Attentive *might* in inquisitive semantics[*]

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This paper points out that the notion of meaning propounded by inquisitive semantics is not only suited to capture both informative and inquisitive content, but also a sentence's potential to *draw attention* to certain possibilities. This leads to a novel analysis of *might*.

Contents

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1   Introduction

Traditionally, the meaning of a sentence is identified with its *informative* content. However, even in a conversation whose only purpose is to exchange information, sentences are not only used to *provide* information. They are also used to *request* information. That is, sentences may be both informative and inquisitive, and they may even be both informative and inquisitive at the same time.

Inquisitive semantics (Groenendijk, 2009; Mascarenhas, 2009; Groenendijk and Roelofsen, 2009; Ciardelli and Roelofsen, 2009, among others) intends to capture these two dimensions of meaning in a uniform way. It takes a sentence to express a proposal to update the common ground of a conversation. Such a proposal does not necessarily specify just one way of updating the common ground. It may suggest alternative ways of doing so, inviting other participants to respond in such a way that one or more of the proposed updates may indeed be established. Formally, a proposition consists of one or more *possibilities*. Each possibility is a set of possible worlds, embodying a possible update of the common ground. If the common ground contains possible worlds that are eliminated by each of the proposed updates, then the proposition is *informative*. Moreover, if a proposition consists of two or more possibilities, it is *inquisitive*: it requests information in order to establish one or more of the proposed alternative updates. Thus, construing propositions as sets of possibilities makes it possible to capture both the informative and the inquisitive content of a sentence.

In the present paper we argue that this notion of meaning has an additional advantage. Namely, it is also suitable to capture what we will call the *attentive* content of a sentence: its potential to *draw attention* to certain possibilities.

One empirical phenomenon that, in our view, calls for an account of attentive content, is the behavior of *might* sentences, like (1):[1]

(1)   John might be in London.

This sentence clearly differs from the assertion in (2) and the question in (3).

(2)   John is in London.

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[1]The idea that a semantic analysis of *might* sentences should capture their potential to draw attention to certain possibilities is not new. It has been informally alluded to in various places in the literature, and several formal accounts have been proposed recently, see for instance Swanson (2006), Franke and de Jager (2008), and Brumwell (2009). All these accounts differ substantially from the account that will be offered here, both technically and in empirical scope. Some discussion will be provided in section 6, but a detailed comparison is left for a future occasion.

(3)   Is John in London?

(1) differs from (2) in that it does not *provide* any information about the state of the world, and it differs from (3) in that it does not *request* any information: one may respond to (1) simply by nodding, or saying "ok", whereas (3) requires an informative response.

In this sense, (1) is neither informative nor inquisitive. But it is certainly meaningful. Thus, a semantic account of (1) must distinguish a third meaning component, different from informative and inquisitive content. Intuitively, the semantic contribution of (1) lies in its potential to *draw attention* to the possibility that John is in London. It is this attentive meaning component that we wish to capture, and we will find that the notion of meaning propounded by inquisitive semantics is especially well-suited for this purpose.

The paper is organized as follows. Section 2 provides a brief recapitulation of inquisitive semantics. Section 3 shows how attentive content can be captured in this framework. In particular, it offers a straightforward analysis of the attentive content of *might* sentences, and shows that this analysis accounts for certain rather striking empirical facts concerning the interaction between *might* on the one hand, and disjunction, conjunction, negation, and implication on the other. Section 4 turns to pragmatic aspects of the interpretation of sentences that are not merely informative, but also inquisitive and/or attentive. This will lead, among other things, to a pragmatic account of the *epistemic* component of the interpretation of *might*. The proposed account will compared with the classical analysis of *might* as an epistemic modal operator, and also with the treatment of *might* in Veltman's (1996) update semantics. Section 5 discusses the behaviour of *might* in certain embedded contexts, and argues on the basis of this behaviour that the semantic meaning of *might* sentences is, under certain conditions, strengthened in a particular way before being composed with the semantic meaning of the embedding operator. Section 6 closes with some final remarks.

2   Inquisitive semantics

The central feature of inquisitive semantics is that sentences are taken to express *proposals* to update the common ground of a conversation, and that such proposals do not necessarily specify just one way of updating the common ground, but may suggest several alternative ways of doing so.

Technically, the proposition expressed by a sentence is taken to be a set of

alternative *possibilities*. Each possibility is a set of possible worlds—or *indices* as we will call them—embodying a possible way to update the common ground. In this setting, a sentence may be *informative*, in the sense that certain indices may be eliminated from the common ground by any of the proposed updates, and it may also be *inquisitive*, in the sense that it proposes two or more alternative updates, and invites other participants to provide information such that at least one of these updates can be established.

Thus, the proposition that a sentence expresses in inquisitive semantics embodies both the information that it *provides* and the information that it *requests* from other conversational participants. If a sentence φ expresses a proposition $[\varphi]$, it provides the information that at least one of the possibilities in $[\varphi]$ obtains, and requests from other participants information that could be used to establish for at least one possibility that it indeed obtains.

2.1 Alternatives

It is common practice in inquisitive semantics to construe propositions as sets of *alternative* possibilities—that is, sets of possibilities such that no element is contained in any other element. The rationale behind this assumption is the following.

Suppose that a proposition $[\varphi]$ contains two possibilities, α and β (possibly among others), such that it would take strictly more information to establish α than it would take to establish β. Technically, this would mean that α is included in β (recall that both α and β are sets of indices). In this case, α does not really help in any way to represent the information that φ provides or requests. For, on the one hand, saying that at least one of α and β obtains is just as informative in this setting as saying that β obtains, and on the other hand, asking other participants to provide enough information so as to establish at least one of α or β is just the same as asking them to provide enough information so as to establish β. Thus, possibilities that are included in other possibilities do not really contribute to representing the informative and inquisitive content of a sentence. Therefore, as long as we are only interested in capturing informative and inquisitive content, non-maximal possibilities may be disregarded, and propositions can be construed as sets of alternative possibilities.[2]

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[2]There is an important caveat to note here: strictly speaking, non-maximal possibilities may only be disregarded if they are included in a maximal possibility. For, suppose that $[\varphi]$ consists of an infinite sequence of ever increasing possibilities $\alpha_1 \subset \alpha_2 \subset \alpha_3 \subset \ldots$. Then there is no maximal possibility, which means that disregarding non-maximal possibilities amounts to disregarding *all* possibilities. As long as there are only finitely many distinct possibilities, which is indeed the case

2.2 Indices, possibilities, and propositions

Below we define an inquisitive semantics for a propositional language, mostly drawing on (Groenendijk and Roelofsen, 2009; Ciardelli and Roelofsen, 2009). The language is based on a finite set of proposition letters, with $\bot$, $\wedge$, $\vee$, and $\rightarrow$ as its basic logical connectives. $\neg\varphi$ is defined as an abbreviation of $\varphi \rightarrow \bot$. There are two additional operators: $!\varphi$, the *assertive closure* of φ, is defined as an abbreviation of $\neg\neg\varphi$; and $?\varphi$, the *non-informative closure* of φ, is defined as an abbreviation of $\varphi \vee \neg\varphi$.

The basic ingredients for the semantics are *indices* and *possibilities*. An index is a binary valuation for the atomic sentences in the language. We use ω to denote the set of all indices. A possibility is a set of indices. We will use α, β as variables ranging over possibilities, and $\mathcal{P}$ as a variable ranging over non-empty sets of possibilities. Propositions are defined as non-empty sets of maximal possibilities:

Definition 1 (Propositions). A proposition is a non-empty set of possibilities $\mathcal{P}$ such that for no $\alpha, \beta \in \mathcal{P}$: $\alpha \subset \beta$.

In order to give a recursive definition of the propositions that are expressed by the sentences in our language, we define two auxiliary notions. First, for any sentence φ, the *truth set* of φ, denoted by $|\varphi|$, is the set of indices where φ is classically true. Thus, $|\varphi|$ embodies the classical meaning of φ.

