Existential Inquisitive Semantics

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January 20, 2011

1 Introduction

It is important for the development of a first-order inquisitive semantics that we can retrace the motivations for changes that have been made to the previous semantics. A key work in that respect is (Ciardelli 2009) in which some problems for an extension of propositional to first-order inquisitive semantics are examined. In the first part of the present paper, we revisit these problems and Ciardelli's solutions. Although we will not draw any strong conclusions with regard to the future of first-order inquisitive semantics, we will show that some of Ciardelli's changes to the semantics lack proper motivation, and that others do not provide a solution.

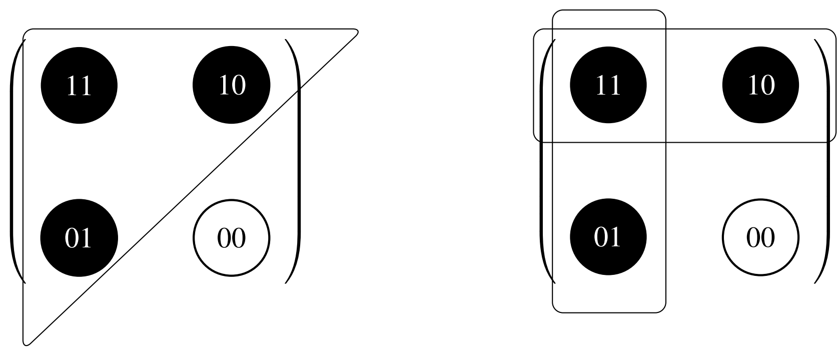
It is also important that a first-order inquisitive semantics yield empirical predictions in the domain of natural language. In the second part of this paper we suggest a first analysis for the semantics of indefinite and interrogative noun phrases.

2 Inquisitive Semantics

2.1 Propositional inquisitive semantics

The primary goal of inquisitive semantics is to capture the 'interactive' use of language in exchanging information in a dynamic setting. As such, inquisitive semantics views conversations as the process of raising and resolving issues. This process is collaborative in the sense that propositions represent *proposals* to update the common ground, which at each turn may denote more than one possibility for update. At each proposal turn, the addressee is given a choice to assent to one possibility among a set of alternatives to update the common ground. Formally, a proposition denotes a set of possibilities, which are in turn a set of indices (possible worlds). The update process involves the standard elimination of indices that do not fall within any one of the possibilities for the proposition. A proposition is *inquisitive* if and only if it consists of more than one possibility to update the common ground, and it is *informative* if it eliminates at least one world from the common ground (Groenendijk and Roelofsen (2009)).

The core innovation of inquisitive semantics is its interpretation for disjunction, represented in figure (1). Whereas classically a disjunctive sentence of the form $p \vee q$ updates the common ground



(a) Classical disjunction (b) Inquisitive disjunction

Figure 1: Classical and inquisitive pictures for $p \vee q$

by eliminating indices where both p and q are false, in inquisitive semantics the disjunction is an inquisitive proposal with overlapping possibilities. Figure (1) represents two possibilities made up of those indices where p is true, and those where q is true, and thereby, also proposes to eliminate indices where p and q are both false.

As such, $p \vee q$ denotes a hybrid proposition that is at once inquisitive and informative.

Maximal possibilities So far we said that a proposition is a set of possibilities. Let us add the notion of a *maximal possibility*. A possibility ρ is maximal for a sentence φ iff there is no possibility ρ' for φ such that $\rho \subset \rho'$. As we will see in the remainder of this paper, the question of whether propositions should only denote their maximal possibilities or whether we should allow for non-maximal possibilities requires a careful treatment.

States and support A state is a set of indices. We use a state to indirectly define the proposition expressed by a sentence via the notion of support (Groenendijk and Roelofsen (2009)).

(1)
a. $\sigma \vDash \varphi$ iff $\forall i \in \sigma : i(p) = 1$
b. $\sigma \vDash \neg\varphi$ iff $\forall \tau \subseteq \sigma : \tau \nvDash \varphi$
c. $\sigma \vDash \varphi \vee \psi$ iff $\sigma \vDash \varphi$ or $\sigma \vDash \psi$
d. $\sigma \vDash \varphi \vee \psi$ iff $\sigma \vDash \varphi$ and $\sigma \vDash \psi$
e. $\sigma \vDash \varphi \rightarrow \psi$ iff $\forall \tau \subseteq \sigma :$ if $\tau \vDash \varphi$ then $\tau \vDash \psi$

Informative and Inquisitive meaning The meaning of a sentence φ, in notation, $[\varphi]$, simultaneously *provides* but also *requests* information. The information provided by $[\varphi]$ coincides with the set of indices that make the sentence true, in notation, $|\varphi|$. We call $|\varphi|$ the *truth-set* of φ. Alternatively, we write *info*(φ), defined as $\bigcup[\varphi]$ (Ciardelli (2009)). There is yet a third way of specifying the informative content of φ, namely, its double negation, $\neg\neg\varphi$. As discussed in Groenendijk and Roelofsen (2009), $\neg\varphi$ is never inquisitive, since it always denotes a single possibility, i.e. the set of indices where φ is false. Thus, applying negation twice gets us the union of the possibilities for φ, i.e. its informative content.

The inquisitive content of $[\varphi]$ can be defined in two different ways. In §4.3 below, we will evaluate both definitions. The first definition calls a sentence φ inquisitive if and only if there are at least two maximal possibilities for φ. That is, if the sentence proposes more than one way to update the common ground. The second definition calls a sentence φ inquisitive if and only if $|\varphi| \notin [\varphi]$. According to the second definition, a sentence is inquisitive just in case it requests more information than it provides.

Attentive content Ciardelli et al. (2009) appeal to an *unrestricted* inquisitive semantics in which a proposition does not only denote its maximal possibilities, but its non-maximal possibilities also.[1] As such, propositions do not only provide and request information, but they may also *draw attention* to certain possibilities. Ciardelli et al. (2009) argue that attentive content can be used to account for the semantics of *might* in English. We will say that φ is *attentive* if and only if $[\varphi]$ contains a non-maximal possibility.

2.2 First-order inquisitive semantics

Ciardelli (2009) embarks to construct, based on propositional inquisitive semantics, a first-order inquisitive semantics. He begins by making the simplifying assumption that our models all share the same domain $\mathcal{D}$ and the same interpretation I for all the constants and function symbols of our language $\mathcal{L}$.

Let $\mathbb{D}$ be such a fixed structure: we call a first-order model for $\mathcal{L}$ based on $\mathbb{D}$ a $\mathbb{D}$-*model*.

A *state* is defined as set of $\mathbb{D}$-*models*. A proposition is a set of maximal supporting states.

(2) Let s be a state and g an assignment function into $\mathcal{D}$.

a. $s, g \vDash \varphi \iff \forall M \in s : M, g \vDash \varphi$ *for* φ *atomic*

b. *Boolean connectives* $\iff$ *as in the propositional case*

c. $s, g \vDash \exists x\varphi \iff s, g[x \mapsto d] \vDash \varphi$ *for some* $d \in \mathcal{D}$

d. $s, g \vDash \forall x\varphi \iff s, g[x \mapsto d] \vDash \varphi$ *for all* $d \in \mathcal{D}$

Importantly, the existential behaves like disjunction: "it will only be supported in those states where a specific witness for the existential is known." We will refer to the first order inquisitive semantics in (2) as the MAX-restricted FOIS, as we are only interested in maximal supporting states by this definition.

