

# Attentive Pragmatics: An account of Exhaustivity and the Final Rise

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**Abstract.** I present a unifying solution to two well-known empirical puzzles: (i) how to account for the exhaustive interpretation of answers, and (ii) how to account for the semantics of the final rise in American English. It relies on the hypotheses that pragmatic reasoning is sensitive to the possibilities that a sentence *draws attention to* and that the final rise conveys the speaker’s *uncertain cooperativity*. The take-home message is that the Gricean approach to exhaustivity is viable, provided that we enrich the underlying semantics with *attentive content*.

## 1 Introduction

I present a unifying solution to two well-known empirical puzzles concerning (i) the exhaustive interpretation of answers, and (ii) the interpretation of the final rise boundary tone in American English.<sup>1</sup>

### 1.1 Exhaustivity

Responding to a question with one of its possible answers may convey that the answer is *exhaustive*, i.e., that the other possible answers are false.

- (1) Which colours does John like?  
John likes blue.  $\rightsquigarrow$  *He doesn’t like red*

The exhaustive interpretation of answers is often considered a prime example of Gricean *conversational implicature*, but so far no theory exists that actually explains it as such. A conversational implicature of an utterance is information that must be supposed in order to maintain the assumption that the speaker is cooperative (Grice, 1975, cf. Levinson, 2000). The typical ‘Gricean’ approach to the exhaustive interpretation of the response in (1) goes as follows:

1. The speaker didn’t say John likes red.

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2. She should have said so, had she been able to.
3. She must lack the knowledge that John likes red.
- ...
4. She knows that John *doesn't* like red.

The exhaustivity in 4. is obtained from the *Quantity implicature* in 3. through a strengthening known as the *epistemic step* (Sauerland, 2004). The epistemic step is considered a core problem for ‘Gricean’ approaches to exhaustivity, because it is not clear how it follows from the assumption of cooperativity (Chierchia, Fox, & Spector, 2008). To this day no solutions exist within the Gricean paradigm.

I present a solution to this problem, based on the idea that our pragmatic theories are fine as they are; rather, it is the underlying, classical semantics that is too weak for an account of exhaustivity implicatures. Classical semantics models only the *informative content* of utterances, but the following example suggests that this is insufficient foothold for a theory of exhaustivity:

- (2) Which colours does John like?

John likes at least blue / blue or blue and red. ✗ *John doesn't like red.*

The response in (1) is just as informative as the responses in (2), but only the former is interpreted exhaustively.<sup>2</sup> Intuitively, the difference between (2) and (1) lies not in the informative content, but in the possibilities that the responses *draw attention to*, in particular, whether the response draws attention to the possibility that John also likes red. The responses in (2), but not (1), draw attention to this possibility, and perhaps pragmatic reasoning is sensitive to this.

**Hypothesis 1:** Pragmatic reasoning is sensitive to attentive content.

This hypothesis has been entertained before by (Ciardelli, Groenendijk, & Roelofsen, 2009), in their account of ‘might’. It entails that, if we study pragmatic phenomena, we should be using a semantics that models not only the informative content of utterances, but also their attentive content.

I show that if we thus enrich the underlying semantics, the maxim of Relation as it occurs in the literature (e.g., Roberts, 1996) automatically inherits this sensitivity. The increased sensitivity of the maxim of Relation results in stronger Relation implicatures, which enable us to take the epistemic step.

## 1.2 The final rise

Responding to a question by answering with a *high rise* boundary tone, indicated here by ‘...’, can yield many different readings:<sup>3</sup>

<sup>2</sup> Groenendijk and Stokhof (1984) already argued that exhaustivity cannot be derived through the maxim of Quantity. After all, the Quantity implicature always says ‘this is as informative as I can safely be’, hence it can never be used to *strengthen* what is said, as is required for the epistemic step. The contrast in (2) supports this view from a different angle: it’s not only quantity of information that matters.

<sup>3</sup> The theory developed here does not apply to only one out of many final rising contours, and I will not attempt to make sense of the variation. Following (Gunlogson,

- (3) Which colours does John like?  
John likes blue... [high rise]

This has at least four salient readings, that I will name by the Kantian categories:

1. **Quality:** The speaker isn't sure if John likes blue.
2. **Quantity:** The speaker isn't sure how specific she should be. 'Aquamarine'?
3. **Manner:** The speaker isn't sure about her pronunciation of 'blue'.
4. **Relation:** The speaker isn't sure whether John likes red (for instance).