Second, we define a function ALT which transforms any set of possibilities $\mathcal{P}$ into a proposition by removing all the non-maximal possibilities in $\mathcal{P}$.[3]

Definition 2 (Alternative Closure).
$\text{ALT}\,\mathcal{P} = \{\alpha \in \mathcal{P} \mid \text{ there is no } \beta \in \mathcal{P} \text{ such that } \alpha \subset \beta\}$

The proposition expressed by a sentence φ is denoted by $[\varphi]$, and is recursively defined as follows.

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in the setting that we will consider below and that has been considered in most previous work, a proposition can of course not contain an infinite sequence of ever increasing possibilities, and non-maximal possibilities may safely be disregarded across the board. However, as observed and discussed in detail in (Ciardelli, 2009a,b), this is not the case in the first-order setting. There, a possibility may only be disregarded if it is stricly contained in a maximal one.

[3]In the light of the remark made in footnote 2, ALT must be defined in a slightly more involved way in order to carry over straightforwardly to the first-order setting:

- $\text{ALT}\,\mathcal{P} = \{\alpha \in \mathcal{P} \mid \text{ there is no } \textit{maximal } \beta \in \mathcal{P} \text{ such that } \alpha \subset \beta\}$

In the present setting, this definition is equivalent to the one given in definition 2.

Definition 3 (Inquisitive Semantics)**.**

1. $[p] = \{|p|\}$ if p is atomic

2. $[\bot] = \{\emptyset\}$

3. $[\varphi \lor \psi] = \text{ALT}\{\alpha \mid \alpha \in [\varphi] \text{ or } \alpha \in [\psi]\}$

4. $[\varphi \land \psi] = \text{ALT}\{\alpha \cap \beta \mid \alpha \in [\varphi] \text{ and } \beta \in [\psi]\}$

5. $[\varphi \rightarrow \psi] = \text{ALT}\{\gamma_f \mid f \in [\psi]^{[\varphi]}\}$,   where $\gamma_f = \bigcap_{\alpha \in [\varphi]} (\alpha \Rightarrow f(\alpha))$

The clause for implication is defined in terms of a two-place operator $\Rightarrow$, which remains to be specified. Notice that $\Rightarrow$ takes two possibilities as its input, and yields a third possibility as its output. For simplicity, we define $\Rightarrow$ as material implication here. But in principle, any more sophisticated analysis of non-inquisitive conditionals could be 'plugged in' here.[4]

Definition 4 ($\Rightarrow$)**.** $\alpha \Rightarrow \beta \;\; := \;\; \overline{\alpha} \cup \beta$

Notice that definition 3 assures that $[\varphi]$ is always a set of alternative possibilities, i.e., a proposition. We call the possibilities in $[\varphi]$ the possibilities *for* φ.

Let us briefly go through the clauses of the definition one by one. In doing so, it will be useful to make a distinction between *classical* sentences, whose proposition contains just one possibility, and *inquisitive* sentences, whose proposition contains at least two possibilities. Figure 1 provides some examples of inquisitive sentences.

Atoms.   The proposition expressed by an atomic sentence p always consists of just one possibility: $|p|$. So an atomic sentence is always classical.

Bottom and negation.   The proposition expressed by $\bot$ consists of the empty possibility. This means that $\bot$ expresses the unacceptable proposal: if it were accepted, the common ground would become inconsistent.

Recall that $\neg\varphi$ is defined as $\varphi \rightarrow \bot$. So $[\neg\varphi] = \text{ALT}\{\gamma_f \mid f \in \{\emptyset\}^{[\varphi]}\}$. There is only one function f from $[\varphi]$ to $\{\emptyset\}$, namely the one that maps every element of $[\varphi]$ to $\emptyset$. The possibility γ_f associated with this function f is:

$$\gamma_f \;\; = \;\; \bigcap\{\alpha \Rightarrow \emptyset \mid \alpha \in [\varphi]\} \;\; = \;\; \bigcap\{\overline{\alpha} \mid \alpha \in [\varphi]\} \;\; = \;\; \overline{\bigcup\{\alpha \mid \alpha \in [\varphi]\}}$$

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[4]See, for instance, (Groenendijk and Roelofsen, 2010), where $\Rightarrow$ is construed as sensitive to a similarity-order between indices, along the lines of (Stalnaker, 1968) and (Lewis, 1973).
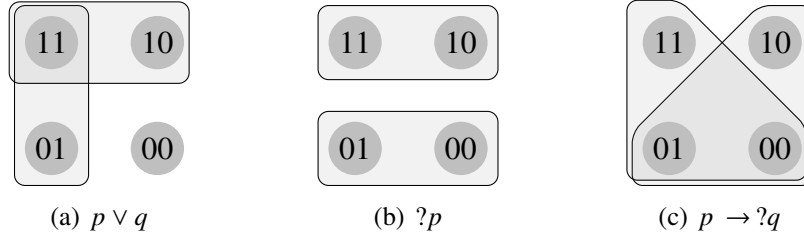
(a) $p \lor q$ (b) $?p$ (c) $p \rightarrow ?q$

Figure 1: Some examples of inquisitive sentences.

It can be shown that, for any φ, the union of the possibilities for φ, $\bigcup\{\alpha \mid \alpha \in [\varphi]\}$, coincides with the truth-set of φ, $|\varphi|$. This means that:

$$\overline{\bigcup\{\alpha \mid \alpha \in [\varphi]\}} \;\; = \;\; \overline{|\varphi|} \;\; = \;\; |\neg\varphi|$$

So $[\neg\varphi]$ always amounts to $\{|\neg\varphi|\}$. In particular, $\neg\varphi$ is always classical.

Disjunction. Disjunctions are typically inquisitive. To determine the proposition expressed by a disjunction $\varphi \lor \psi$ we first collect all possibilities for φ and all possibilities for ψ, and then apply Alt to obtain a proposition. Figure 1(a)–1(b) provide some examples: a simple disjunction of two atomic sentences $p \lor q$, and a polar question $?p$ (recall that $?p$ is defined as $p \lor \neg p$).

Conjunction. To determine the proposition expressed by a conjunction $\varphi \land \psi$ we take the pairwise intersection of all possibilities for φ and all possibilities for ψ, and then apply Alt to obtain a proposition. Notice that if φ and ψ are both classical, then conjunction simply amounts to intersection, just as in the classical setting.

Implication. The clause for implication is the one that is most involved. Let us consider several cases separately. First, suppose that the consequent of the implication, ψ, is classical (this includes the case of negation, discussed above). As a concrete example, take $(p \lor q) \rightarrow r$. In this case, there exists only one function from $[\varphi] = \{|p|, |q|\}$ to $[\psi] = \{|r|\}$, namely the function that maps both $|p|$ and $|q|$ to $|r|$. Call this function f_*. Then the only possibility for $[\varphi \rightarrow \psi]$ is γ_{f_*}, which is defined as follows:

$$\bigcap\nolimits_{\alpha \in [\varphi]} (\alpha \Rightarrow f_*(\alpha))$$

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This amounts to $|(p \rightarrow r) \wedge (q \rightarrow r)|$, which can be further simplified to $|(p \vee q) \rightarrow r|$. Thus, $(p \vee q) \rightarrow r$ behaves classically. And this holds more generally: whenever the consequent ψ of a conditional $\varphi \rightarrow \psi$ is classical, the unique possibility for that conditional is $|\varphi \rightarrow \psi|$.

