

# Embedded questions: the *wh*/*\*whether* puzzle

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August 11, 2015

## Abstract

This paper offers an account of the fact that certain verbs license *wh*-questions as their complement but not *whether*-questions. For instance, it is felicitous to say that *Amy realized who Bill had invited* but not to say that *Amy realized whether Bill had invited his wife*. We refer to this contrast as the *wh*/*\*whether* puzzle. After reviewing a number of previously proposed explanations, we formulate an account which crucially rests on the assumption that the relevant kind of verbs are not only sensitive to the resolution conditions of the questions that they take as their complement, but also to their *anaphoric potential*, i.e., the propositions and properties that these questions bring into salience and thereby make available for subsequent anaphoric reference. While the anaphoric potential of root questions is clearly important to understand their role in discourse, the present paper is, to the best of our knowledge, the first to argue that it is also crucial for understanding embedded questions and the verbs that such questions as their complement.<sup>1</sup>

## 1 Introduction

The first issue that Karttunen (1977) considers in his seminal article on embedded questions is whether all such questions should be taken to belong to the same syntactic category. In particular, Karttunen asks whether *wh*-questions, which begin with an interrogative noun phrase or adverb like *what*, *which girl*, *why*, or *how*, should be treated as belonging to the same syntactic category as *whether*-questions, which are prefixed with *whether* or *if*. Karttunen (p.5) writes:

“These two types of questions have virtually the same syntactic distribution. Nearly all verbs which take *wh*-questions as complements also take *whether*-questions. A verb which doesn’t allow embedded *wh*-questions in general doesn’t complement with *whether*-questions either. This is illustrated in (1) and (2).

- (1) a. John knows what they serve for breakfast.  
b. John knows whether they serve breakfast.
- (2) a. \*John assumes what they serve for breakfast.  
b. \*John assumes whether they serve breakfast.

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<sup>1</sup>This paper has been submitted for publication. Comments are more than welcome.

There are two classes of exceptions to this generalization, both of which seem marginal to me. So-called ‘emotive factives’, such as *amaze*, *surprise*, and *bother* take *wh*-questions but do not allow *whether*-questions. Dubitative verbs, such as *doubt*, *question*, and *be dubious*, have the opposite characteristic. This is shown in (3) and (4).

- (3) a. It is amazing what they serve for breakfast.  
 b. \*It is amazing whether they serve breakfast.
- (4) a. \*I doubt what they serve for breakfast.  
 b. I doubt whether they serve breakfast.

The ungrammaticality of (3b) and the grammaticality of (4b) pose problems for me and require some special treatment. Nevertheless, it seems correct to assume, in the light of the great majority of cases of overlapping distribution, that *wh*-questions and *whether*-questions should be assigned to the same syntactic category.”

In much subsequent work on questions, Karttunen’s conclusion has been taken to heart. However, if *wh*-questions and *whether*-questions are indeed taken to be of the same syntactic category, a semantic or pragmatic explanation is needed for the contrasts in (3) and (4). Our main focus will be on the first type of contrast, i.e., on verbs like *amaze* and *surprise*, which can take *wh*-questions as their complement but not *whether*-questions. We will refer to this phenomenon as the *wh*/*\*whether* puzzle.<sup>2</sup>

After Karttunen’s initial observations, it has been noted in the literature that the *wh*/*\*whether* contrast is not only exhibited by ‘emotive factives’ like *amaze*, *surprise*, *bother*, *disappoint*, *be happy*, etcetera, but also by ‘epistemic factives’ like *realize* and *anticipate* (see, e.g., Guerzoni, 2007).

- (5) a. Amy realized what Bill drank.  
 b. \*Amy realized whether Bill drank wine.

Several explanations of the contrast have been suggested; some semantic in nature (d’Avis, 2002; Abels, 2004) and others pragmatic (Guerzoni, 2007; Sæbø, 2007). We will argue, however, that each of these proposals still has certain shortcomings. In particular, as already noted by Egré (2008), one of the assumptions that is crucial for the pragmatic approaches, namely the assumption that emotive and epistemic factives involve so-called *speaker factivity* (Guerzoni and Sharvit, 2007), faces systematic counterexamples. Furthermore, we will show that these approaches do not account for examples that are slightly more complex than the ones above, e.g., ones involving quantification, like (6) and (7).

- (6) \*Every guest was amazed whether he got breakfast.  
 (7) \*Every woman realized whether her husband drank wine.