Although a formal account exists of the Quality reading (Gunlogson, 2008) (and perhaps of the Relation reading (Constant, 2012), see section 4.2 below), it is unclear how this connects to the other readings.

I propose a unifying account of the many readings of the final rise. I claim that the final rise conveys *uncertain cooperativity*, in the Gricean sense:

**Hypothesis 2:** The final rise conveys uncertain cooperativity.

I assume that this uncertainty may pertain to any aspect of cooperativity, and that the four readings correspond to uncertain compliance with the maxims of Quality, Quantity, Manner and Relation, respectively (hence the labels). For the first three readings, this is seen intuitively, and I will not give a formal account. It is harder to see that the fourth reading corresponds to uncertain compliance with the maxim of Relation. Therefore, in the present paper, I will show formally how it is derived. Hypothesis 1 will again be crucial: the fourth reading is predicted only if the maxim of Relation is sensitive to attentive content.

### 1.3 Outline

Section 2 introduces the main building blocks - an *attentive* semantics and a set of fairly standard conversational maxims - and shows how exhaustivity implicatures are accounted for. Section 3 uses the same building blocks to account for the final rise. Section 4 discusses the results in a broader context.

## 2 Exhaustivity

### 2.1 Attentive semantics

As the enriched semantic backbone for pragmatics, I adopt Roelofsen's (2011) *attentive semantics*, designed to model informative and attentive content. Attentive semantics is closely related to *basic inquisitive semantics* (Groenendijk & Roelofsen, 2009), which is aimed at modeling informative content and *inquisitive content*, and *unrestricted inquisitive semantics* (Ciardelli, 2009; Ciardelli et al., 2009), which has been taken to model all three components at once.

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2008), one may take 'H\* H- H%', in Pierrehumbert's (1980) notation, as a typical example.

In attentive semantics, propositions are sets of possibilities, each possibility a set of worlds, i.e., a classical proposition. Let  $\mathbf{W}$  be the set of all possible worlds, assigning truth values to the atomic formulae of a language of choice.

**Definition 1 (Proposition, possibility, informative content).**

A possibility  $a$  is a set of worlds,  $a \subseteq \wp \mathbf{W}$ .

A proposition  $A$  is a set of non-empty possibilities,  $A \subseteq \wp \wp \mathbf{W}$ .

For all propositions  $A$ , let  $|\varphi| := \bigcup[\varphi]$  denote the informative content of  $A$ .

I will use propositional logic without implication, given in Backus-Naur Form:

**Definition 2 (Syntax).**

For  $p$  a propositional letter, formulae  $\varphi ::= \perp \mid p \mid \neg\varphi \mid (\varphi \wedge \varphi) \mid (\varphi \vee \varphi)$

We can restrict a proposition to a set of worlds, i.e., a piece of information:

**Definition 3 (Restriction).** For all propositions  $A$  and sets of worlds  $s$ ,  $A$  restricted to  $s$  is given by  $A_s = \{a \cap s \mid a \in A, a \cap s \neq \emptyset\}$ .

For all formulae  $\varphi$ ,  $[\varphi]$  denotes the proposition expressed by  $\varphi$ , defined as:

**Definition 4 (Attentive semantics).**

For  $p$  a propositional letter,  $\varphi, \psi$  formulae:

1.  $[p] = \{\{w \in \mathbf{W} \mid w(p) = \text{true}\}\}$
2.  $[\neg\varphi] = \{\overline{\bigcup[\varphi]}\}$  if  $\bigcup[\varphi]$  is nonempty;  $\emptyset$  otherwise.
3.  $[\varphi \vee \psi] = [\varphi] \cup [\psi]$
4.  $[\varphi \wedge \psi] = [\varphi]_{\bigcup[\psi]} \cup [\psi]_{\bigcup[\varphi]}$

The last clause reads: a conjunction draws attention to each possibility that a conjunct draws attention to, restricted to the information of the other conjunct.