Now suppose that ψ is inquisitive, but that the antecedent, φ, is classical. Take as a concrete example the conditional question $p \rightarrow ?q$. In this case, there is one possibility for the antecedent, $|p|$, and two for the consequent, $|q|$ and $|\neg q|$. So there are two functions from $[\varphi]$ to $[\psi]$ in this case, one mapping $|p|$ to $|q|$, and one mapping $|p|$ to $|\neg q|$. Call the first f_q and the second $f_{\neg q}$. The corresponding possibilities are:

$$\gamma_{f_q} \quad = |p| \Rightarrow |q| \quad = |p \rightarrow q|$$

$$\gamma_{f_{\neg q}} = |p| \Rightarrow |\neg q| \quad = |p \rightarrow \neg q|$$

So the proposition expressed by $p \rightarrow ?q$ is $\{|p \rightarrow q|, |p \rightarrow \neg q|\}$, as depicted in figure 1(c). This proposition reflects the empirical observation that the expected answers to a conditional question like (4) are (5-a) and (5-b):

(4)   If John goes to London, will he fly British Airways?

(5)   a.   Yes, if he goes to London, he will fly BA.
       b.   No, if he goes to London, he won't fly BA.

Finally, there are cases where both the antecedent φ and the consequent ψ are inquisitive. In this case, there are n^m functions from $[\varphi]$ to $[\psi]$, where $m \geq 2$ is the number of possibilities for φ and $n \geq 2$ is the number of possibilities for ψ. Each function delivers a potential possibility for $\varphi \rightarrow \psi$ (which may still be filtered out by ALT). To see how this works, let us take a concrete example: $(p \vee q) \rightarrow ?r$. There are $2^2 = 4$ functions from $[p \vee q] = \{|p|, |q|\}$ to $[?r] = \{|r|, |\neg r|\}$, and each of these functions yields a potential possibility for $(p \vee q) \rightarrow ?r$:

$$\gamma_{f_{++}} \quad = |(p \rightarrow r) \wedge (q \rightarrow r)| = |(p \vee q) \rightarrow r|$$

$$\gamma_{f_{+-}} \quad = |(p \rightarrow r) \wedge (q \rightarrow \neg r)|$$

$$\gamma_{f_{-+}} \quad = |(p \rightarrow \neg r) \wedge (q \rightarrow r)|$$

$$\gamma_{f_{--}} \quad = |(p \rightarrow \neg r) \wedge (q \rightarrow \neg r)| = |(p \vee q) \rightarrow \neg r|$$

Here, f_{++} is the function that maps both $|p|$ and $|q|$ to $|r|$, f_{+-} is the function that maps $|p|$ to $|r|$ and $|q|$ to $|\neg r|$, etcetera. These are all alternative possibilities, so none of them will be filtered out by ALT.

As a natural language example, let us take a variant of (4), where the antecedent contains a disjunction:

(6)   If John goes to London or to Paris, does he fly British Airways?

One could respond to this question in any of the following ways:

(7)   a.   Yes, if he goes to L or P, he flies BA.
        b.   If he goes to L, he flies BA, but if he goes to P, he doesn't.
        c.   If he goes to L, he doesn't fly BA, but if he goes to P, he does.
        d.   No, if he goes to L or P, he doesn't fly BA.

Each of these responses corresponds to one of the possibilities for $(p \vee q) \rightarrow\ ?r$.

2.3   Questions and assertions

A proposition $[\varphi]$ is viewed as a proposal to update the common ground. If it contains more than one possibility, it embodies an *inquisitive* proposal: each possibility embodies a possible way to update the common ground, and other conversational participants are requested to provide information such that at least one of these possible updates can be established. If there are indices that are not included in any of the possibilities in $[\varphi]$, then φ is *informative*. For in this case certain indices will be eliminated by any of the possible updates proposed by φ.

Definition 5 (Inquisitiveness and informativeness)**.**

- φ is *inquisitive* if and only if $[\varphi]$ contains at least two possibilities;

- φ is *informative* if and only if $\bigcup[\varphi] \neq \omega$.

Assertions are defined as sentences whose only effect, if any, is to provide information, and questions as sentences whose only effect, if any, is to request information.

Definition 6 (Questions and assertions)**.**

- φ is a *question* if and only if it is not informative;

- φ is an *assertion* if and only if it is not inquisitive.

Notice that not every sentence is a question or an assertion. There are also *hybrid* sentences, which are both informative and inquisitive. A simple example of a hybrid sentence is the disjunction $p \vee q$ (see figure 1(a)).

Tautologies are defined as sentences that express a trivial proposal, and contradictions as sentences that express an unacceptable proposal.

Definition 7 (Tautologies and contradictions).

- φ is a *tautology* if and only if $[\varphi] = \{\omega\}$

- φ is a *contradiction* if and only if $[\varphi] = \{\emptyset\}$

Note that contradictions are assertions, and that tautologies count both as questions and as assertions. It is easy to see that a formula is a contradiction iff it is a classical contradiction. This does not hold for tautologies. Classically, a formula is tautological iff it is not informative. In inquisitive semantics, a formula is tautological iff it is neither informative nor inquisitive. Classical tautologies may well be inquisitive, as exemplified by the question $?p$.

Definition 8 (Equivalence).
Two sentences φ and ψ are *equivalent*, $\varphi \sim \psi$, if and only if $[\varphi] = [\psi]$.

Proposition 9 (Alternative characterizations of questions).
For any sentence φ, the following are equivalent:

1. φ is a question

2. φ is a classical tautology

3. $\neg\varphi$ is a contradiction

4. $\varphi \sim ?\varphi$

Proposition 10 (Alternative characterizations of assertions).
For any sentence φ, the following are equivalent:

1. φ is an assertion

2. $[\varphi]$ contains exactly one possibility;

3. $[\varphi] = \{|\varphi|\}$;

4. $\varphi \sim !\varphi$.

Note that a sentence is an assertion if and only if the proposition it expresses consists of just one possibility, which corresponds with its classical meaning. In this sense, assertions behave classically. It can be shown that disjunction is the only source of non-classical, inquisitive behavior in our language:

Proposition 11. Any disjunction-free sentence is an assertion.

Finally, the informative content of a sentence φ is embodied by $\bigcup[\varphi]$ (indices that are not in $\bigcup[\varphi]$ are proposed to be eliminated from the common ground). The following proposition guarantees that inquisitive semantics preserves the classical treatment of informative content.

Proposition 12. For any sentence φ: $\quad \bigcup[\varphi] = |\varphi|$.

3 Attention

We observed in the introduction that sentences like (8) can very well make a significant contribution to a conversation, even though they are neither informative nor inquisitive.

(8)   John might be in London.

Intuitively, the semantic contribution of sentences like (8) lies in their potential to draw attention to certain possibilities, in this case the possibility that John is in London. The conception of a proposition as a set of possibilities is ideally suited to capture this intuition. If a sentence φ expresses a proposition $[\varphi]$ we can simply think of the elements of $[\varphi]$ as the possibilities that φ draws attention to; the possibilities that it proposes to take into consideration. At the same time, we can still think of φ as providing the information that at least one of the possibilities in $[\varphi]$ obtains, and as requesting information that could be used to establish for at least one of these possibilities that it indeed obtains. Thus, if a proposition is conceived of as a set of possibilities, it may in principle capture the informative, inquisitive, and attentive content of a sentence all at once.

Recall that in section 2 propositions were formally defined as sets of *alternative* possibilities. This was because non-maximal possibilities do not contribute in any way to the representation of informative and inquisitive content, and these were the only aspects of meaning that we were interested in. However, as soon as attentive content becomes of interest, non-maximal possibilities should be taken into account as well. In general, there is no reason why a sentence may not draw attention to two possibilities α and β such that $\alpha \subset \beta$. The only exception is that it seems unreasonable to think of any non-contradictory sentence as drawing attention to the *empty* possibility. Thus, we define propositions as arbitrary non-empty sets of possibilities, with the one exception that the empty possibility can

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only form a proposition on its own (the 'unacceptable' proposition, expressed by contradictions).

Definition 13 (Propositions)**.** A proposition is a non-empty set of possibilities $\mathcal{P}$ such that either $\emptyset \notin \mathcal{P}$ or $\mathcal{P} = \{\emptyset\}$.