[1] That is, with the exception of $\emptyset$, which is filtered out. See the original paper for discussion.

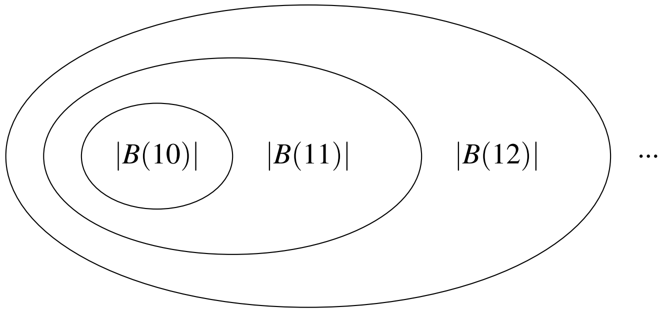


Figure 2: $[B(10)] \subset [B(11)] \subset [B(12)] \ldots$

3 Amending the semantics: the maximality problem

3.1 The maximality problem

As observed by Ciardelli (2009), the MAX-restricted FOIS gives rise to what we will refer to as the 'maximality problem'. Ciardelli uses the example in (3) to illustrate the problem, henceforth called the *boundedness formula*, which proposes a bound for some set P.

(3) $\exists x \in \mathbb{N}\ [\forall y \in \mathbb{N}\ [P(y) \to y \leq x]]$ abbr. $\exists x B(x)$

Ciardelli notes that (3) does not have a maximal supporting state, because for every state s that supports (3), we can find a superstate of s, call it s', such that s' also supports (3).[2] For example, consider a state that supports $B(10)$, i.e. 10 is a bound for P. This sentence will be supported at every index where 10 is a bound for P, and excludes all indices where 10 is not a bound for P, i.e. indices where the extension of P includes numbers greater than 10. Now consider the sentence $B(11)$. Clearly, every index that makes $[B(10)]$ true, also makes $[B(11)]$ true. However, there will be indices where $[B(11)]$ is true, while $[B(10)]$ is not. As such, any state supporting $B(10)$ also supports $B(11)$, and not the other way around. Therefore, $[B(10)]$ cannot be considered as an alternative to $[B(11)]$, as the former is properly included in the latter. Now, in the case of the boundedness formula, for every witness that we consider, we will always find a state that properly includes the possibility for that witness. Given the infinity of $\mathbb{N}$, the formula does not have a maximal supporting state. And so the formula denotes the empty set! See figure 2 for an illustration.

In conclusion, given our MAX-restricted FOIS, the boundedness formula yields the empty proposition, as it has no maximal supporting state. Ciardelli rightly observes that something has gone amiss:

> Let us meditate briefly on this example. [...] The existential quantifier [...] is designed to be satisfied only by the knowledge of a concrete bound, just like in the propositional case a disjunction [...] is designed to be satisfied only by the knowledge of a disjunct.

[2]See Ciardelli (2009) for a formal proof.

> Therefore, what we would expect from the boundedness formula is a hybrid behaviour: of course, it should inform that there is an upper bound to *P*; but it should also raise the issue of *what* number is an upper bound of *P*.

According to Ciardelli, the boundedness formula should not yield the empty proposition, because (i) we expect it to be *informative*, informing us that there is an upper bound to *P*, and (ii) we expect it to be *inquisitive*, raising the issue *what* number is an upper bound to *P*. Ciardelli concludes that the requirement that states in a proposition be maximal should be dropped.

While we agree with (i), we wish to argue against the expectation in (ii), as we believe that Ciardelli's motivation for the expected inquisitivity of the boundedness formula rests on a misconception. We will return to expectation (ii) in section 4.3, where we will argue that the boundedness formula is *not* expected to be inquisitive. But let us not worry about that detail quite yet, and tackle the worry raised by (i).

3.2 Candidate solution 1: Unrestricted FOIS

As Ciardelli remarks, the most straightforward solution to the maximality problem is to drop the requirement that the states in a proposition be maximal. So the definition of 'proposition' becomes as follows:

(4) $[\varphi]$ is the set containing all (maximal and non-maximal) states that support φ.

We will call this the *unrestricted* FOIS, although Ciardelli reserves this name for another system, which we will discuss further below.[3] We will shortly see that the system Ciardelli calls 'unrestricted' is in fact more restricted than the unrestricted FOIS presently under discussion.

Since the definition of 'proposition' in unrestricted FOIS does not rule out any states, all supporting states are maintained in the case of the boundedness formula (which, consequently, will contain infinitely many states). As a result, $\text{info}(\exists x B(x))$ contains all worlds in which there is an upper bound for *P* - this is exactly the informative content we would expect of the boundedness formula. Hence, unrestricted FOIS complies with Ciardelli's first desiderata in (i).

3.2.1 The maximality problem partially unresolved

But the unrestricted FOIS leaves Ciardelli's second worry unsolved, namely, the expectation that the boundedness formula should raise the issue as to which number is a bound. After all, in the unrestricted system, the proposition expressed by the boundedness formula now contains not only one supporting state for each number (i.e. each possible response), but it also contains every substates for each possibility. In other words, the boundedness formula's proposition is the powerset of the formula's informative content. As such, it is not exactly clear *what* issue the boundedness formula raises in the present setting. This becomes especially apparent in the following example,

[3] The difference lies in the treatment of atomic sentences, which, in Ciardelli's system is restricted to atom's truth-set. By contrast, we here even allow for any substate of the atom.

taken from Ciardelli (2009). Consider the boundedness formula with the additional constraint that the bound be non-zero. Think of this formula as the counterpart of the interrogative sentence "what is a non-zero bound for P?":

(5) $\exists x \in \mathbb{N}\ [\forall y \in \mathbb{N}\ [P(y) \rightarrow y \leq x] \wedge x \neq 0]$ abbr. $\exists x(B(x) \wedge x \neq 0)$

We will call this the *non-zero boundedness formula*. Crucially, the original–unconstrained– boundedness formula is truth-conditionally equivalent to the non-zero boundedness formula.[4] If there is a bound, then there is a non-zero bound; and vice versa, if there is a non-zero bound, then there is a bound. Therefore, the boundedness formula and the non-zero boundedness formula are supported by the same states. Hence, they both yield the same proposition.

The problem arises, as Ciardelli makes clear, that while the formulas yield identical propositions, we have the strong intuition that while "zero!" resolves the issue to "what is a bound for P?", it is entirely unacceptable as an answer to "what is a non-zero bound for P?". By Ciardelli's diagnostic, this problem poses a challenge for a support-based definition of inquisitive content. Instead, he considers two new definitions for a first-order inquisitive semantics, given below, both of which bypass the notion of support by giving a direct, recursive definition of propositions. We will call these 'atom-restricted FOIS' (what Ciardelli calls 'unrestricted' semantics), in which the propositions of atomic formulas are restricted to maximal states, and 'NOD-restricted FOIS' (Ciardelli's 'restricted' semantics), in which propositions are restricted to non-optimally dominated supporting states.