**Definition 5 (Entailment).**

For all prop.  $A, B$ ,  $A$  entails  $B$ ,  $A \vDash B$ , iff (i)  $\bigcup A \subseteq \bigcup B$  and (ii)  $B_{\bigcup A} \subseteq A$ .

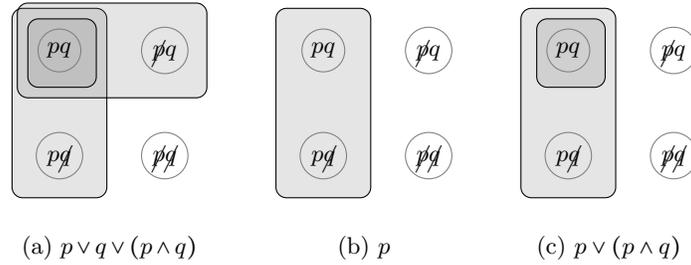
Condition (i) requires that  $A$  provides at least as much information as  $B$ ; condition (ii) requires that  $A$  draws attention to at least as many possibilities as  $B$ . Intuitively,  $A$  entails  $B$  if you can get from  $B$  to  $A$  by removing worlds and adding possibilities. Despite the richer semantics, attentive semantics treats informative content fully classically, in the following sense:

**Fact 1 (Classical treatment of informative content)**

For all formulae  $\varphi$ ,  $|\varphi| (= \bigcup[\varphi])$  is its classical meaning.

Without loss of generality, I assume that there exist only two colours, blue and red. For examples (1, 2, 3) in the introduction, this means I can assume the simplified, minimal translations into propositional logic in (4):

- |     |   |                              |
|-----|---|------------------------------|
| (4) | a. Which colours does John like?                    | $p \vee q \vee (p \wedge q)$ |
|     | b. John likes blue.                                 | $p$                          |
|     | c. John likes at least blue / blue or blue and red. | $p \vee (p \wedge q)$        |



**Fig. 1.** Three propositions. Circles represent worlds, shaded areas possibilities.

Translation (4a) simulates in propositional logic existential quantification over sets of colours.<sup>4</sup> Translations (4b) and (4c) are straightforward, where the latter is in line with Coppock and Brochhagen’s (2013) account of ‘at least’ in inquisitive semantics. These translations give us the propositions depicted in Figure 1.

With a richer semantics, entailment is more sparse than usual. Whereas classically (4b) and (4c) would both entail (4a), now only the latter does. This is easily seen: one cannot get from Figure 1a to Figure 1b by removing worlds or adding possibilities, for one cannot remove the  $[p \wedge q]$  possibility. This reflects the fact that (4a), though less informative than (4b), is strictly *more attentive*. This is not the case for (4c).

## 2.2 The maxims

I assume very standard maxims. I will define them in informal terms, achieving more formal rigour in the subsequent facts that characterise implicatures due to the maxim. Following a long tradition, I assume that the goal of the conversation is to resolve a *question under discussion* (a recent example is Spector, 2007), and that relevance is also defined relative to that question (as featured prominently in the work of Roberts (1996)). In what follows, for brevity I will use the word ‘know’ as ‘taking oneself to know’.

### Definition 6 (The Maxims).

- **Quality:** *Only say what you know to be true.*
- **Quantity:** *Support with your utterance as many possibilities of the question under discussion as possible.*
- **Relation:** *Let your utterance, restricted to your information state, entail the question under discussion.*
- **Manner:** *Try to be clear, concise, etcetera.*

**Fact 2 (Quality implicature)** *A speaker with information state  $s$ , uttering proposition  $B$ , complies with the maxim of Quality iff  $s \subseteq \cup B$ .*

<sup>4</sup> Other suitable translations for (4a) would be  $p \vee q$  or  $p \vee q \vee (p \wedge q) \vee \neg(p \vee q)$ .