In defining the semantics of our formal language, we will of course no longer make use of ALT (which turned any $\mathcal{P}$ into a set of *alternative* possibilities), but rather of a function PRO, which turns any $\mathcal{P}$ into a proposition in the sense of definition 13:

Definition 14 (Propositional closure)**.** $\text{PRO}\,\mathcal{P} = \begin{cases} \mathcal{P} & \text{if } \mathcal{P} = \{\emptyset\} \\ \mathcal{P} - \{\emptyset\} & \text{otherwise} \end{cases}$

Definition 15 (Inquisitive semantics with non-maximal possibilities)**.**

1. $[\![p]\!] = \{|p|\}$ if p is atomic

2. $[\![\bot]\!] = \{\emptyset\}$

3. $[\![\varphi \vee \psi]\!] = \text{PRO}\,\{\alpha \mid \alpha \in [\![\varphi]\!] \text{ or } \alpha \in [\![\psi]\!]\}$

4. $[\![\varphi \wedge \psi]\!] = \text{PRO}\,\{\alpha \cap \beta \mid \alpha \in [\![\varphi]\!] \text{ and } \beta \in [\![\psi]\!]\}$

5. $[\![\varphi \rightarrow \psi]\!] = \text{PRO}\,\{\gamma_f \mid f \in [\![\psi]\!]^{[\![\varphi]\!]}\},$ \qquad where $\gamma_f = \bigcap_{\alpha \in [\![\varphi]\!]} (\alpha \Rightarrow f(\alpha))$

In comparing the system defined in section 2 with the one defined here, we will refer to the former as *restricted* inquisitive semantics, or $\text{Inq}_{\not\subset}$ for short, and to the latter as *unrestricted* inquisitive semantics, or $\text{Inq}_{\emptyset}$ for short.[5]

Notice also that in definition 15 we use the notation $[\![\varphi]\!]$ in order to avoid confusion with $[\varphi]$. Thus, $|\varphi|$ is the proposition that is classically expressed by φ, $[\varphi]$ is the proposition expressed by φ in $\text{Inq}_{\not\subset}$, and $[\![\varphi]\!]$ is the proposition expressed by φ in $\text{Inq}_{\emptyset}$. If no confusion arises, we will henceforth simply refer to $[\![\varphi]\!]$ as the proposition expressed by φ. The elements of $[\![\varphi]\!]$ will be called the possibilities *for* φ.

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[5]The restriction that the empty possibility can only form a proposition on its own should not be seen as a significant restriction. We could also simply have defined possibilities as non-empty sets of indices, and propositions as completely arbitrary (possibly empty) sets of possibilities, taking the empty proposition to be the semantic value of $\bot$. This is in fact the route taken in (Groenendijk and Roelofsen, 2009). The only reason we include empty possibilities here (and thus avoid empty propositions) is that it allows for a perspicuous formulation of the clause for implication.

3.1 Informative, inquisitive, and attentive content

As in $\mathsf{Inq}_{\not\subset}$, the informative content of a sentence φ in $\mathsf{Inq}_\emptyset$ is determined by the union of all the possibilities for φ. Thus, $\mathsf{Inq}_\emptyset$ preserves the classical treatment of informative content, just as $\mathsf{Inq}_{\not\subset}$ did.

Proposition 16. For any sentence φ, $\quad \bigcup[\![\varphi]\!] = \bigcup[\varphi] = |\varphi|$

Also just as in $\mathsf{Inq}_{\not\subset}$, the inquisitive content of a formula φ in $\mathsf{Inq}_\emptyset$ is determined by the *maximal* possibilities for φ. For, these possibilities still completely determine which information is minimally required to establish at least one of the possibilities for φ. It is easy to check that a possibility α is a maximal element of $[\![\varphi]\!]$ if and only if it is an element of $[\varphi]$. Thus, as far as informative and inquisitive content are concerned, $\mathsf{Inq}_\emptyset$ and $\mathsf{Inq}_{\not\subset}$ coincide.

However, in $\mathsf{Inq}_{\not\subset}$, the meaning of a formula was completely exhausted by its informative and inquisitive content. In $\mathsf{Inq}_\emptyset$, these two components are still present, and still behave exactly the same, but they do no longer fully determine the meaning of a formula: a third, *attentive* meaning component has entered the stage.

Definition 17 (Informativeness, inquisitiveness, and attentiveness)**.**

- φ is informative iff $|\varphi| \neq \omega$;

- φ is inquisitive iff $[\![\varphi]\!]$ contains at least two maximal possibilities;

- φ is attentive iff $[\![\varphi]\!]$ contains a non-maximal possibility.

Informativeness is defined just as in $\mathsf{Inq}_{\not\subset}$. The definition of inquisitiveness now explicitly requires the existence of two *maximal* possibilities—in $\mathsf{Inq}_{\not\subset}$ possibilities were always maximal, so there we could just require the existence of at least two possibilities. Finally, attentiveness requires the existence of a non-maximal possibility, something that could clearly never arise in $\mathsf{Inq}_{\not\subset}$.[6]

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[6]In (Ciardelli, 2009b) inquisitiveness and attentiveness are defined as follows:

- φ is *inquisitive* iff $|\varphi| \notin [\![\varphi]\!]$;

- φ is *attentive* iff there is a possibility for φ that is strictly included in a maximal possibility for φ.

In the propositional setting, these alternative definitions are equivalent to the ones given above. They may be slightly less transparent from our current perspective, but have the advantage of carrying over straightforwardly to the first-order setting.
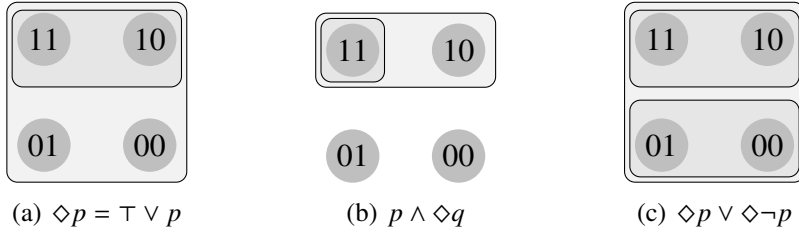
Figure 2: Three examples of attentive formulas.

Perhaps it is worth emphasizing that *every* sentence draws attention to certain possibilities, not only attentive sentences. What is special about attentive sentences is that they draw attention to possibilities that do not contribute in any way to representing the informative or inquisitive content of the sentence. Attentive sentences do something *more* than providing or requesting information (if they provide or request any information at all).

3.2 *Might*

Let us consider some examples of attentive formulas. First consider the proposition depicted in figure 2(a). This proposition consists of two possibilities: the possibility that p, and the 'trivial possibility', ω. We take this to be the proposition expressed by '*might p*'. It draws attention to the possibility that p, but does not provide or request any information. This is indeed how *might* sentences typically behave in natural language.

We will add an operator $\Diamond$ to our formal language, representing *might*. But notice that our basic formal language already contains a formula that expresses the proposition in figure 2(a): the formula $\top \vee p$. This means that we can simply take $\Diamond p$ to be an abbreviation of $\top \vee p$. More generally, for any formula φ, we take $\Diamond\varphi$ to be an abbreviation of $\top \vee \varphi$. Thus, the effect of $\Diamond\varphi$ is to draw attention to the possibilities for φ without providing or requesting any information. To see what this amounts to, let us consider two more concrete examples. First, take the proposition depicted in figure 2(b). This proposition is expressed by $p \wedge \Diamond q$. It consists of two possibilities: $|p|$ and $|p \wedge q|$. As such, it provides the information that p holds, and draws attention to the possibility that q may hold as well.

Finally, consider the proposition depicted in figure 2(c). This proposition is expressed by $\Diamond p \vee \Diamond\neg p$. It is especially instructive to consider how this formula differs from the polar question $?p$. The latter is inquisitive; it requires a choice

between two alternative possibilities. $\Diamond p \lor \Diamond \neg p$ on the other hand, does not require any information: it highlights the possibility that p and the possibility that $\neg p$, and other participants may indeed confirm one of these possibilities in their response. But they are not required to do so; they may also just nod, or say "ok". These would not be compliant responses to $?p$.