3.3 Candidate solution 2: Atom-restricted FOIS

In order to better capture inquisitive content, Ciardelli proposes what we call 'atom-restricted FOIS'. Ciardelli called this system 'unrestricted semantics', which is an unhappy choice because atomic formulas are still restricted by the maximality of the supporting states (hence the name). Atom-restricted semantics bypasses the notion of support, defining propositions directly in terms of other propositions, as follows:

(6) Atom-restricted-FOIS

a. $[p] = \{|p|\}$ *if* $p \in \mathcal{P}$

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

c. $[\varphi \vee \psi] = ([\varphi] \cup [\psi])$

d. $[\varphi \wedge \psi] = \{s \cap t \mid s \in [\varphi] \text{ and } t \in [\psi]\}$

e. $[\varphi \rightarrow \psi] = \{\Pi_f \mid f : [\varphi] \rightarrow [\psi]\}$,

where $\Pi_f = \{w \in \omega \mid \textit{for all } s \in [\varphi], \textit{ if } w \in s \textit{ then } w \in f(s)\}$

[4]The same argument applies to other variants of the non-zero boundedness formula, e.g. what is an *even* bound for *P*?

f. $[\exists\varphi]_g = \bigcup_{d\in\mathcal{D}}[\varphi]_{g[x\mapsto d]}$

g. $[\forall\varphi]_g = \{\ \bigcap_{d\in\mathcal{D}} s_d \mid s_d \in [\varphi]_{g[x\mapsto d]}\}$

While the semantics for Atom-restricted FOIS have been formulated without a notion of support - indeed, the non-zero boundedness formula is taken by Ciardelli as evidence against the notion of support - a suitable notion of support can be defined. It must capture the single difference between atom-restricted FOIS and unrestricted FOIS: in the atom-restricted FOIS, atomic formulas denote only their maximal supporting state (hence the name). Translating this into the notion of support, the only part of the definition of support that needs to be changed with respect to the old notion is the part concerning atomic formulas: a state supports an *atomic* formula only if it is a *maximal* state in which the formula is true; for other formulas, support remains the same: TODO: add the clauses for negation, implication, universal.

(7) a. $\sigma, g \vDash \varphi \Longleftrightarrow \sigma = |\varphi|$ *for* φ *atomic*

b. $\sigma, g \vDash \varphi \vee \psi \Longleftrightarrow \sigma, g \vDash \varphi$ or $\sigma, g \vDash \psi$

c. $\sigma, g \vDash \varphi \wedge \psi \Longleftrightarrow \exists\sigma'\exists\sigma''$ s.t. $\sigma', g \vDash \varphi$ and $\sigma'', g \vDash \psi$ and $\sigma = \sigma' \cap \sigma''$

d. $\sigma, g \vDash \exists x\varphi \Longleftrightarrow \sigma, g[x \mapsto d] \vDash \varphi$ for some d$\in \mathcal{D}$

As in the unrestricted case, the proposition of a formula is simply the set of states that support the formula: $[\varphi]_{g,\tau} = \{\sigma |\ \sigma, g \vDash_\tau \varphi\ \}$

An advantage of having a notion of support underlying the semantics, is that we can see whether the atom-restricted FOIS makes sense by interpreting this notion of support. It no longer captures only knowledge, like the old notion - after all, such an interpretation of the new notion of support would mean that an atom φ would not be known in any of the proper substates of $|\varphi|$, and that is of course not true. If a state s' supports φ, that means s' can be reached from the current state s by updating s with φ and resolving any issue raised by φ in s. In other words, if a state s' supports φ, it means that accepting and resolving φ in the current state s is *sufficient* for reaching s'. For an atom φ, every substate of the state that supports φ cannot be reached by only updating with φ, for it requires additional information. For an inquisitive formula, each particular way of resolving it may be sufficient for a different state, and it is irrelevant whether and how these states overlap (unlike in the MAX-restricted FOIS, in which only maximal states are maintained). With this notion of support, a formula denotes the set of states that can be reached by accepting and resolving it in the current state.

TODO: Possibly interesting stuff: Discuss that it is a departure from classical logic - inf and inq no longer exhaust meaning. $(p \vee q) \wedge (p \vee q)$ (perhaps weakened case of pairwise intersection? Jeroen? - mention attentive content here. Is it to be expected that the notion of 'sufficient knowledge' does not behave classically? Yes, obviously, pairtwise intersection is non-classical. Grmlm. BUT: inquisitive and informative content may still behave classically. $[(p \vee q) \wedge (p \vee q)]$ contains not only $|p|$ and $|q|$, but also $|p \wedge q|$ - that is the non-classical part. But from this perspective, it makes sense: accepting and resolving the first conjunct, followed by accepting and resolving the second conjunct.

3.4 Candidate solution 3: NOD-restricted FOIS

Ciardelli then constructs a more conservative extension of propositional inquisitive semantics: a first-order semantics in which quantifier-free formulas behave classically. He calls this system ‘restricted semantics’, but we will call it ‘NOD-restricted FOIS’ in order to contrast it with the two other restricted semantics (MAX-restricted FOIS and atom-restricted FOIS). Like the definition of atom-restricted FOIS, this definition bypasses the notion of support. Also like atom-restricted FOIS, the propositions of atomic formulas are restricted by the maximality of supporting states. However, unlike atom-restricted FOIS, the propositions of non-atomic formulas are restricted by the notion of ‘non-optimal dominance’ (NOD) as follows:

(8) Atom-restricted-FOIS

a. $[\varphi]_g = \{|\varphi|_g\}$ *if* φ *is atomic*

b. $[\bot]_g = \{\emptyset\}$

c. $[\varphi \vee \psi]_g = \textsc{Nod}([\varphi]_g \cup [\psi]_g)$

d. $[\varphi \wedge \psi]_g = \textsc{Nod}\{s \cap t \mid s \in [\varphi]_g \text{ and } t \in [\psi]_g\}$

e. $[\varphi \to \psi]_g = \textsc{Nod}\{\Pi_f \mid f : [\varphi]_g \to [\psi]_g\}$

f. $[\exists\varphi]_g = \textsc{Nod}(\bigcup_{d \in \mathcal{D}} [\varphi]_{g[x \mapsto d]})$

g. $[\forall\varphi]_g = \textsc{Nod}\{\bigcap_{d \in \mathcal{D}} s_d \mid s_d \in [\varphi]_{g[x \mapsto d]}\}$

As before, we can try and define a notion of support to go with these semantics. The notion of support will be identical to atom-restricted FOIS, except for the support-definition for inquisitive formulas. In this case, a state s supports an inquisitive formula φ if it is a possible resolution for φ (as before), with the additional constraint that none of the other possible resolutions for φ that contain s may be maximal. Hence, in order to compute whether a certain state supports an inquisitive formula φ, one has to investigate all other states that potentially support φ. We believe this is less pretty than the notion of support underlying atom-restricted FOIS - whether a state supports a formula can no longer be determined ‘locally’.

The main advantage that Ciardelli believes NOD-restricted FOIS has over atom-restricted FOIS is that in the NOD-restrictef FOIS, any quantifier-free formula behaves as in the propositional case. In other words, NOD-restricted FOIS is a more orthodox extension of propositional inquisitive semantics. However, we believe that it is undesirable for a propositional connective to behave differently when combined with a quantifier. For instance, while $[(p \vee q) \wedge (p \vee q)]$ does not contain $|p \wedge q|$ (i.e. as in the propositional case, it is equivalent with $[p \vee q]$), $|p \wedge q|$ does come out as a possible resolution when embedding $[p \vee q]$ within the proposition of the boundedness formula. For instance, if we know that whenever p or q, then P is empty, then $(\exists x B(x) \vee (p \vee q)) \wedge (\exists x B(x) \vee (p \vee q))$ is not equivalent with $\exists x B(x) \vee (p \vee q)$: the former contains $|p \wedge q|$ as an extra possibility. TODO: maybe a picture here

More generally, the NOD-restricted FOIS discriminates between finite and infinite propositions in a way that we think is *ad-hoc* and has nothing to do with informative or inquisitive content.