**Fact 3 (Quantity implicature)** *A speaker with information state  $s$ , uttering proposition  $B$  in response to  $A$ , complies with the maxim of Quantity iff for all  $a \in A$ , if  $\cup B \not\subseteq a$  then  $s \not\subseteq a$ .*<sup>5</sup>

The maxim of Relation is meant to govern examples like the following:

- (5) - Was John at the party? ( $p \vee \neg p$ )  
 - It was raining. ( $q$ )  $\rightsquigarrow$  if it rained, he {was/wasn't} at the party

For the response to comply with the maxim of Relation, the responder must know of a *dependency* between the rain and John's attendance. This dependency is what makes the response *relevant* to the question under discussion.

What exactly the maxim of Relation, as defined above, achieves, depends on the sparseness of entailment, which in turn depends on the richness of the semantics. If the same semantics is adopted as in (Roberts, 1996), this maxim follows logically from her *relevance* (entailment relative to the *common ground*, see section 4.4). With attentive semantics, the maxim yields the following implicature, characterised here for responses with a single possibility:<sup>6</sup>

**Fact 4 (Relation implicature)** *A speaker with information state  $s$ , uttering proposition  $B$  in response to  $A$ , where  $B = \{b\}$ , complies with the maxim of Relation iff (i)  $s \subseteq \bar{b} \cup \cup A$  and (ii) for all  $a \in A$ ,  $s \subseteq \cup \bar{B} \cup a$  or  $s \subseteq \bar{b} \cup \bar{a}$ .*

*Proof.* The speaker complies with the maxim of Relation iff  $B_s \models A$ , iff (i)  $\cup B_s \subseteq \cup A$  and (ii)  $A_{\cup B_s} \subseteq B_s$ . Since  $B_s = \{b \cap s\}$ , requirement (ii) means that for all  $a \in A$ ,  $a \cap b \cap s = b \cap s$  or  $a \cap b \cap s = \emptyset$ , which holds iff  $s \subseteq \bar{b} \cup a$  or  $s \subseteq \bar{b} \cup \bar{a}$ .

This result states that a speaker who responds with a single non-empty possibility  $b$ , knows that for every possibility  $a$  of the question, either it or its negation follows from  $b$ . For example (5), Fact 4 tells us that the response implicates that the speaker knows either that  $q \rightarrow p$ , or that  $q \rightarrow \neg p$ .<sup>7</sup>

### 2.3 Results

Applying Facts 2, 3 and 4 to example (1), translated according to (4), yields the following implicatures, which together imply exhaustivity:

1. The speaker knows that  $p$  (Quality)
2. She lacks the knowledge that  $q$  (Quantity)

<sup>5</sup> To be fair, what is typically called the Quantity implicature in fact arises from the interplay of the maxims of Quantity and Quality: the maxim of Quantity requires a reason for not giving a more informative response, and the reason is typically that giving the more informative response would violate the maxim of Quality.

<sup>6</sup> I have looked for more general results, but so far the best formulations are no more readable than simply the definitions spelled-out, and I will omit them.

<sup>7</sup> For brevity, I use ' $\rightarrow$ ' as classical material implication, which suffices because 'knowledge that  $\varphi$ ' pertains to the informative content of  $\varphi$  only.

3. She knows  $p \rightarrow q$  or  $p \rightarrow \neg q$  (Relation)

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4. She knows  $\neg q$  = exhaustivity!

One can conceive of the Relation implicature (together with Quality) as enabling the epistemic step. In contrast, the response in (2) already entails the question, hence it lacks a Relation implicature, and no exhaustivity is implicated. More generally, the theory predicts the following exhaustivity implicatures:

**Fact 5 (Exhaustivity implicature)** *A speaker with information state  $s$ , uttering proposition  $B$  in response to  $A$ , where  $B = \{b\}$ , is cooperative iff for all  $a \in A$ , if  $b \notin a$ ,  $s \subseteq \bar{a}$ .*

*Proof.* This follows directly from Facts 2, 3, and 4.