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<sup>2</sup>A semantic explanation of the second type of contrast, involving verbs like *doubt*, has been suggested in Pruitt and Roelofsen (2011); Farkas and Roelofsen (2012); Biezma and Rawlins (2012). However, as soon as we look beyond English such a semantic explanation becomes highly problematic, since the cross-linguistic behavior of verbs like *doubt* is far from stable. For instance, as pointed out to us by Henk Zeevat, Dutch *betwijfelen* is much better with *whether*-complements than with *that*- or *wh*-complements (although the latter are occasionally attested in corpora as well). On the other hand, Italian *dubitare* only licenses *that*-complements, no *whether*- or *wh*-complements.

On the other hand, while the semantic approach developed by d’Avis (2002) and Abels (2004) accounts for the fact that verbs like *amaze* do not take plain polar *whether*-questions as their complement, it does not account for the fact that such verbs do not take *alternative questions* as their complement either, as illustrated in (8) and (9).

(8) \*It is amazing whether they serve eggs for breakfast, or cereals.

(9) \*Amy realized whether Bill drank the wine, or Chris.

We will offer an explanation of the *wh*/\**whether* puzzle that accounts for the unacceptability of plain polar questions and alternative questions, as well as the quantified cases, and which does not need to assume speaker factivity.

The structure of the paper is as follows. Section 2 provides a somewhat more detailed discussion of previous work, Section 3 presents our own account, and Section 4 offers some concluding remarks.

## 2 Previous work

We start with a discussion of the pragmatic approaches of Guerzoni (2007) and Sæbø (2007) in Section 2.1, and then turn to the semantic approach developed by d’Avis (2002) and Abels (2004) in Section 2.2.<sup>3</sup>

### 2.1 Pragmatic approaches

Guerzoni (2007) and Sæbø (2007) both try to explain why emotive and epistemic factives cannot embed *whether*-complements on the basis of Gricean maxims governing cooperative conversational behavior. Both accounts crucially rely on the assumption that emotive and epistemic factives are, in Guerzoni and Sharvit’s (2007) terminology, *speaker factive*: whenever they embed a question *Q*, the resulting sentence presupposes that the speaker knows the true answer to *Q*. For example, in order for the sentences in (10) and (11) (adapted from Guerzoni, 2007) to be felicitous, it seems that the speaker needs to know who passed the exam.

(10) a. It will surprise Bill who passed the exam.  
b. It won’t surprise Bill who passed the exam.

(11) a. John realized who passed the exam.  
b. John didn’t realize who passed the exam.

Let us see how this assumption leads to the prediction that emotive and epistemic factives do not accept *whether*-complements on Guerzoni’s account—Sæbø’s account is similar in nature and also prone to the objections that we will raise below. Consider a case where *surprise* takes a *whether*-complement.

(12) \*It surprised John whether Bob called.

The semantic entry for *surprise* given by Guerzoni ensures that (12) is asymmetrically entailed by both (13) and (14).

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<sup>3</sup>Shortly before the present paper was submitted, another account of the *wh*/\**whether* puzzle was presented by Romero (2015). We leave a comparison of this account with ours for a future occasion.

- (13) It surprised John that Bob called.  
 (14) It surprised John that Bob didn't call.

Thus, by standard pragmatic reasoning, an utterance of (12) would generate the implicature that the speaker is not in a position to utter (13) or (14), i.e., that she is not certain as to whether John was surprised that Bob called or surprised that Bob did not call. The quantity implicature can be expressed as follows (where  $B_x$  stands for *the speaker is certain that...*,  $S_j$  stands for *it surprised John that...*, and  $C_b$  stands for *Bob called*).

$$(15) \quad \neg B_x(S_j C_b) \wedge \neg B_x(S_j \neg C_b)$$

Moreover, given Guerzoni's semantic entry for *surprise*, the Gricean Quality maxim requires that if someone were to utter (12) she must believe that John was either surprised that Bob called or surprised that Bob did not call:

$$(16) \quad B_x(S_j C_b \vee S_j \neg C_b)$$

Finally, by speaker factivity, (12) presupposes that the speaker knows the answer to the embedded question, hence she is certain as to whether Bob actually called or not:

$$(17) \quad B_x C_b \vee B_x \neg C_b$$

Now, (16) and (17) together with the factivity of *surprise* entail (18).

$$(18) \quad B_x(S_j C_b) \vee B_x(S_j \neg C_b)$$

But (18) contradicts the quantity implicature in (15). Under the assumption that the quantity implicature cannot be suspended it follows that (12) inevitably results in a contradiction, hence the sentence is not felicitous.<sup>4</sup>

This account has at least two shortcomings, which also apply to that of Sæbø (2007). First, as already noted by Egré (2008, p.12), it seems difficult to defend that verbs like *surprise* indeed generally involve speaker factivity. Egré provides the following counterexample.