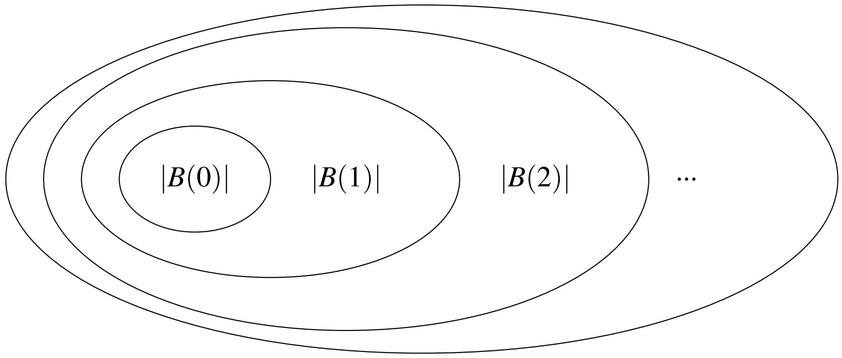


Figure 3: $[\exists x B(x)]$

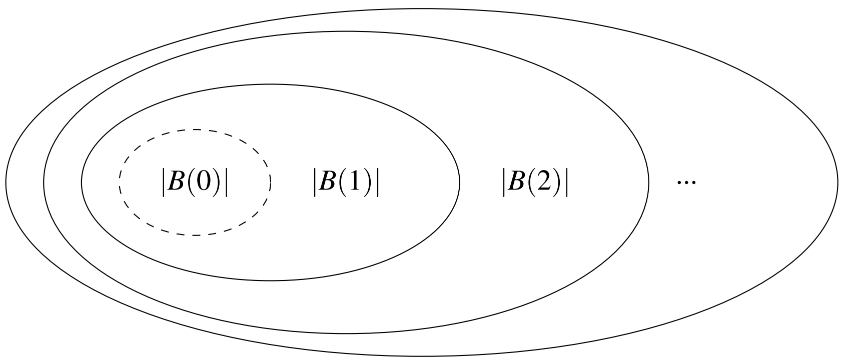


Figure 4: $[\exists x B(x) \& \ x \neq 0]$

Somehow, for $\exists x B(x) \wedge x < 999$ all the inner states are irrelevant, while for $\exists x B(x)$ they are all maintained. The same issue will surface when discussing definitions of inquisitivity, in section 4.3, and we postpone a further discussion of it to that section.

Setting aside the possible advantages and disadvantages of the last two candidates - atom-restricted FOIS and NOD-restricted FOIS - do they actually solve the problem they were designed to solve, i.e. explain why "zero!" is not a possible answer to "what is a non-zero bound for P?"? At first sight (figures 3.4 and 3.4), yes: both candidates assign a different proposition to the boundedness formula than to the non-zero boundedness formula: the non-zero boundedness formula lacks the smallest (inner) supporting state. However, upon closer examination, the proposition assigned by both semantics to the non-zero boundedness formula in fact does not rule out "zero!" as an answer - it is overinformative, but acceptable nonetheless. So what is going on?

4 Inquisitive content

Let us start this section with a short summary. So far, we have seen four definitions for first-order inquisitive semantics. In the MAX-restricted FOIS, the boundedness formula undesirably yields the empty proposition. In the unrestricted FOIS, the boundedness formula is informative in the right way, but from its proposition it is unclear what issue it raises - e.g. its proposition is identical to the proposition of the non-zero boundedness formula, which Ciardelli claims has a different inquisitive content. In both atom-restricted FOIS and NOD-restricted FOIS, the propositions for these formulas are different, but not in a way that explains the contradictory nature of "zero!" as an answer to the non-zero boundedness formula. In this section, we attempt to clean up the landscape.

4.1 Why the unacceptability of "zero!" is not due to inquisitive content

The formula to which an answer like "zero!" corresponds is underspecified. A number on its own is not a valid formula in the logical language. Instead, the meaning assigned to "zero!" is saturated by its linguistic context. Here are some illustrative examples.

(9) a. A: How many children do you have? / B: Zero! (= I have zero children)
    b. A: What is your favourite number? / B: Zero! (= Zero is my favourite number)
    c. A: What is the current temperature? / B: Zero! (= Zero is the current temperature)

Regardless of what kind of syntactic analysis one wishes to apply to B's answers, we must acknowledge that the semantic content of a sentence fragment is sensitive to its discourse context. From this perspective, what does the non-zero bound problem look like?

(10) a. A: What is a bound for P? / B: Zero! (= Zero is a bound for P)
    b. A: What is a non-zero bound for P? / B: # Zero! (= Zero is a non-zero bound for P)

Once we have fully spelled out the "zero!"-answers, it becomes clear what has gone wrong in (10b): "zero is a non-zero bound for P!" is contradictory, *regardless of the issue it is meant to resolve*. The contradictory nature of this answer is completely independent of the semantics of the questions. As such, we do not find the argument strong enough as a motivation to replace the unrestricted FOIS by either one of the atom-restricted or the NOD-restricted FOIS. The non-zero bound problem, we argue, is really a linguistic problem.

But perhaps Ciardelli's argument can be saved, if the boundedness formula and the non-zero boundedness formula differ in some other way in their range of possible answers. Consider first the non-zero boundedness formula answered with "zero is a bound" ($B(0)$). This answer is not contradictory like the underspecified "zero!" - rather, it is overinformative: it resolves the issue, but there are safer answers available. To indicate the overinformativeness, it is natural to mark it with "well" as in (11a), analogously to (11b):

(11) a. A: What is a non-zero bound for P? / B: Well, zero is a bound for P.
    b. A: Is it rainy or sunny? / B: Well, it is rainy *and* sunny.

In both cases, B is not being annoying or contradictory, but simply very helpful.

But if we take 'overinformative' to mean 'providing more information than required to resolve the issue', then, in a similar fashion, *all* answers to the non-zero boundedness formula are overinformative. For any number you give as an answer, you could have given infinitely many less informative, safer answers with a higher number, which would successfullu resolve the issue. Indeed, it seems natural to precede *any* answer to the interrogative "what is a non-zero bound for P?", marked with "well" (12), suggesting that the answer is non-compliant. Likewise, for the original boundedness formula (13).[5]

(12) A: What is a non-zero bound for P? / B: Well, eight is a non-zero bound for P.

(13) a. A: What is a bound for P? / B: Well, zero is a bound for P.

b. A: What is a bound for P? / B: Well, eight is a bound for P.

If there is no difference in essence to B's answer in (11a) and B's answers in (12) and (13) - i.e. they are all compatible but overinformative - then there is no reason why the boundedness formula and the non-zero boundedness formula should denote different propositions. As a result, there is no reason (at least as far as inquisitive content is concerned) for replacing unrestricted FOIS by atom-restricted FOIS or NOD-restricted FOIS, as Ciardelli proposes.

So far we have argued that, even if the boundedness formula is expected to be inquisitive, then the non-zero bound problem is not caused by a 'wrong' implementation of inquisitive content. We think, however, that a more pressing question at this stage is: should the boundedness formula *really* be considered inquisitive at all?