### 3 The final rise

#### 3.1 Objective and subjective cooperativity

To explore Hypothesis 2 in a formal manner, it is crucial that we distinguish two ways in which ‘cooperativity’ may be defined, that I coin the *objective* way and the *subjective* way. The maxim of Quality, for instance, can be phrased as ‘only say what is true’ (objective) or as ‘only say what you *know* to be true’ (subjective). The literature since (Grice, 1975) freely mixes objective and subjective formulations of the maxims. Generally this sloppiness is harmless, because conversational implicatures are always of a subjective nature anyway: a speaker can only *try* to be objectively cooperative, as constrained by her abilities and beliefs. However, what ‘uncertain cooperativity’ amounts to, differs for the two stances. Uncertain compliance with Quality, for instance, would amount to ‘I am not sure whether what I say is true’ (objective) or ‘I am not sure whether I know what I say is true’ (subjective). The objective stance yields the right Quality reading of (3) (as given in section 1.2), while the subjective reading is overly embedded, and perhaps contradictory: if knowledge is closed under positive introspection, it is impossible to be unsure of one’s own knowledge.<sup>8</sup> Therefore, the final rise must convey uncertain *objective* cooperativity.

Let ‘...’ denote the final rise in natural language. For any natural language expression  $\alpha$ , let  $\langle \alpha \rangle$  denote its translation into a suitable logic.<sup>9</sup>

**Definition 7 (Contribution of final rise ‘...’).** *For any natural language expression  $\alpha$ ,  $\langle \alpha \dots \rangle := \langle \alpha \rangle \wedge \langle I'm not sure whether/how I'm objectively cooperative \rangle$ .*

What exactly the second conjunct conveys depends on which aspects of cooperativity the uncertainty pertains to, i.e., the final rise is ambiguous. As announced in the introduction, I will formalize only the Relation reading.

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<sup>8</sup> A comment by Manuel Kriz̄ (p.c.) made me realize this.

<sup>9</sup> I think that the contribution of the final rise is *non-at-issue* content. However, this distinction is left implicit, because it is irrelevant for the present purposes.

### 3.2 Relevance

Formalizing the Relation reading requires that we find the objective notion of *relevance* that underlies the subjective maxim of Relation defined above. The dependency in example (5), between the weather and John’s attendance, is a *contingency*. Hence, objective relevance is a world-dependent notion:

**Definition 8 (Relevance).** *For all propositions  $A, B$ :*

1.  $B$  is relevant to  $A$  in  $w$  iff for some  $t \subseteq \mathbf{W}$ ,  $w \in t$ ,  $B_t \models A$ .
2.  $B$  is relevant to  $A$  iff  $B$  is relevant to  $A$  in the actual world.

The definition of relevance yields the following, perhaps counter-intuitive, result:

**Fact 6 (Everything is relevant to a true proposition)**

*For all propositions  $A, B$  and world  $w$ , if  $w \in \cup A$ , then  $B$  is relevant to  $A$  in  $w$ .*

*Proof.* Suppose  $w \in \cup A$ . Then for  $t = \{w\}$ ,  $B_t = \{\{w\}\}$ , and hence  $B_t \models A$ .

The reason why, nevertheless, not every utterance is judged as relevant, is that a speaker has only partial knowledge about the world, and hence about the dependencies that exist. The maxim of Relation, defined above, requires that the speaker knows not only *that* something is relevant (because *everything* is), but also *how* it is relevant, i.e., by which dependency.

**Fact 7 (Knowing how it’s relevant)**

*An agent with information state  $s \subseteq \mathbf{W}$  knows how  $B$  is relevant to  $A$  iff  $B_s \models A$ .*

Uncertain relevance is then simply the negation of ‘knowing how it’s relevant’.

**Fact 8 (Uncertain relevance)** *A speaker with information state  $s$ , uttering  $B$  in response to  $A$ , where  $B = \{b\}$ , is unsure how her response is relevant iff for some  $a \in A$ ,  $s \not\subseteq \bar{b} \cup a$  and  $s \not\subseteq \bar{b} \cup \bar{a}$ .*

### 3.3 Results

The Relation reading of (3) arises from the interplay of Quality (Fact 2) and Quantity (Fact 3) implicatures, together with the semantic contribution of the final rise as conveying uncertain relevance (Fact 8).