3.3 Questions, assertions, and conjectures

As in $\mathsf{Inq}_{\not\subset}$, we define assertions as formulas whose only effect, if any, is to provide information, and questions as formulas whose only effect, if any, is to request information. As a third category, we now also distinguish formulas whose only effect, if any, is to draw attention to certain possibilities. We call such formulas *conjectures*.

Definition 18 (Questions, assertions, and conjectures)**.**

- φ is a *question* iff it is neither informative nor attentive;

- φ is an *assertion* iff it is neither inquisitive nor attentive;

- φ is a *conjecture* iff it is neither informative nor inquisitive.

The borderline cases, tautologies and contradictions, are defined just as in $\mathsf{Inq}_{\not\subset}$: tautologies are formulas that express the trivial proposition; contradictions are formulas that express the unacceptable proposition.

Definition 19 (Tautologies, contradictions)**.**

1. φ is a *tautology* if and only if $[\![\varphi]\!] = \{\omega\}$;

2. φ is a *contradiction* if and only if $[\![\varphi]\!] = \{\emptyset\}$.

Notice that, as in $\mathsf{Inq}_{\not\subset}$, contradictions are assertions, and tautologies now count not only as borderline cases of questions and assertions, but also of conjectures. The equality $\bigcup[\![\varphi]\!] = |\varphi|$ immediately entails that contradictions in $\mathsf{Inq}_\emptyset$ are precisely the classical contradictions; classical tautologies, however, may well express meaningful, non-trivial propositions in $\mathsf{Inq}_\emptyset$: they are never informative, but they may well be inquisitive and/or attentive. The meaning of a sentence in $\mathsf{Inq}_\emptyset$ is completely exhausted by its informative, inquisitive, and attentive content.

Proposition 20. If a sentence is neither informative, nor inquisitive, nor attentive, then it must be a tautology.

Equivalence is defined as expected:

Definition 21 (Equivalence).
Two formulas φ and ψ are *equivalent* in $\mathsf{Inq}_\emptyset$, $\varphi \approx \psi$, if and only if $\llbracket \varphi \rrbracket = \llbracket \psi \rrbracket$.

The characterization of assertions given in proposition 10 is preserved:

Proposition 22 (Alternative characterizations of assertions).
For any sentence φ, the following are equivalent:

1. φ is an assertion;

2. $\llbracket \varphi \rrbracket$ contains exactly one possibility;

3. $\llbracket \varphi \rrbracket = \{|\varphi|\}$;

4. $\varphi \approx \,!\varphi$.

Also, all closure properties of assertions carry over from $\mathsf{Inq}_{\not\subset}$ to $\mathsf{Inq}_\emptyset$.

Proposition 23 (Closure properties of assertions).
For any proposition letter p and any sentences φ and ψ:

1. p, $\neg\varphi$, and $!\varphi$ are assertions;

2. if both φ and ψ are assertions, then so is $\varphi \wedge \psi$;

3. if ψ is an assertion, then so is $\varphi \to \psi$.

In particular, any disjunction-free sentence is still an assertion. Thus, disjunction is the only source of non-classical behavior in $\mathsf{Inq}_\emptyset$, just as it was in $\mathsf{Inq}_{\not\subset}$.

Corollary 24. Disjunction-free sentences are assertions.

Proposition 9 also carries over to $\mathsf{Inq}_\emptyset$ as a characterization of non-informative sentences.

Proposition 25 (Alternative characterizations of non-informative sentences).
For any sentence φ, the following are equivalent:

1. φ is non-informative

2. φ is a classical tautology

3. $\neg\varphi$ is a contradiction

4. $\varphi \approx {?}\varphi$

Note, however, that proposition 9 was originally presented as a characterization of *questions*. In $\mathsf{Inq}_{\not\subseteq}$, questions are, by definition, non-informative, and vice versa, all non-informative sentences are questions. In $\mathsf{Inq}_{\emptyset}$ this does no longer hold. For instance, $\Diamond p$ is non-informative, but it is not a question. Proposition 25 still provides a general characterization of non-informative sentences, but not of questions. For instance, $\Diamond p$ is equivalent to $?\Diamond p$, but neither of these sentences is a question. More generally, a sentence of the form $?\varphi$ is a question just in case φ is not attentive:[7]

Proposition 26 (Questions and attentiveness)**.**
$?\varphi$ is a question iff φ is not attentive.

Conjectures can be characterized very much in parallel with assertions and non-informative sentences.

Proposition 27 (Alternative characterizations of conjectures)**.**
For any sentence φ, the following are equivalent:

1. φ is a conjecture;

2. $[\![\varphi]\!]$ contains ω;

3. $\varphi \approx \Diamond\varphi$.

Notice that a sentence is a conjecture in $\mathsf{Inq}_{\emptyset}$ if and only if it is a tautology in $\mathsf{Inq}_{\not\subseteq}$. $\mathsf{Inq}_{\not\subseteq}$ refined the classical notion of meaning in such a way that some of the sentences that were tautological in the classical setting formed a new class of meaningful sentences, namely questions. $\mathsf{Inq}_{\emptyset}$ further refines the notion of meaning in such a way that some of the sentences that are tautological in $\mathsf{Inq}_{\not\subseteq}$ again form a new class of meaningful sentences, namely conjectures.

Proposition 28 (Closure properties of conjectures)**.**
For any sentences φ and ψ,

1. $\Diamond\varphi$ is a conjecture;

2. if φ and ψ are conjectures, then so is $\varphi \wedge \psi$;

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[7]This is why ? is referred to as *non-informative closure* rather than, say, the 'question operator'.

3. if at least one of φ and ψ is a conjecture, so is $\varphi \vee \psi$;

4. if ψ is a conjecture, then so is $\varphi \rightarrow \psi$.

Thus, sentences like those in (9) are all conjectures.

(9) a. John might be in London. $\Diamond p$
     b. John might be in London and Bill might be in Paris. $\Diamond p \wedge \Diamond q$
     c. John is in London, or he might be in Paris. $p \vee \Diamond q$
     d. If John is in London, Bill might be in Paris. $p \rightarrow \Diamond q$

3.4 *Might* meets the propositional connectives

It is well-known that *might* interacts with the propositional connectives in peculiar ways. In particular, it behaves differently in this respect from expressions like 'it is possible that' or 'it is consistent with my beliefs that', which is problematic for any account that analyzes *might* as an epistemic modal operator. The present analysis sheds new light on this issue.

Disjunction and conjunction. Zimmermann (2000, p.258–259) observed that (10), (11), and (12) are all equivalent.[8]

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

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

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

Notice that *might* behaves differently from clear-cut epistemic modalities here: (13) is not equivalent with (14).