4.2 Why the boundedness formula *need not be* inquisitive

What motivation does Ciardelli offer for the expected inquisitivity of the boundedness formula? He argues that we expect the boundedness formula to be inquisitive, because the existential quantifier is designed to be satisfied only by the knowledge of a concrete bound. We have our reservations about the strength of this motivation. For while disjunction and (its higher-order counterpart) existential quantification are a *source* of inquisitivity, they are (obviously) not *sufficient conditions* for inquisitivity: not every formula that contains a disjunction or an existential quantifier is inquisitive. For instance, $p \vee (p \wedge q)$ is not inquisitive; it has only one maximal supporting state (or, using definition 1, it contains its own informative closure). There should be nothing surprising about some disjunctive formulas being non-inquisitive, nor does their existence mean that our semantics is wrong.

Note that natural language intuitions cannot be of any assistance here: See section 5 below.

While for us this settles the issue - there is no reason why the boundedness formula should be inquisitive - we believe the following perspective may be insightful. The inquisitivity of a formula is always evaluated relative to a state. For instance, $p \vee q$ is not inquisitive in a state where $p \rightarrow q$ is

[5] In these cases, overinformativity marking with "well" seems to be optional, but this - we will propose later - has to do with the availability of a pragmatically strengthened reading.

known, because in such a state the possibility for p is included in the possibility for q. If the state is not made explicit, this comparison state is taken to be the *ignorant state* ω. Hence, one could say that whenever a potentially inquisitive formula (i.e. a formula with an existential quantifier or a disjunction) turns out to be non-inquisitive, it must be the case that the state against which its inquisitivity is evaluated is not entirely ignorant. For instance, consider the formula $\exists x(2+2=x)$, which will not be inquisitive with respect to ω, since in every world in ω 2 + 2 yields the same sum. This would be different, of course, were we to allow for 'mathematically impossible worlds' in ω (e.g. worlds where 2 + 2 =5), due to which the formula *would* become inquisitive. Similarly, the boundedness formula is not inquisitive in a state where the ordering relation on $\mathbb{N}$ is held constant, which we assume for ω. For in all mathematically possible worlds, knowing one bound results in knowing all higher bounds, and the boundedness formula yields the set of nested supporting states and comes out as non-inquisitive. Note that if we populate ω with worlds where the ordering relation on $\mathbb{N}$ does not hold, then the boundedness formula does come out inquisitive, as each supporting state for a witness will no longer conform to the nested structure. To wrap up: the fact that the boundedness formula comes out as non-inquisitive is not due to a defect in the semantics, but because the 'ignorant' state ω is not truly ignorant.

4.3 Why the boundedness formula *is not* inquisitive

TODO: Add an 'apart from definitions' to the previous section. Of course, the question whether the boundedness formula is or is not inquisitive is really a question regarding the definition of inquisitivity. Two definitions have been proposed. According to one, it is inquisitive; according to the other, it is not. Hence, deciding which of the definitions is the right one will suffice to reveal whether the boundedness formula is inquisitive.

The first definition of inquisitivity comes from Groenendijk and Roelofsen (2009).

(14) A sentence φ is inquisitive if and only if $[\varphi]$ contains at least two maximal states.

(14) captures the effect of an inquisitive sentence on the common ground. Accordingly, an inquisitive sentence proposes *alternative* ways to update the common ground. Inherent to inquisitive semantics is the notion that proposing maximal alternative substates on the common ground requires that the addressee choose one of the alternatives. As such, (14) highlights the philosophical underpinning of the inquisitive turn as the view that language use is about information *exchange*. (14) allegedly faces a problem concerning the boundedness formula (Ciardelli 2009) discussed above. If we want the boundedness formula to be *inquisitive*, then it falls hopelessly short of (14), since the boundedness formula does not have a maximal possibility.[6]

The second definition of inquisitivity comes from Ciardelli (2009).

(15) A sentence φ is inquisitive if and only if $|\varphi| \notin [\varphi]$.

[6]Of course, if we disregard the expectation that the boundedness formula should be inquisitive, then (14) is quite satisfactory.

According to (15), if the informative content of a sentence is not included in the proposition expressed by the sentence, then it is inquisitive. Or, in other words, a sentence is inquisitive just in case it requests more information than it provides. First, notice that definition (14) could be called 'constructive' analogously to 'constructive' proofs in mathematics: it tells you not only whether a formula is inquisitive, but also, if it is, what issue it raises: it requests information to establish one of the formula's maximal supporting states. Definition (15), on the other hand, is not constructive: it tells you whether a formula is inquisitive, but not what issue it raises. Are all the states in a proposition part of a raised issue, or only a selected few of them? This is a question that definition (15) leaves unanswered. Our suggested answer would be 'only maximal states are part of the raised issue', but that would yield an account of inquisitivity according to which sentences can raise an issue without any alternatives to choose from... Setting aside this issue, let us consider what definition (15) as such gives us.

This definition of inquisitivity covers the following (and only the following) three cases:

i) Formulas that yield propositions with *alternative* supporting states.

ii) Formulas that yield propositions with *no* supporting states at all.

iii) Formulas that yield propositions with an *infinite* number of supporting states, none of which is maximal

The most prototypical case of inquisitivity is (i), and it is also (and only) covered by (14). Case (ii) expresses the fact that non-proposals are inquisitive. It is a rather strange case to include in a definition of inquisitivity, even if only as an unintended side effect. In the MAX-restricted FOIS, i.e. the orthodox extension of the propositional case with which we commenced our quest, this definition would have ruled in the boundedness formula as inquisitive. It just wasn't *the right kind of inquisitivity*. Of course, empty propositions may be ruled out by adding a clause to the definition of 'proposition', but that changes nothing about the fact that this definition of inquisitivity *an sich* considers non-proposals (wherever they be) to be inquisitive. Perhaps the empty proposition could be reserved for non-sensical utterances in natural language, such as (16).

(16) Colorless green ideas sleep furiously.

This sentence has been traditionally analysed as non-sensical and lacking a truth value. If this is a proper analysis, and if non-sensicality amounts to failing to make a proposal, whether informative or inquisitive, then this would be an example of a sentence that is inquisitive according to definition (15).

Case (iii) deals with the boundedness formula and its relatives. Indeed, the switch from definition (14) to definition (15) was intended in part to rule the boundedness formula as inquisitive (even though it need not be, as discussed in the previous subsection). But we believe a strong objection to (15) is precisely case (iii): it discriminates between finite and infinite propositions. For instance, $\exists xB(x)$ would be inquisitive while $\exists xB(x) \wedge x < 1000$ would not be inquisitive, because it contains a maximal possibility (namely $|B(999)|$) and as a result it contains its own informative content. According to definition (14), on the other hand, both kinds of formulas come out as non-inquisitive -

a uniformity that we believe is desirable. From a more epistemic perspective, it seems wrong to let a notion of inquisitivity depend so strongly on whether a proposition is infinite. Any agent dealing with the real world needs to be pragmatic anyway, ignoring irrelevant possibilities for efficiency reasons (e.g. ignore all $B(x)$ for $x > 20$ if the agent knows the set P represents John's roommates - no one has more than 20 roommates). Similarly, any agent dealing with the real world will never be able to compute all possible supporting states, and will never know for sure whether there is a maximal state - but does that mean that for this agent all formulas are inquisitive?

Similarly, case (iii) discriminates between 'at most' and 'at least', which becomes apparent if we consider the following two formulas.

(17) a. $\exists x John - read - books - amount(x) \wedge x > 3$
b. $\exists x John - read - books - amount(x) \wedge x < 3$

While (17a) lacks a maximal possibility (just like the boundedness formula), (17b) does not. The maximal possibility for (17b) is the possibility containing indices where John read four or less books. According to (15), (17a), but not (17b), is inquisitive.