1. The speaker knows that  $p$  (Quality)
2. She lacks the knowledge that  $q$  (Quantity)
3. She is unsure whether  $p \rightarrow q$  or  $p \rightarrow \neg q$  (Relation)

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4. She is unsure whether  $q$  = the ‘Relation’ reading of (3)

In contrast, example (2) lacks a Relation reading, because the response is trivially relevant, and likewise for (3) if we had not used attentive semantics. More generally, the theory predicts the following Relation readings:

**Fact 9 (Relation reading)**

*A speaker with information state  $s$ , uttering ‘ $\alpha \dots$ ’ in response to proposition  $A$ , where  $[(\alpha)] = \{b\}$ , conveys that for some  $a \in A$ ,  $s \not\subseteq a$  and  $s \not\subseteq \bar{a}$ .*

*Proof.* This follows directly from Facts 2, 3, and 8.

## 4 Discussion

Standard conversational maxims, combined with attentive semantics, enable a Gricean account of exhaustivity, with the Relation implicature enabling the epistemic step. This supports Hypothesis 1 (that pragmatic reasoning is sensitive to attentive content). Together with Hypothesis 2 (that the final rise conveys uncertain cooperativity) it yields four readings of the final rise. The current section discusses further links to the literature, as well as directions for future work.

### 4.1 Existing approaches to the epistemic step

The epistemic step is often taken by invoking the contextual assumption that the speaker is *opinionated* (e.g. Schulz & Rooij, 2006; Spector, 2007).

1. She lacks the knowledge that  $q$  (Quantity)
2. She knows either  $q$  or  $\neg q$  (Opinionatedness)

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3. She knows  $\neg q$

The main problem with the opinionatedness assumption, as argued by (Chierchia et al., 2008), is that it does not follow from the assumption of cooperativity. Because of that, it would demote exhaustivity to a case of *underspecification*, rather than conversational implicature, and one would expect ambiguity in (1). However, I cannot think of a context, with a cooperative speaker and final fall intonation, where (1) does not implicate exhaustivity.<sup>10</sup> Interestingly, Chierchia et al.'s (2008) *grammatical* approach to exhaustivity, which was meant to avoid the epistemic step, predicts a similar ambiguity. In their approach, exhaustivity is a semantic contribution of a covert *exhaustivity operator*, and the ambiguity arises because of its optionality and covertness.<sup>11</sup>

No such ambiguity is predicted by the theory outlined here. One may think of the Relation implicature as conveying not opinionatedness, but merely *conditional opinionatedness*, and only with regard to the non-attended possibilities. Crucially, I have shown that it follows from the assumption of cooperativity.

### 4.2 Relation to rise-fall-rise

The response in example (3) can also be read with *rise-fall-rise* intonation, in which case the Relation and Quantity readings become the most salient (but, it seems to me, not the only) readings. I follow (Constant, 2012) in assuming that the rise-fall-rise contour is composed of the intonational emphasis of a focused constituent (in this case 'blue') plus a final *low rise* (as opposed to a high rise). For reasons of space, I can merely *point* at a possible explanation:

<sup>10</sup> The exception would be the very artificial context where 'blue' can be used as a *pars-pro-toto* for 'blue and red', but this changes the example at the *semantic* level.

<sup>11</sup> Another motivation for the grammatical approach is the supposed existence of 'embedded' implicatures. For reasons of space I cannot go into this discussion, but the theory outlined here already accounts for some cases of embedded implicature, e.g., triple disjunctions, or existentials under universals (cf. Westera, 2012).

- The different final rises share the core semantic component of uncertain cooperativity. After all, Hypothesis 2 makes the right semantic predictions, and rise-fall-rise and high rise share at least the Relation and Quantity readings.
- The Quantity and Relation readings are particularly salient for rise-fall-rise, because the focus conveys that the utterance is aimed as a response to a question (e.g. Rooth, 1992), making the maxims which govern the question-response relation more salient: Quantity and Relation.

In addition, it seems to me that the higher the final rise, the larger the uncertainty conveyed; and perhaps more subtle differences in final rise may serve to disambiguate to which aspect of cooperativity the uncertainty pertains. These are ideas that I hope to pursue in future work.

