket \cap \llbracket ?q \rrbracket \subseteq \mathcal{C} \cap \llbracket p \rrbracket$, we show $\mathcal{C} \cap \llbracket p \rrbracket \subseteq \mathcal{C} \cap \llbracket p \rrbracket \cap \llbracket ?q \rrbracket$. Fix any non-empty $s \in \mathcal{C} \cap \llbracket p \rrbracket$. Then $s \in \llbracket p \rrbracket$. We show that $s \in \mathcal{C} \cap \llbracket p \rrbracket \cap \llbracket ?q \rrbracket$. Since $s \in \mathcal{C}$ and by assumption $s \in \llbracket ?q \rrbracket$, we obtain $s \in \mathcal{C} \cap \llbracket p \rrbracket \cap \llbracket ?q \rrbracket$.
- b. ($\mathcal{C} \Rightarrow ?q$ implies $\mathcal{C} \Rightarrow (p \rightarrow ?q) \wedge (\neg p \rightarrow ?q)$)
 Assume that $\mathcal{C} \Rightarrow ?q$. That is, $\mathcal{C} \cap \llbracket ?q \rrbracket = \mathcal{C}$. We show that $\mathcal{C} \cap \llbracket p \rightarrow ?q \rrbracket = \mathcal{C}$ and $\mathcal{C} \cap \llbracket \neg p \rightarrow ?q \rrbracket = \mathcal{C}$. Since we already know $\mathcal{C} \cap \llbracket \neg p \rightarrow ?q \rrbracket \subseteq \mathcal{C}$, we show $\mathcal{C} \subseteq \mathcal{C} \cap \llbracket \neg p \rightarrow ?q \rrbracket$. Fix any non-empty $s \in \mathcal{C}$. We show $s \in \llbracket p \rightarrow ?q \rrbracket$. By assumption, $s \in \llbracket ?q \rrbracket$. Fix any non-empty $t \subset s$ such that $t \in \llbracket p \rrbracket$. Then, there is a non-empty $u \subset t$ such that $u \in \llbracket ?q \rrbracket$, since $u \subset s$. Since s and t are arbitrary, $s \in \llbracket p \rightarrow ?q \rrbracket$. Similarly, we obtain $\mathcal{C} \cap \llbracket \neg p \rightarrow ?q \rrbracket = \mathcal{C}$.

References

- Adams, E. 1965. The logic of conditionals. *Inquiry* 8. 166–97.
- Austin, John Langshaw. 1950. Truth. *Aristotelian Society Supp.* 24. 111–129.

- Ciardelli, Ivano. 2016. Questions as information types. *Synthese* 1–45. doi: 10.1007/s11229-016-1221-y.
- Ciardelli, Ivano, Jeroen Groenendijk & Floris Roelofsen. 2015. On the semantics and logic of declaratives and interrogatives. *Synthese* 192. 1689–1728.
- Ciardelli, Ivano, Jeroen Groenendijk & Floris Roelofsen. 2019. *Inquisitive Semantics* Oxford Surveys in Semantics and Pragmatics. OUP Oxford. <https://books.google.co.jp/books?id=a8d-DwAAQBAJ>.
- Ciardelli, Ivano A. & Floris Roelofsen. 2015. Inquisitive dynamic epistemic logic. *Synthese* 192(6). 1643–1687.
- Frank, A. 1996. Context dependence in modal constructions. Tech. rep. Stuttgart.
- Franke, Michael. 2007. The pragmatics of biscuit conditionals. In Maria Aloni, Paul Dekker & Floris Roelofson (eds.), *Proceedings of the 16th Amsterdam Colloquium*, 91–96.
- Franke, Michael. 2009. *Signal to Act: Game Theory in Pragmatics*: Universiteit van Amsterdam dissertation.
- Gärdenfors, P. 1986. Belief revision and the ramsey test for conditionals. *Philosophical Review* 95. 81–93.
- Grice, H. Paul. 1975. Logic and conversation. In Peter Cole & Jerry Morgan (eds.), *Syntax and Semantics*, vol. 3: Speech Acts, 43–58. New York: Academic Press.
- Groenendijk, Jeroen. 1999. The logic of interrogation. In Tanya Matthews & Devon Strolovitch (eds.), *Proceedings of SALT IX*, 109–126. Ithaca, NY: Cornell University.
- Groenendijk, Jeroen. 2007. Inquisitive semantics: Two possibilities for disjunction. In P. Bosch, D. Gabelaia & J. Lang (eds.), *Seventh International Tbilisi Symposium on Language, Logic, and Computation*, Springer-Verlag.
- Hamblin, C.L. 1958. Questions. *Australasian Journal of Philosophy* 36. 159–168.
- Hamblin, C.L. 1971. Mathematical models of dialogue. *Theoria* 37. 130–155.
- Hara, Yurie & Katsuhiko Sano. 2018. Conditional questions revisited. handout presented at Semantics Research Group. <https://semanticsarchive.net/Archive/mQzNDA30/>.
- Heim, Irene. 1982. *The Semantics of Definite and Indefinite Noun Phrases*: University of Massachussets, Amherst dissertation. [Distributed by GLSA].
- Hulstijn, J. 1997. Structured information states. In A. Benz & G. Jäger (eds.), *Proceedings of MunDial97*, .