It might be insightful to look at the following (approximate) natural language paraphrases of both formulas:

(18) John read at least three books.

(19) John read at most three books.

Surely if 'Yes, four books!' is a felicitous response to (18), then so is 'Yes, two books!' to (19). Although the mapping from inquisitive logic to natural language may be non-trivial, we believe it would be a waste if the similarity between both natural language sentences would not in some way be reflected by a similarity between both logical formulas.[7] According to (14), neither formula is inquisitive, since the propositions expressed by (17a) and (17b) each have less than two maximal states.

In sum, we believe definition (15) should be abandoned and definition (14) reinstated. [8] Now, let us go back to the maximality problem. If we adopt, as we have tried to argue in favor of, definition (14) of inquisitivity, then the boundedness formula and its relatives (e.g. the non-zero boundedness formula) do not come out as inquisitive. As a result, the difference between e.g.

[7] We do not claim that these natural language sentences raise an issue - the point we are making is orthogonal to that.

[8] Apart from (14) and (15), we point out the possibility for an informal, non-semantic definition of inquisitive meaning for natural language that the literature implicitly endorses: a sentence is inquisitive if and only if it requests information. We have our reservations about definitions of this sort, since our pre-theoretic linguistic intuitions about whether a sentence *requests* information is not fine-tuned. In fact, were we to endorse such an informal definition, then we might be hard-pressed not to call sentences like (1) inquisitive, since declarative sentences in natural language are not generally used to request information.

(1) Alf or Bea is coming to the party.

But the inquisitive turn relies precisely on examples like (1) for lift-off. And the logical intuition here is that a sentence with disjunction proposes alternative possibilities the common ground may be updated with (as per (14)).

the boundedness formula and the non-zero boundedness formula does not reflect a difference in inquisitive content (as we already hinted at in section 4.1).

5 $\exists$, $\vee$, and inquisitive meaning

In this section, we tackle some natural language examples as an an empirical test-bed to evaluate our notion of inquisitivity, but also to gain a better understanding of the difference between inquisitive meaning on the one hand, and raising issues on the other.

The inquisitive turn views sentences as making proposals that serve the dual function of simultaneously providing information, but also requesting information. Traditionally, in the grammar of natural languages, declarative sentences are considered to perform the former function, while interrogative sentences perform the latter. The inquisitive turn challenges this simple division of labour between grammatical sentence-types by observing that declarative sentences containing disjunction or indefinites also have the potential to request information.[9] In this section, we investigate the relationship between inquisitive meaning and requesting information.

5.1 Inquisitive meaning and scope

5.1.1 Generics/habituals

Inquisitive semantics identifies disjunction and indefinites as the *source* of inquisitive meaning. Now consider the following sentences, under the reading where 'or' in (20) and 'a movie' in (21) take scope *under* the adverbial.

(20) After dinner, John smokes a cigarette or drinks a martini.

(21) On Fridays, Liesolette watches a movie.

Somewhat simple-mindedly, we might want to say that inquisitive semantics predicts (20) and (21) to be inquisitive, since they contain disjunction and indefinites. However, from a purely intuitive perspective on language use, neither sentence seems to request any information. In other words, the sentences do not seem to give rise to any issues. We observe this by the infelicity of the responses in (22) and (23).

(22) a. A: After dinner, John smokes a cigarette or drinks a martini.
b. B: # Yes, he drinks a martini!

(23) a. A: On Fridays, Liesolette watches a movie.
b. B: # Yes, The Titanic![10]

[9] Another question worth considering is whether interrogative sentences can ever be informative, and to provide a formal explanation for why they are strictly more demanding.

[10] Of course, if Liesolette does indeed have the habit of typically watching the Titanic on Fridays, then B's response is OK. But for the sake of these examples, we are not interested in the wide-scope reading of the indefinite or disjunction.

We observe that B's response in the examples above are not only infelicitous (insofar as they appear to provide an unsolicited resolution), but that they also violate other principles of conversation. In the case of (22), B's response is under-informative, and in (23), B's response is (potentially) false.

Let us see why B's response in (22) is under-informative. If John has the disposition to smoke cigarettes or drink martinis after dinner (the content of A's assertion), then John must be disposed to smoking cigarettes *and* drinking martinis after dinner. John need not (and the sentence seems to implicate that he does not) indulge in his smoking *and* his drinking habits after every (typical) dinner event. But for any (typical) dinner event, both dispositions are a possibility. As such, the sentence has a conjunctive interpretation. And yet, this interpretation is quite unlike (24).

(24) After dinner, John smokes a cigarette and drinks a martini.

What (24) seems to say is that every typical after-dinner-event for John is one in which he smokes a cigarette *and* drinks a martini. This is not what (20) says. (20) allows for after-dinner events where John consumes either one of cigarettes or martinis and not the other. Not so for (24). But crucially, (20) is *false* if John only smokes cigarettes and does not drink martinis after every typical dinner.

Now, since the information contained in B's response in (22) is only a subset of the information that A provides, B's response cannot even be taken to *confirm* what A is proposing. As such, given the information contained in A's assertion, B's response is both redundant, but also under-informative.

In the case of B's response in (23), things are a little different. This time, B's response can be plain false (again, excluding the wide-scope interpretation of the indefinite). So unlike the case of disjunction, where stating only one of the disjuncts would be under-informative, in the case of (23), providing an explicit witness in the context of a habitual sentence could make the sentence false. Liesolette may very well be disposed to watching movies on Fridays without ever having watched the Titanic, rendering B's response false. In the case of (22), John cannot be disposed to smoking or drinking without ever drinking.

As a starting hypothesis, we may want to say that inquisitive meaning arises only from wide-scope disjunction or indefinites. In (20) and (21), the disjunction and indefinites fall within the scope of a generic-like operator (i.e. the adverbials) that retards an inquisitive interpretation. Let us now take a closer look at this hypothesis.

5.1.2 Wide *vs* narrow scope inquisitives

If the scope of an indefinite (or disjunction) determines inquisitive meaning, this would predict only the wide-scop reading of 'a girl' in (25) to yield an inquisitive interpretation.

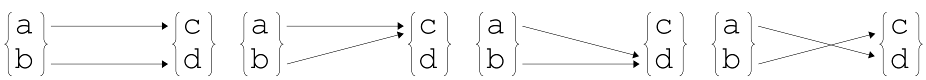
(25) Every sailor loves a girl.

(26) a. $\exists y[Girl(y) \& \forall x[Sailor(x) \rightarrow Loves(x,y)]]$

b. $\forall x[Sailor(x) \rightarrow \exists y[Girl(y)\ \&\ Loves(x,y)]]$

Intuitively, (26) seems to confirm our hypothesis. The wide-scope reading of the indefinite behaves inquisitively insofar as it gives rise to the question who this girl is whom every sailor loves. But what about the narrow-scope reading of the indefinite? Does this reading also invite a response? Well, it turns out that (26b) is also inquisitive by either definition of inquisitivity discussed above (whether or not it invites a response). For let us restrict ourselves to a model $\mathcal{M}$, wherein our domain of sailors consist of {a, b}, and our domain of girls {c, d}. Now, what are the possibilities that make (26b) true? Well, every possibility we get from the set of functions that map each sailor to a girl.