My approach improves on Constant’s (2012) account of rise-fall-rise. Constant analyses rise-fall-rise as indicating uncertainty with respect to *all* alternatives that remain assertable (neither inconsistent nor uninformative) after the actual utterance is evaluated, i.e., in example (3) all colours except blue. The Relation reading in my approach is weaker: it conveys uncertainty only with respect to (at least) *one* alternative, and a mere inability to affirm the others (via Quantity). My theory is more accurate: rise-fall-rise, with a Relation reading, is fine even if you can exclude some alternatives. Despite this difference, the two theories perform the same on all puzzles solved by Constant (2012). But in addition, my theory predicts that (2), where a ‘post-assertable’ alternative is *not* left unattended, does not have a Relation reading, making the Quantity reading more salient, which seems to be borne out. No such prediction follows from Constant’s (2012) approach.

### 4.3 Other suitable semantics

Attentive semantics is not the only suitable backbone for a pragmatic account of exhaustivity, and thinking of these richer meanings in terms of attentive content is not the only way. For instance, in (Westera, 2012) I used *unrestricted inquisitive semantics* (Ciardelli, 2009; Ciardelli et al., 2009), which is equivalent to Fine’s (2013) *truth-maker semantics* (Ciardelli, 2013), which is thought to model *exact verification*. Minimally, however, a suitable semantic backbone for a pragmatic theory of exhaustivity must lack the *absorption laws*:

**Definition 9 (Absorption laws).**  $\varphi \wedge (\varphi \vee \psi) \equiv \varphi \equiv \varphi \vee (\varphi \wedge \psi)$

For one, (4b) and (4c) can be semantically distinguished only if the absorption laws do not hold.<sup>12</sup> But in addition, if the absorption laws would hold, the maxim of Relation would be too weak to enable the epistemic step:

**Fact 10 (Exhaustivity through the maxim of Relation)**

*If the absorption laws hold, (1) does not have a Relation implicature.*

<sup>12</sup> While I cannot rule out an explanation in terms of their different surface forms, such an account would not generalize as well as a semantic one.

*Proof.* Suppose the absorption laws hold. Then  $(4a) \equiv p \vee q \vee (p \wedge q) \equiv p \vee q$ . Because conjunction is the *meet* operation with respect to the entailment order (Roelofsen, 2011),  $[\varphi] \models [\psi]$  iff  $\psi \wedge \varphi \equiv \varphi$ . Hence, because  $p \equiv (p \vee q) \wedge p$  and  $p \vee q \equiv p \vee q \vee (p \wedge q)$  (absorption), we would have  $[p] \models [p \vee q \vee (p \wedge q)]$ . This shows that (4b) would entail (4a), i.e., (4b) would comply with the maxim of Relation as it is, and we would get no Relation implicature.

#### 4.4 Comparison to Roberts’s (2012) relevance

Ignoring the difference in semantics and entailment, the maxim of Relation defined above follows from Roberts’s (1996) *relevance* (entailment relative to the common ground), and it is also similar to Groenendijk and Stokhof’s (1984) *pragmatic answerhood* (entailment relative to the hearer’s knowledge). However, the latter two conflate the requirement of relevance as such, with a ‘transparency’ requirement that all dialogue participants should understand how an utterance is relevant. And although a requirement like the latter is necessary, their formulations are too strong: the dialogue participants need not *already know* how an utterance is related; it suffices if they can *figure it out*. In the case of exhaustivity, the dialogue participants can figure out which of the dependencies holds, by means of the Quantity and Quality implicatures. My approach allows this, but according to Roberts (1996) such cases would violate the maxim of Relation.

#### 4.5 Alternatives and scales

In the literature, the maxim of Quantity is often conceived of as comparing an utterance to more informative possible answers to the same question, the *relevant alternatives*. For instance, in (1), ‘John likes blue and red’ is a more informative alternative of ‘John likes blue’, hence saying the latter implies that you couldn’t say the former. In contrast, the maxim of Relation, when sensitive to attentive content, can be conceived of as comparing an utterance to equally informative, but *more attentive* alternatives. For instance, ‘John likes blue or blue and red’ (2) is a more attentive alternative of ‘John likes blue’ (1). Since one can draw attention to possibilities without committing to them, mere ignorance is insufficient reason for not uttering the more attentive alternative, and something stronger is implicated, which enables the epistemic step.

One can (but need not) think of the present approach as relying on *scales* of alternatives, that are ordered by entailment just as in the original work of Horn (1984), with the difference that entailment is now sensitive to attentive content.

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