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

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

A further subtlety is that Zimmermann's observation seems to crucially rely on the fact that 'being in London' and 'being in Paris' are mutually exclusive. If they

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[8]These type of examples have often been discussed in the recent literature in relation to the phenomenon of *free choice permission*, which involves deontic modals (cf. Geurts, 2005; Simons, 2005; Alonso-Ovalle, 2006; Aloni, 2007; Fox, 2007; Klinedinst, 2007; Chemla, 2009).
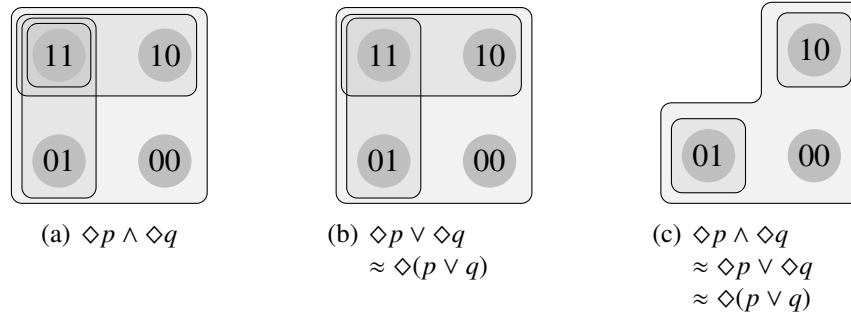
Figure 3: *Might* interacting with conjunction and disjunction.

had not been chosen in this specific way, the equivalence between (10) and (11) on the one hand, and (12) on the other would not have obtained. To see this, consider the following examples:

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

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

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

'Speaking English' and 'speaking French' are not mutually exclusive, unlike 'being in London' and 'being in Paris'. To see that (15) and (16) are not equivalent with (17) consider a situation, suggested to us by Anna Szabolcsi, in which someone is looking for an English-French translator, i.e., someone who speaks *both* English and French. In that context, (17) would be perceived as a useful recommendation, while (15) and (16) would not.

These patterns are quite straightforwardly accounted for in $\mathsf{Inq}_\emptyset$. The proposition expressed by $\Diamond p \wedge \Diamond q$ is depicted in figure 3(a), and the proposition expressed by $\Diamond(p \vee q)$ and $\Diamond p \vee \Diamond q$ (which are equivalent in $\mathsf{Inq}_\emptyset$) is depicted in figure 3(b). Notice that $\Diamond p \wedge \Diamond q$, unlike $\Diamond(p \vee q)$ and $\Diamond p \vee \Diamond q$, draws attention to the possibility that $p \wedge q$, that is, the possibility that John speaks both English and French. This explains the observation that (17) is perceived as a useful recommendation in the translator-situation, unlike (15) and (16).

In Zimmermann's example, p stands for 'John is in London' and q for 'John is in Paris'. It is impossible for John to be both in London and in Paris. So indices where p and q are both true must be left out of consideration, and relative to this

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restricted common ground[9], $\diamondsuit(p \wedge q)$, $\diamondsuit p \vee \diamondsuit q$, and $\diamondsuit p \wedge \diamondsuit q$ all express exactly the same proposition, which is depicted in figure 3(c).

Implication and negation.　Now let us consider how *might* interacts with implication and negation. First, consider a sentence where *might* occurs in the consequent of an implication:

(18)　　If John is in London, he might be staying with Bill.

The corresponding expression in our formal language, $p \rightarrow \diamondsuit q$, is equivalent with $\diamondsuit(p \rightarrow q)$. It draws attention to the possibility that p implies q, without providing or requesting information. This seems a reasonable account of the semantic effect of (18). Indeed, one natural response to (18) is to confirm that John is staying with Bill if he is in London. But such an informative response is not required. Nodding, or saying "ok" would also be compliant responses.

　　Now let us consider an example where *might* occurs in the antecedent of an implication:

(19)　　If John might be in London, he is staying with Bill.　　　　$\diamondsuit p \rightarrow q$

This sentence is perceived as odd. In $\mathsf{Inq}_\emptyset$, this observation may be explained by the following general property of implication:

Proposition 29 (Implication and redundancy of non-informative content)**.** If ψ is an assertion, then for any φ: $\quad \varphi \rightarrow \psi \quad \approx \quad !\varphi \rightarrow \psi$.

This proposition says that if the consequent of an implication is an assertion, then we could replace the antecedent φ by $!\varphi$ (which has exactly the same informative content as φ, but lacks any inquisitive or attentive content) without changing the meaning of the implication as a whole. In other words, the inquisitive and attentive content of the antecedent is redundant in such constructions: there is a simpler way to express exactly the same meaning. In particular, the meaning expressed by (19) could just as well be expressed by the simpler sentence "John is staying with Bill" (according to proposition 29, $\diamondsuit p \rightarrow q$ is equivalent to $\top \rightarrow q$, which reduces to q). This may be a reason why constructions like (19) are generally not used, and are perceived as odd if they do occur.

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[9]We have not explicitly defined propositions relative to an arbitrary common ground here. But such a definition can be given straightforwardly (see, e.g., Groenendijk and Roelofsen, 2009).

Our general empirical prediction is that implications with an assertive consequent and an inquisitive or attentive antecedent are 'marked'.[10] This has particular consequences for negation, which is treated in our system as a special case of implication. In English, standard sentential negation cannot take wide scope over *might*. For instance, (20) can only be taken to draw attention to the possibility that John is not in London.

(20)   John might not be in London.

Notice, again, that *might* behaves differently from clear-cut epistemic modalities here, which can occur in the scope of negation:

(21)   It is not consistent with my beliefs that John is in London.

The fact that *might* cannot occur in the scope of negation is explained in $\mathsf{Inq}_\emptyset$ by the fact that $\neg\Diamond\varphi$ is always a contradiction (recall that $\neg\Diamond\varphi$ is defined as $\Diamond\varphi \to \bot$; by proposition 29, this is equivalent with $\top \to \bot$, which reduces simply to $\bot$). Thus, $\neg\Diamond\varphi$ expresses a non-sensical, unacceptable proposal. $\Diamond\neg\varphi$ on the other hand, seems to have exactly the semantic effect of sentences like (20): it draws attention to the possibility that $\neg\varphi$.

Notice that questions cannot be interpreted in the scope of negation either. This basic parallel between *might* sentences and questions is straightforwardly captured: $\neg?\varphi$ is always contradictory, just like $\neg\Diamond\varphi$. The general prediction is that any non-informative sentence is uninterpretable in the scope of negation.

4   The pragmatics of proposing

Gricean pragmatics generally assumes a classical, truth-conditional semantics, where the meaning of a sentence is identified with its informative content. Inquisitive semantics departs from this basic assumption. A sentence is taken to express a proposal to update the common ground, which embodies not only its informative content, but also its inquisitive and attentive content. This means that the pragmatics also changes. Gricean pragmatics can be seen as the pragmatics of

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[10]In some cases, marked sentences may not be perceived as odd, but rather associated with a marked meaning, i.e., a meaning that differs from the one they are standardly associated with. The association of marked forms with marked meanings (and unmarked forms with unmarked meanings) is widely assumed to play a significant role in interpretation (cf. Horn, 1984). The repercussions of this mechanism for the interpretation of *might* will be discussed in more detail in section 5.

providing information. With inquisitive semantics comes a move to a 'pragmatics of proposing'.

Such a pragmatics has been articulated in (Groenendijk and Roelofsen, 2009). It is concerned with conversations that are geared towards the exchange of information, where the participants' main purpose is to *enhance the common ground* as effectively as possible in order to satisfy some given informational need.

In such a cooperative effort, each participant must first of all ensure that his own information state remains consistent, and does not incorporate any information that he does not take himself to know. In short, participants must *maintain their information state*.

On the other hand, participants must also make sure that their representation of the common ground does indeed represent the information that has been established by the conversation, and moreover, they must make sure that the common ground indeed embodies *common* information: the information in the common ground must be incorporated into each of their own individual information states as well. In short, we say that participants must *maintain the common ground*. In particular, if one participant proposes a certain update, and no other participant objects, then each participant must update both his own information state and his representation of the common ground according to the given proposal. If a participant cannot execute the update because that would lead to inconsistency of his own information state, he must publicly announce this, so that other participants will also refrain from executing the update and the common ground is properly maintained.

Within the bounds of these qualitative requirements of maintaining individual information states and the common ground, there is a general quantitative preference for *more informative* proposals—the more information you provide, the more likely it is that the purpose of the conversation will be fulfilled—and a preference for *less inquisitive* proposals—the less information you request, the more likely it is that other participants will be able to provide that information.[11]

Without going into the more subtle details, for now, let us discuss some of the repercussions of a pragmatic theory along these lines for the interpretation of *might*.

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[11]For a formal definition of what it means for one utterance to be more or less informative/inquisitive than another, we refer to (Groenendijk and Roelofsen, 2009).