(27) $[(26b)]^{\mathcal{M}} = \{\rho |\ \rho \in \{f | \{a,b\} \rightarrow \{c,d\}\}\}$
$= \{\rho |\ \rho \in \{\{\langle a,c\rangle, \langle b,d\rangle\}_{f1}, \{\langle a,d\rangle, \langle b,c\rangle\}_{f2}, \{\langle a,c\rangle, \langle b,c\rangle\}_{f3}, \{\langle a,d\rangle, \langle b,d\rangle\}_{f4}\}$



The same is true of course for narrow scope disjunction. e.g. Every sailor loves beef or chicken. There are four alternative possibilities that will make this sentence true. For comparison, note that sentences like (28) and (29) are never inquisitive, in that their maximal possibilities will always be at most one, i.e. there is only one way in which the the proposition in (28) or (29) can be realized.

(28) Every sailor loves every girl.

(29) Every sailor loves beef and chicken.

The semantic analysis that we propose for indefinites below will depart slightly from our observations at this point. In fact, we will go as far as to say that the semantics of indefinites involves non-inquisitive closure. Our treatment will thus distinguish sentences such as the one in (25), from their interrogative counterparts, such as (30).

(30) a. Which girl does every sailor love?
b. Which sailors love which girls?

At this point, we cannot really tell how scope affects inquisitive behavior. For example, narrow-scope indefinites are predicted to be inquisitive, since the proposition they express denotes several different possibilities. However, as we will see below, the narrow-scope reading of a disjunctive sentence gives rise to a different pragmatic behavior than its wide-scope reading. We still need to uncover the systematic pattern underlying these examples. In the following section, we look at the principle of inquisitive sincerity (Groenendijk and Roelofsen 2009) and try to use the principle as a yard stick to discriminate amongst sentences that raise issues, and those that do not. We also investigate the behavior of interrogative pronouns and probe them for inquisitive meaning alongside indefinites and disjunction.

6 Advancing an inquisitive semantics for indefinites

What we ultimately want is a compositional inquisitive semantics for natural language interrogative and indefinite noun phrases. We want to ground inquisitive meaning in these lexical items (since they are logically associated with the existential quantifier), but we also want our semantics to articulate the (contrasting) discourse behaviour of these items. In this section, we investigate the relationship between indefinite and interrogative NPs, and their similarity and differences with natural language 'or'. For the sake of exposition, we find it convenient to revert to a support-based semantics. Therefore, to side-step the difficulties that *support* gives rise to in the first-order case, we will assume a finite domain.

6.1 Indefinite-interrogative affinity

It is already widely recognized that in many languages indefinite and interrogative NPs are morphologically closely related (what Haida (2008) calls the "indefinite-interrogative affinity".) This view is consonant with the inquisitive philosophy, since $\exists$ is closely affiliated with indefinites, and is also the source of inquisitive, and hence, interrogative meaning. We want, therefore, to examine just how we can harness $\exists$ in our semantic representation of both indefinite and interrogative NPs.

6.1.1 Knowing who *vs.* knowing someone

We begin by taking note of the major differences between indefinite and interrogative NPs. For illustrative purposes, we use *who* and *someone*.[11] Our first observation is that, when embedded under the attitude verb 'to know',[12] *who* and *someone* minimally differ in the following way: for a state to support the sentence 'who came', it is necessary that the set of individuals who fall into the extension of the predicate remain uniform at every index in the state. This constraint is relaxed for 'someone came'. The minimal requirement for a state to support 'someone came' is that the extension of the predicate be non-empty at every index. That is, the set of individual witnesses may differ at each index. We illustrate this observation in (31) and (32) below.

(31) a. I know who came . . . # but I don't know who!
     b. $\sigma \models \text{Who came} \iff \exists x : \forall i \in \sigma : came'(x)(i)$

(32) a. I know someone came . . . but I don't know who!
     b. $\sigma \models \text{Someone came} \iff \forall i \in \sigma : \exists x : came'(x)(i)$

Our observations in (31) and (32) lead us to conclude that the interrogative pronoun 'who' is more restrictive, or *demanding* than the indefinite 'someone'. We will see the consequences of this

[11] For the time being, we are glossing over the distinct syntactic structure of interrogative *vs* indefinite NPs.

[12] We are making the assumption here that inquisitive *support* models the meaning of natural language 'know': much in the same way that supporting an inquisitive formula comes down to supporting one of its resolutions, knowing a question comes down to knowing the answer to the question.

property in the remaining data. But before we go on, it is worthwhile to compare this behavior of 'who' and 'someone' with 'or'.

A digression on 'or' Recall that a state supports a disjunction if and only if it supports either one of the disjuncts. We would expect then that the sentence $K_x(\varphi \vee \psi)$, x knows φ or ψ, to be to be supported in x's state, if $K_x(\varphi)$, x knows φ. Much like knowing a question means knowing the resolution to the question, we expect things to work the same way in the case of natural language 'or'. So if knowing that Bill came qualifies me to utter I know who came, I should also be qualified to utter I know Bill or Sue came. (33) shows that our expectation does not quite meet the data.

(33) a. I know Bill or Sue came. . . . # Bill came!
  b. I know Bill or Sue came. . . . but I don't know which.
  c. I know who came. . . . Bill came.

We might be able to use the principle of Inquisitive Sincerity (Groenendijk and Roelofsen 2009) to explain the infelicity of (33a). The principle states: if φ is inquisitive in the common ground, then it should be inquisitive in the speaker's information state. We might then want to argue that the utterance 'I know that Bill or Sue came' has an inquisitive effect on the common ground consisting of two (overlapping) possibilities, one for Bill coming, the other for Sue coming. But since the speaker is stating that she *knows*, and hence supports the proposition, she must not be in an inquisitive state. Hence, the violation of the principle. A word of caution is in order: if inquisitive sincerity could explain the infelicity of (33a), what prevents (33c) from violating the principle also?

Let us try again. This time, also taking (33b) into account. What transpires from this comparison is that the disjunctive sentence embedded under *know* must be *non-inquisitively closed*, as the continuation makes clear. This means that the speaker's information state includes both indices where Bill came, but also indices where Sue came. Furthermore, the speaker's information state supports the non-inquisitive closure of the disjunction. In other words, the speaker knows that the answer to the polar question 'whether Bill or Sue came' is affirmative.

Now the first clause in (33) is compatible with indices where Sue but not Bill came, while a felicitous use of the second clause requires that every index in the speaker's information be one in which Bill came. If disjunction is interpreted non-inquisitively under the knowledge operator, then the content of the speaker's assertion would simply erase indices where neither Bill nor Sue came from the common ground, without creating alternative possibilities. See figure 5.

But we still do not have an explanation for the infelicity of (33a), for it is possible that the speaker be certain about Bill coming, but only be half certain about whether Sue came. In such a state, the speaker would still support the non-iquisitive closure of Bill or Sue came.

(34) I know that Bill came, and maybe Sue came also.

Now what prevents the speaker in (34) to utter (33a) instead? That is to say, a speaker in the information state described by figure 6 also knows the non-iquisitive closure of Bill or Sue came.

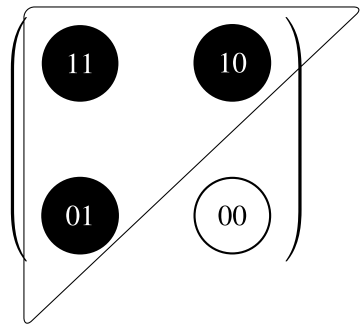


Figure 5: Non-inquisitive closure of Bill or Sue came.