- (19) I met John this morning. He was very surprised by who had failed the exam in his class. I did not dare ask him which students had failed, but he seemed to be really disappointed.

The qualification "I did not dare ask which students had failed" clearly conveys that the speaker does not know who failed the exam. Wataru Uegaki (p.c.) independently provided a similar example:

- (20) I don't know who called, but it surprised John: I could see it in his face.

A second problem is that the approach does not apply, at least not without further stipulations, to somewhat more complex constructions, like cases where the verb has a quantificational subject binding a pronoun in the *whether*-complement.

- (21) \*Every boy was surprised whether his mother called.

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<sup>4</sup>A similar argument can be constructed if the embedded question is an alternative question.

The reasoning followed above is based on a comparison of the given sentence to pragmatic alternatives. What are the pragmatic alternatives of (21)? Perhaps the following:

(22) Every boy was surprised that his mother called.

(23) Every boy was surprised that his mother did not call.

But certainly these pragmatic alternatives would not lead us to the desired conclusion, and it is difficult to see which other possible pragmatic alternatives would.

## 2.2 A semantic approach

A purely semantic account of the *wh*/\**whether* puzzle has been developed by Abels (2004), building on a more informal proposal by d’Avis (2002). Abels’ account has two components: (i) a specific, non-standard semantic treatment of polar questions, and (ii) a specific treatment of the verb *surprise*.<sup>5</sup>

Following Hamblin (1973), Abels assumes that questions express sets of propositions. More specifically (and here Abels departs from Hamblin), he assumes that the meaning of a *polar* question  $?p$  is a singleton set containing the proposition expressed by  $p$  (Hamblin would also include the complement of this proposition).

$$(24) \quad \llbracket ?p \rrbracket = \{\llbracket p \rrbracket\}$$

Furthermore, following Heim (1994), Abels defines the *weakly exhaustive answer* to a question  $Q$  in a world  $w$  as the intersection of the propositions in  $\llbracket Q \rrbracket$  that are true in  $w$ :

$$(25) \quad \text{ans}_w(Q) = \bigcap \{\alpha \in \llbracket Q \rrbracket \mid w \in \alpha\}$$

One consequence of this definition is that in a world where none of the propositions in  $\llbracket Q \rrbracket$  are true, the weakly exhaustive answer to the question is the *trivial* proposition, i.e., the set of all worlds, denoted as  $W$ .<sup>6</sup> This is particularly relevant for polar questions. Namely, in a world where  $p$  is true, the weakly exhaustive answer to  $?p$  is just  $\llbracket p \rrbracket$ , but in a world where  $p$  is false, no proposition in  $\llbracket ?p \rrbracket$  holds, so the weakly exhaustive answer is  $W$ .

As for the semantics of *surprise*, Abels’ essential assumptions can be summarized as follows.<sup>7</sup> Consider a sentence of the form  $x$  is surprised by  $Q$ , where  $x$  is an individual and  $Q$  a question. For any world  $w$ , let  $B_{x,w}$  stand for the set of worlds that are compatible with what  $x$  believes in  $w$ , and let  $E_{x,w}$  stand for the set of worlds that are compatible with  $x$ ’s expectations in  $w$ . Then, what is required for  $x$  is surprised by  $Q$  to be true in  $w$  is the following. First,  $x$  should believe the weakly exhaustive answer to  $Q$  in  $w$ :

$$(26) \quad B_{x,w} \subseteq \text{ans}_w(Q)$$

Second, this answer should be incompatible with  $x$ ’s expectations:

<sup>5</sup>Abels (2004) focuses explicitly on *surprise*. His account would naturally apply to verbs like *amaze* as well, but it is more difficult to see whether it could be extended to epistemic factives like *realize* and *anticipate*, or even to emotive factives like *be happy*.

<sup>6</sup>This follows from the definition of the generalized intersection operator. Namely, for any set of propositions  $S$ , we have that  $\bigcap S = \{w \in W \mid w \in \alpha \text{ for all } \alpha \in S\}$ . Thus, if  $S$  is empty, then  $\bigcap S = W$ .