4.1 Quality implicatures

There are two basic empirical observations about *might* that we have not discussed at all so far, even though each of them has given rise to one of the two 'classical' semantic theories of *might*. Both observations can be illustrated by means of our initial example:

(22)   John might be in London.

The first observation, perhaps the most basic one, is that if someone utters (22) we typically conclude that she considers it *possible* that John is in London. This observation has given rise to the analysis of *might* as an epistemic modal operator. Clearly, our own semantics has nothing to say about this.

The second observation is that if someone hears (22) and already knows that John is not in London, she will typically object, pointing out that (22) is inconsistent with her information state. In this sense, even though *might* sentences do not provide any information about the state of the world, they can be 'inconsistent' with a hearer's information state. One classical account of this observation is that of Veltman (1996). Veltman's update semantics specifies for any given information state σ and any given formula φ, what the information state $\sigma[\varphi]$ is that would result from updating σ with φ. The update effect of $\Diamond\varphi$ is defined as follows:

$$\sigma[\Diamond\varphi] = \begin{cases} \emptyset & \text{if } \varphi \text{ is inconsistent with } \sigma \\ \sigma & \text{otherwise} \end{cases}$$

The idea is that, if φ is inconsistent with a hearer's information state, then updating with $\Diamond\varphi$ leads to the absurd state. To avoid this, the hearer must make a public announcement signalling the inconsistency of φ with her information state. As a result, whoever uttered $\Diamond\varphi$ in the first place may come to discard the possibility that φ as well. Again, our semantics clearly has nothing to say about this.

However, we believe that this is rightly so. In our view, both observations should be explained pragmatically. And they can be. It follows from the qualitative maintenance requirements formulated above that if a cooperative speaker expresses a certain proposal $[\![\varphi]\!]$ and α is a possibility in $[\![\varphi]\!]$, then α must be consistent with the speaker's information state. For otherwise, if other participants would indeed agree to update with α, the update would be executed, and this would make the speaker's information state inconsistent. Thus, in particular, a cooperative speaker who utters (22) must consider it possible that John is in London.

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It also follows from the qualitative maintenance requirements that if a hearer is confronted with a sentence φ, and one of the possibilities for φ is inconsistent with her information state, then she must signal this inconsistency, in order to prevent other participants from considering the possibility in question to be a 'live option'. Thus, both observations are accounted for.

And this pragmatic account, unlike the mentioned semantic analyses, extends straightforwardly to more involved cases. Consider for instance:

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

This sentence is problematic for both semantic accounts just mentioned. The epistemic modality account predicts that the speaker considers it possible that John is in London or in Paris. But note that this is compatible with the speaker knowing perfectly well that John is not in London. What (23) implies is something stronger, namely that the speaker considers it possible that John is in London *and* that he considers it possible that John is in Paris. This follows straightforwardly on our pragmatic account.

Now consider a hearer who is confronted with (23) and who knows that John is not in London. We expect this hearer to object to (23). But Veltman's update semantics does not predict this: it predicts that an update with (23) has no effect on her information state. Our pragmatic account on the other hand, does urge the hearer to object.

The only task of our semantics is to specify which proposals can be expressed by means of which sentences. The pragmatics, then, specifies what a context—in particular, the common ground and the information state of the speaker—must be like in order for a certain proposal to be made, and how a hearer is supposed to react to a given proposal, depending on the common ground and her own information state. Together, these two components account for the basic features of *might* that classical semantic theories take as their point of departure. Shifting some of the weight to pragmatics evades problems with more involved cases, like (23), in a straightforward way. But, of course, the necessary pragmatic principles can only be stated if the underlying semantics captures more than just informative content.

4.2   Quantity implicatures

If someone says that John might be in London, we typically do not only conclude that she considers it possible that John is in London, but also that she considers it possible that he is *not* in London. In short, we infer that she is *ignorant* as

to whether John is in London or not. Notice, however, that this inference is not always warranted. For instance, if a child is figuring out, as a homework exercise, who Napoleon Bonaparte was, a helping mother may say: "He might have been a French emperor". In this case, we do not conclude that the mother must be ignorant about Napoleon's historical role. Probably, she did not want to take the entire homework assignment off her child's hands, but just wanted to leave him with the lighter task of verifying her suggestion.

This kind of context dependency is characteristic of Gricean quantity implicatures. And this is indeed what the inference in question is usually taken to be. However, a problem arises for the Gricean account as soon as we consider slightly more involved cases. A good example is, again, sentence (23). In the standard Gricean framework, it is possible to derive the implicature that the speaker doesn't know whether or not John is in London or in Paris. But notice that this is consistent with the speaker knowing very well that John is not in London. What we want to derive is the stronger implicature that the speaker does not know whether John is in London, and that she does not know either whether John is in Paris.

In the inquisitive setting, this implicature is straightforwardly derived.[12] We have already seen how to establish the inference that the speaker considers it *possible* both that John is in London and that John is in Paris. Morover, it follows from the quantitative preference for more informative and less inquisitive proposals that whenever a cooperative speaker A expresses a proposition $[[\varphi]]$ and α is a possibility in $[[\varphi]]$ such that $\alpha \subset |\varphi|$ (that is, A proposes α as a possible update, but does not provide enough information to actually establish that update), we can conclude that A does not have sufficient information to directly propose an update with α. For such a proposal would certainly have been more informative than $[[\varphi]]$, and as most as inquisitive.

Ignorance implicatures arise in exactly the same way for questions, disjunctions, and other inquisitive/attentive utterances. Deriving ignorance implicatures for disjunctions in a Gricean framework has proven to be far from trivial, as it is difficult to decide in any principled way what the 'alternatives' are that a disjunction should be compared with. In the inquisitive setting, these alternatives are directly determined by the semantics.

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[12]There are numerous attempts in the literature to revise the classical Gricean framework in more or less radical ways in order to deal with the ignorance implicatures associated with sentences like (23). See (Chemla, 2009) for a recent proposal and further references.

5 Epistemic re-interpretation

In certain embedded environments, $\diamond p$ really seems to be interpreted as saying that p is consistent with some contextually given body of information (usually, but not necessarily, the information state of the speaker or the hearer). One may be tempted to conclude that this is simply due to *might* being ambiguous, permitting both an 'epistemic use' and an 'attentive use', and possibly other usages as well.

However, it may be worth trying to avoid such a conclusion, at least in its strongest form. For, if *might* were simply ambiguous between an attentive use and an epistemic use, then we would lose our explanation for the fact that *might* obligatorily takes wide scope over standard negation, unlike sentential operators like 'it is consistent with my beliefs that'. Recall the relevant example:

(24)   John might not go to London.

We pointed out in section 3.4 that $\neg\diamond p$ is always a semantic contradiction, and offered this as an explanation for the fact that negation cannot take wide scope in (24). But this explanation only goes through, of course, if the semantic contribution of $\diamond p$ is to draw attention to the possibility that p. If $\diamond p$ were ambiguous, and could also be interpreted as saying, semantically, that p is consistent with some contextually determined body of information, then there would be no reason anymore why negation should obligatorily take narrow scope. After all, we saw that negation is perfectly happy with wide scope in sentences like (25):

(25)   It is not consistent with my beliefs that John will go to London.

Thus, rather than assuming plain ambiguity, we would like to offer a more nuanced account of the epistemic interpretation of $\diamond p$ in the relevant embedded environments. In particular, we will argue that in such environments there is generally a specific *reason* not to interpret $\diamond p$ as simply drawing attention to the possibility that p. We hypothesize that this triggers *re-interpretation* of $\diamond p$ in terms of the ignorance implicatures that it typically triggers when not embedded. We will discuss three environments where this phenomenon occurs: in the scope of negation, in the antecedent of a conditional, and in questions.[13]

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[13]The proposal made here is in line with recent observations by Levinson (2000) and Chierchia, Fox, and Spector (2008), among others, that the semantic contribution of certain expressions is sometimes strengthened 'locally', i.e., before it enters the semantic composition process. Construing this process as 're-interpretation' is especially in line with Geurts' (2009) take on such phenomena.