- Isaacs, James & Kyle Rawlins. 2008. Conditional questions. *Journal of Semantics* 25. 269–319.
- Karttunen, Lauri. 1974. Presupposition and linguistic context. *Theoretical Linguistics* 1(1/2). 182–194.
- Kaufmann, Stefan. 2000. Dynamic context management. In S. Kaufmann M. Faller & M. Pauly (eds.), *Formalizing the Dynamics of Information*, Stanford, CA: CSLI.
- Kratzer, Angelika. 1991. Conditionals. In A. von Stechow & D. Wunderlich (eds.), *Semantics: an international handbook of contemporary research*, 651–656. Berlin: De Gruyter.
- Krifka, Manfred. 2001. Quantifying into question acts. *Natural Language Semantics* 9. 1–40.
- Landman, Fred. 1986. Conflicting presuppositions and modal subordination. *CLS* 22. 195–207.
- Lewis, David. 1975. *Adverbs of Quantification* 5–20. Cambridge; Cambridge: Cambridge University Press.
- Mackie, J. L. 1973. *Truth, Probability and Paradox*, vol. Clarendon Press. Oxford. Oxford: Clarendon Press.
- Ramsey, Frank P. 1931. General propositions and causality. In R. Braithwaite (ed.), *The Foundations of Mathematics: Collected Papers of Frank P. Ramsey*, 237–255. London: Routledge.
- Rawlins, Kyle. 2008. *(Un)conditionals: an investigation in the syntax and semantics of conditional structures*: University of California, Santa Cruz dissertation.
- Rawlins, Kyle. 2013. (Un)conditionals. *Natural Language Semantics* 40. 111–178.
- Roberts, Craige. 1996. Information structure in discourse: Towards an integrated formal theory of pragmatics. In Jae Hak Yoon & Andreas Kathol (eds.), *Ohio State University Working Papers in Linguistics*, vol. 49, 91–136. The Ohio State University.
- Rooth, Mats. 1992. A Theory of Focus Interpretation. *Natural Language Semantics* 1(1). 75–116.
- Rooth, Mats. 1995. Indefinites, adverbs of quantification and focus semantics. In Gregory N. Carlson & Francis Jeffrey Pelletier (eds.), *The Generic Book*, Chicago: Chicago University Press.
- Rooth, Matts. 1985. *Association with Focus*: University of Massachusetts at Amherst dissertation.

- Sano, Katsuhiko & Yurie Hara. 2014. Conditional independence and biscuit conditional questions in dynamic semantics. In *Proceedings of SALT 24*, 84–101. Ithaca, NY: Cornell University.
- Searle, John R. 1969. *Speech acts: an essay in the philosophy of language*. Cambridge: Cambridge University Press.
- Stalnaker, Robert. 1968. A theory of conditionals. In N. Resher (ed.), *Studies in Logical Theory*, Oxford: Blackwell.
- Stalnaker, Robert. 1978. Assertion. In Peter Cole (ed.), *Syntax and Semantics, Volume 9: Pragmatics*, 315–332. New York: Academic Press.
- Velissaratou, Sophia. 2000. *Conditional questions and which-interrogatives*. University of Amsterdam, ILLC Publications MA thesis.