Now, if we say that disjunction embedded under 'know' is interpreted non-inquisitively, then saying 'I know Bill or Sue came' in an uninquisitive state such as figure 6 should be fine. We seem to need a more refined explanation still for the infelicity of (33a).

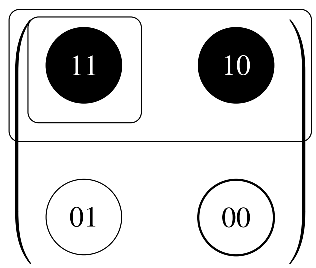


Figure 6: Bill came and maybe Sue did too.

Yet a third explanation, perhaps a consequence of Inquisitive Sincerity, would be to say that the use of disjunction comes along with an ignorance implicature: why use an inquisitive sentence if you can be more informative? If we allow for this implicature to project globally, then the continuation could be seen as a violation of this seemingly non-cancelable implicature. Note that in the case of an indefinite like 'someone', no such implicature is necessary, as witnessed by (35).

(35) I know that someone came. ... It was Bill.

So we seem to actually be observing a three-way division between 'who', 'or', and 'someone'. Both 'who' and 'someone' allow the speaker to provide a resolution for the question that she claims to know. We can also include 'whether' in this category (including embedded alternative questions, (36d)).

(36) a. I know who came. ... It was John.
b. I know that someone came. ... It was John.
c. I know whether Sue came. ... She didn't.

d. I know whether BILL or SUE came. . . . BILL came.
e. I know that Bill or Sue came. . . . # Bill came.

Having taken note of the bahaviour of ‘or’, let us recap what we learnt about indefinites and interrogative pronouns so far. It appears that interrogative pronouns resist non-inquisitive readings (see (31)). As for indefinites, the data so far seems to suggest that indefinites are compatible with the non-inqusitively closed reading.

6.1.2 The self-answerability test

Our second observation, which we would like to suggest as a test for inquisitivity (though more precisely, *issue-raising*) in natural language is what we call ‘the self-answerability test.’ This test also follows directly from the principle of Inquisitive Sincerity.

Self-answerability the issue raised by an inquisitive sentence cannot be resolved by the speaker.

We see that (37) fails the self-answerability test, and is hence inquisitive: it requires inquisitive sincerity. We observe the same requirement for interrogative pronouns, as in (38).

(37) Bill or Sue came. . . . # It was Bill!

(38) Who came? . . . # It was Bill!

Interestingly, however, indefinites do not seem to pass the test. That is, indefinites are not constrained by inquisitive sincerity.

(39) Someone came. . . . It was Bill!

In fact, we would like to suggest that any attempt at resolving the referent of the indefinite by the hearer runs the risk of giving rise to disagreements, and is hence deemed ‘unsafe’. As such, B’s response cannot be regarded as compliant.

(40) a. A: Someone came.
b. B: Yes, it was Sue.
c. A: No, Sue didn’t come. It was Bill!

It is not clear to us however, whether the self-answerability test is really a test for inquisitivity, or perhaps more specifically, it is a test for issue-raising. We may want to keep these ideas distinct. We could say that only inquisitive sentences give rise to issues, but that other pragmatic factors may interfere with this process. For consider the following example, where we are only concerned with the narrow-scope interpretation of ‘or’.

(41) a. Every sailor ate chicken or tofu.

b. ... Sailors A and B ate chicken, and sailors B and C ate tofu.

Now, we know that the sentence in (41a) is inquisitive, since there are more than one way the sentence can be realized (the proposition contains more than one supporting state). However, as the continuation in (41b) makes evident, the sentence passes the self-answering test and is hence predicted to be non-inquisitive. For the present, we may just want to say that narrow-scope disjunction requires obligatory non-inquisitive closure, though we still need a better explanation for such phenomena.

6.2 One remaining observation

Before suggesting a semantics for *who* and *someone*, we would like to discuss one remaining, albeit vexing issue. It is commonly assumed that *wh*-terms carry an existential presupposition, e.g. a question like 'who came?' presupposes 'someone came.'

While we happen to share these intuitions, formalizing presuppositions in our current framework requires a level of sophistication we have not currently developed. For the time being, we propose that we disregard the existential presupposition of *wh*-terms. In defense of this view, consider the examples below.

(42) a. I know that someone came. ... # No one did!

b. I know who came. ... ? No one did!

While our judgements regarding the continuation in (42b) causes us small discomfort, we confidently reject the continuation in (42a), which is a flat-out contradiction. For the time being, we would like to allow the 'no one!' answer as a possibility for 'who came?'. Armed with this distinction, we are now ready to provide a preliminary semantics for 'who' and 'someone'.

6.3 A preliminary semantics for *who* & *someone*

Ok, here we go. We want to build the semantics of our indefinite and interrogative NPs using the existential quantifier, but also we want to account for the patterns that we observed above: i. that interrogative pronouns are necessarily inquisitive; ii. that inquisitive sincerity does not apply to indefinites; and iii. that wh-questions contain the negative answer as one of their possibilities.

We present the semantics that most readily suggests itself in (43) and (44). According to (43), 'someone came' consists of the union of the possibilities for $\exists x\varphi$ and its non-inquisitive closure. Accordingly, the sentence 'someone came' eliminates those indices where no one came, but that crucially, it makes a non-inquisitive proposal: it proposes the single possibility that does not contain any indices where no one came, but for every individual, it may draw attention to the possibility that that individual came.[13] We use ⧫ to indicate that the proposition is non-inquisitive (although informative and possibly attentive).

[13]We still do not have any strong empirical evidence to support the attentive content of 'someone', but stipulate it for the time being without any strong commitments.

(43) $[\text{someone } \varphi]_g = [\exists x\varphi]_g \cup [\neg\neg\exists x\varphi]_g$
$= [\blacklozenge\exists x\varphi]_g$

Our semantics for the wh-question 'who came?' minimally differs from 'someone came' by removing one of the negations in the second disjunct. This move seems to give us the desired interpretation. The wh-question proposes, for each individual, the possibility that that individual came, but also, the possibility that no one came. Furthermore, the sentence may never be informative, since it is non-eliminative.

(44) $[\text{who } \varphi]_g = [\exists x\varphi]_g \cup [\neg\exists x\varphi]_g$
$= [?\exists x\varphi]_g$

The proposed semantics seems to get the support conditions for 'who came' and 'someone came' right. Knowing who came requires supporting either the possibility that no one came, or else, supporting the existential formula, i.e. the answer to the question. And knowing someone came requires supporting the informative content of the sentence or supporting the existential formula.

7 Conclusion

In this paper we have attempted to better understand Ciardelli (2009)'s motivations for moving away from a support-based semantics in the first-order setting, with the view that the support relation provides a stronger notion of inquisitive meaning. We then looked to natural language to provide a first attempt at the inquisitive semantics of indefinites and interrogative pronouns. The ideas in this paper remain under construction.

References

Ciardelli, Ivano. 2009. A first-order inquisitive semantics. In *Proceedings of the seventeenth Amsterdam Colloquium*, ed. Maria Aloni and Katrin Schulz.

Ciardelli, Ivano, Jeroen Groenendijk, and Floris Roelofsen. 2009. Attentive *might* in inquisitive semantics.

Groenendijk, Jeroen, and Floris Roelofsen. 2009. Inquisitive semantics and pragmatics. Presented at the Workshop on Language, Communication, and Rational Agency at Stanford, available via `www.illc.uva.nl/inquisitive-semantics`.

Haida, A. 2008. The indefiniteness and focusing of *wh*-words.