<sup>7</sup>Abels’ actual semantic treatment of *surprise* is a bit more involved, but we believe that this is not essential for his account of the *wh*/\**whether* puzzle.

$$(27) \quad E_{x,w} \cap \text{ans}_w(Q) = \emptyset$$

And third, in every world that is compatible with  $x$ 's expectations in  $w$ , the weakly exhaustive answer to  $Q$  must be non-trivial:

$$(28) \quad \text{For all } w' \in E_{x,w}: \text{ans}_{w'}(Q) \neq W$$

Now, if  $Q$  is a polar question  $?p$ , then these three conditions can only be simultaneously satisfied if  $E_{x,w}$  is empty, i.e., if  $x$ 's expectations in  $w$  are inconsistent. To see this, first suppose that  $p$  is true in  $w$ . Then  $\text{ans}_w(?p) = \llbracket p \rrbracket$ . We must have that  $E_{x,w} \cap \text{ans}_w(?p) = \emptyset$ . So  $E_{x,w}$  can only contain worlds that are not in  $\llbracket p \rrbracket$ , i.e., worlds where  $p$  is false. But we must also have that for all  $w' \in E_{x,w}$ :  $\text{ans}_{w'}(?p) \neq W$ . This means that  $E_{x,w}$  can only contain worlds where  $p$  is true. But if all worlds in  $E_{x,w}$  must be ones where  $p$  is both true and false, then  $E_{x,w}$  has to be empty.

Now suppose that  $p$  is false in  $w$ . Then we have that  $\text{ans}_w(?p) = W$ . But it is required that  $E_{x,w} \cap \text{ans}_w(?p) = \emptyset$ . This immediately implies, again, that  $E_{x,w}$  has to be empty. This explains the infelicity, on Abels' account, of sentences where *surprise* takes a polar question as its complement.

While this proposal avoids the problematic assumption of speaker factivity, and applies straightforwardly to quantified cases like (21) above, it has a number of shortcomings as well. First, it relies on a non-standard notion of weakly exhaustive answers, which seems difficult to justify independently. Certainly, this notion does not correspond to our intuitions about answerhood or resolution conditions of polar questions, according to which the most basic true resolving answer to  $?p$  in a world where  $p$  is false is  $\neg p$ ; to be sure, a tautology would not qualify as a resolving answer in this case.

Even if we were to accept Abels' assumption that the meaning of a plain polar question like (29) below consists of just one proposition—in this example, the set of all worlds where the door is open—we would certainly not want to endorse this assumption for a question like (30), which is equivalent to (29) in terms of resolution conditions but where both alternatives are made explicit.

(29) Is the door open?

(30) Is the door open or closed?

We have to assume that the meaning of (30) consists of two propositions—the set of all worlds where the door is open, and the set of all worlds where the door is closed. There are no grounds for giving one of these two propositions a different status than the other. But this means that (30), unlike (29), is predicted by Abels' account to be licensed under verbs like *surprise*, contrary to fact.

(31) \*Bill was surprised whether the door was open or closed.

Indeed, more generally, Abels' proposal does not account for the infelicity of *alternative questions* under verbs like *surprise*.

(32) \*Bill was surprised whether they served eggs for breakfast, or cereals.

Under the assumption that the meaning of an alternative question contains two disjoint propositions, the three requirements that *surprise* induces can be satisfied without  $E_{x,w}$  having to be inconsistent.

A final problem is that the account is specifically targeted at the verb *surprise*. As already mentioned in footnote 5, it is not so clear how it could be extended to verbs like *be happy*, *realize*, and *anticipate*.

## 3 Proposal

### 3.1 Point of departure

The point of departure of our own account is an empirical observation from d’Avis (2002), namely the fact that when verbs like *amaze* take a *wh*-question as their complement, they trigger an existential presupposition. For instance, (33) below, repeated from the introduction, implies that something is served for breakfast, and this implication is preserved under negation.

(33) It is amazing what they serve for breakfast.

↪ they serve something for breakfast

(34) It is not amazing what they serve for breakfast.

↪ they serve something for breakfast

This presupposition seems to be characteristic for emotive factives in general, and also for epistemic factives. For instance, (35) implies that Bill drank something, and this implication is again preserved under negation.

(35) Amy realized what Bill drank.

↪ Bill drank something

(36) Amy didn’t realize what Bill drank.

↪ Bill drank something

Note moreover that it is odd to cancel the existential implication with *if anything*.

(37) It is amazing what they serve for breakfast, \*if anything.

(38) Amy realized what Bill drank, \*if anything.

This contrasts with other verbs:

(39) Tell me what they serve for breakfast, if anything.

(40) Amy knows what Bill drank, if anything.