Negation. Standard negation cannot take wide scope over *might*. However, there is a complication: wide scope *can* be established by using 'it is not true that' instead of standard negation. Consider:

(26)   It is not true that John might go to London.

This sentence conveys that the speaker believes that John will not go to London. If the sentence were analyzed as $\neg\Diamond\varphi$, then according to $\mathsf{Inq}_\emptyset$ it would be a contradiction, which is evidently not the right analysis. What is going on here, we think, is that the sentence is interpreted as a denial of the *implicature* of the embedded clause. It is in fact a common use of 'it is not true that' constructions to deny pragmatic inferences of their complement clause. For example, in (27) the implicature of the embedded clause is denied, and in (28) the presupposition of the embedded clause is denied:

(27)   It is not true that John has four children. He has five.

(28)   It is not true that the king of France is bald. There is no king of France.

Moreover, it seems that (26) is not necessarily interpreted as denying that it is *possible* that John will go to London. It may also be interpreted as denying the stronger implicature that it is *unknown* whether John will go to London or not. For, someone who utters (26) may continue as in (29), but also as in (30) (where SMALLCAPS indicate contrastive stress).

(29)   It is not true that John might go to London. He will go to PARIS.

(30)   It is not true that John might go to London. He WILL go to London.

Notice that a similar pattern arises with disjunction:

(31)   It is not true that John speaks English or French. He speaks NEITHER.

(32)   It is not true that John speaks English or French. He speaks BOTH.

These observations support the idea that 'it is not true that' constructions can be interpreted as denying pragmatic inferences that the embedded clause gives rise to, and thus lend support to a re-interpretation analysis of examples like (26).

One may ask, of course, why this same re-interpretation strategy could not be applied in (24). We would argue that re-interpretation only occurs if it is triggered. In (24), negation can take narrow scope, and the interpretation of $\Diamond\neg p$ is unproblematic. Thus, there is no need for re-interpretation. In (26) however, negation is

forced to take wide scope, and $\neg\Diamond p$ is, at face value, a contradiction. This is what triggers re-interpretation in this case.

Below we will see that another reason to re-interpret a given construction is that under its standard interpretation, it expresses a meaning that could also have been expressed by a simpler construction. This mechanism, usually referred to as *blocking* or *division of pragmatic labor* is widely assumed to play a crucial role in the process of interpretation (cf. Horn, 1984, 2004).

Implication.   We observed in section 3.4 that an implication with *might* in its antecedent is generally difficult to interpret. The example was:

(33)   If John might be in London, he is staying with Bill.

There are other examples, however, which *can* be interpreted. For instance:

(34)   If John might be in London, I won't go there.

This sentence is clearly interpreted as stating that if it is *possible* that John is in London, then the speaker will not go there. Thus, *might* seems to be interpreted as an epistemic possibility modal here.[14]   This is a case, we would say, where blocking plays a role: the meaning of (34), taken at face value, could just as well have been expressed by the simpler sentence "I won't go to London". This triggers re-interpretation of the *might* construction in the antecedent in terms of the implicatures that it typically generates.

Re-interpretation does not improve the intelligibility of (33). This is explained by the fact that, if the antecedent of (33) is re-interpreted, the sentence as a whole becomes paraphrasable as:

(35)   If it is possible that John is London, he is staying with Bill.

What this is supposed to communicate is, for reasons that need not concern us here, still quite unclear. This is why re-interpretation does not 'save' (33).

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[14]Note that the relevant epistemic state does not seem to be the speaker's own information state here, but rather the information state that would be obtained if all discourse participants would bundle their beliefs. Notice also that the subject of the consequent, "I", can be replaced by "Sue" for instance. In that case, it is even clearer that the relevant epistemic state must be contextually determined in sometimes intricate ways. There is an ongoing debate about this issue, which is largely orthogonal to what is at stake here. See (von Fintel and Gillies, 2010) for a recent proposal and further references.

Questions.   Finally, consider a question containing *might*:

(36)   Might John be in London?

Taken at face value, (36) is presumably interpreted as $?\Diamond p$. But $?\Diamond p$ is equivalent with $\Diamond p$. Thus, the meaning that is standardly assigned to (36) could just as well be expressed by the simpler sentence "John might be in London". Therefore, this interpretation is blocked for (36), and the sentence is re-interpreted in terms of the implicatures that *might* typically evokes.

These observations support the hypothesis that, rather generally, non-attentive readings of *might* are the result of re-interpretation. More work is needed, of course, to solidify this claim. But we think this is a direction worth pursuing.[15]

6   Final remarks

The idea that the core semantic contribution of *might* sentences lies in their potential to draw attention to certain possibilities has been entertained before. For instance, Groenendijk, Stokhof, and Veltman (1996) already wrote that "in many cases, a sentence of the form *might-φ* will have the effect that one becomes aware of the possibility of φ."[16] However, it was thought that capturing this aspect of the meaning of *might* would require a more complex notion of possible worlds and information states, and a different way to think about growth of information. Thus, immediately following the above quotation, Groenendijk *et al.* (1996) write that their own framework "is one in which indices are total objects, and in which growth of information about the world is explicated in terms of elimination of indices. Becoming aware of a possibility cannot be accounted for in a natural fashion in such an eliminative approach. It would amount to extending partial indices, rather than eliminating total ones. To account for that aspect of the meaning of *might* a constructive approach seems to be called for."[17]

The present paper has taken a different route.[18] Indices are still total objects,

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[15]A weaker hypothesis that may be worth considering in case the above hypothesis turns out to be untenable is that the attentive use of *might* is historically primary, and that non-attentive usages are derivative, though (partly) grammaticized (see, e.g., Levinson, 2000, for analyses of this kind of other empirical phenomena).

[16]See also more recent work: Swanson (2006), Franke and de Jager (2008), Brumwell (2009).

[17] Groenendijk *et al.* originally used the terms 'possible world' and 'possibility' instead of 'index'. We adapted the quotation in order to avoid confusion with our own terminology.

[18]See (Brumwell, 2009) for a related approach, with a different empirical scope.

and growth of information is still explicated in terms of eliminating indices. What has changed is the very *notion of meaning*. Our semantics does not specify what the truth conditions of sentences are, or what their update effect is, but rather what the proposal is that they express. And this shift in perspective immediately facilitates a simple and perspicuous way to capture attentive content.

Finally, it is perhaps worth emphasizing that, even though our efforts in this paper have been focussed on giving a systematic account of the possibilities that *might* sentences draw attention to, we certainly do not think that this is all there is to the meaning of *might*. Drawing attention to possibilities may have several side-effects. We discussed how ignorance implicatures typically enter the picture through (possibly grammaticized) pragmatic reasoning. Another potential side-effect is that participants may be led to *hypothetically effectuate* the updates that have been brought under attention for the purpose of further discussion.

This 'hypothetical update' aspect of the use of *might* is familiar from the literature on modal subordination (cf. Roberts, 1989) and also closely related to a prominent line of work on conditionals (cf. Stalnaker, 1968). The literature on modal subordination is typically concerned with constructions like (37):

(37)   A wolf might come in. It would eat you first.

The system proposed here is not dynamic and does not deal with quantification. As such, it has no chance of accounting for constructions like (37). However, transferring its key features to a dynamic, first-order system, may not only lead to a principled account of (37); it is also expected to take care of cases like (38), (39), and (40):

(38)   A wolf or a lion might come in. It would eat you first.

(39)   A wolf or a lion might come in. Would it eat you first?

(40)   If a wolf or a lion comes in, would it eat you first?

Such cases have, to the best of our knowledge, always been thorns in the eyes of theories dealing with modal subordination and/or conditionals.

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