Based on these observations, we posit that emotive and epistemic factives generally trigger a presupposition that at least one ‘positive answer’ to their complement must be true. In order to characterize this ‘positive answer presupposition’ of course we first have to fix a suitable notion of ‘positive answers’. And for the account to have any explanatory value, this notion of positive answers should be motivated independently from the empirical phenomenon at hand. Section 3.2 will introduce such a notion of positive answers, and Section 3.3 will offer a general characterization and further motivation for the positive answer presupposition of emotive and epistemic factives. After this preparatory work, we will specify concrete semantic entries for *amaze* and *realize* in Section 3.4, and then return to the *wh*/\**whether* puzzle in Section 3.5. Finally, in Section 3.6 we will provide further

motivation for the general strategy that we take to resolve the puzzle. We will keep our presentation at a somewhat informal level in order to bring out the conceptual structure of the account in a maximally transparent way. For a detailed formal implementation we refer to Herbstritt (2014).

### 3.2 Positive answers and anaphoric potential

We suggest that an independently motivated notion of positive answers can be obtained by looking at the semantic objects that declarative and interrogative sentences make available for subsequent anaphoric reference. Consider the sentences in (41).

- (41)
- a. They serve breakfast.
  - b. Do they serve breakfast?
  - c. Do they serve eggs for breakfast, or cereals?
  - d. What do they serve for breakfast?

It is plausible to assume that both (41a) and (41b) make the proposition ‘that they serve breakfast’ available for subsequent anaphoric reference (see, e.g., Roelofsen and Farkas, 2015; Krifka, 2013). This proposition may be retrieved by anaphoric expressions like *yes*, *no*, *if so* and *otherwise*:

- (42) They serve breakfast. / Do they serve breakfast?
- a. Yes.  $\rightsquigarrow$  they serve breakfast
  - b. No.  $\rightsquigarrow$  they don’t serve breakfast
  - c. If so, ...  $\rightsquigarrow$  if they serve breakfast, ...
  - d. Otherwise, ...  $\rightsquigarrow$  if they don’t serve breakfast, ...

Similarly, it is plausible to assume that the alternative question in (41c) (pronounced with falling intonation on the second disjunct) makes *two* propositions available for subsequent anaphoric reference, namely the proposition ‘that they serve eggs’ and the proposition ‘that they serve cereals’ (see again Roelofsen and Farkas, 2015). These propositions can be referred to by anaphoric expressions like *the former* and *the latter*.

- (43) Do they serve eggs for breakfast, or cereals?
- a. The former.  $\rightsquigarrow$  they serve eggs
  - b. The latter.  $\rightsquigarrow$  they serve cereals

Finally, it is plausible to assume that the *wh*-question in (41d) does not make a proposition available for subsequent anaphoric reference, but rather a *property*, i.e., a function from individuals to propositions (see, e.g., Groenendijk and Stokhof, 1984; Krifka, 2001; Aloni *et al.*, 2007; Roelofsen and Farkas, 2015):

$$\lambda x.\lambda w.\text{they-serve-for-breakfast}(x)(w)$$

It is often assumed in the literature on *wh*-questions that this property is anaphorically accessed in the interpretation of short answers to the given question, and even in the interpretation of full sentential answers, to compute their *exhaustive* interpretation.<sup>8</sup>

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<sup>8</sup> It should be noted that this assumption is not uncontroversial. On the one hand, some authors have argued that short answers actually involve *ellipsis*, and their interpretation involves reconstructing the syntactic structure of the elided material rather than purely anaphoric access to the semantic property

- (44) What do they serve for breakfast?
- a. Eggs and cereals.  $\rightsquigarrow$  they only serve eggs and cereals
  - b. They serve eggs and cereals.  $\rightsquigarrow$  they only serve eggs and cereals

Moreover, assuming that *yes*, *no*, *if so*, and *otherwise* require a unique propositional antecedent, it follows that these anaphoric expressions are *not* licensed by (43) and (44), repeated below in (45), since neither provides a unique propositional antecedent.

- (45) Do they serve eggs for breakfast, or cereals? / What do they serve for breakfast?
- a. \*Yes.
  - b. \*No.
  - c. \*If so, ...
  - d. \*Otherwise, ...

Following Roelofsen and Farkas (2015), we will say that the semantic objects that a sentence makes available for subsequent anaphoric reference are *highlighted* by that sentence. Since propositions can be viewed as 0-place properties, a sentence always highlights one or more  $n$ -place properties, where  $n \geq 0$  is the number of *wh*-elements in the sentence. The declarative in (41a) and the polar question in (41b) both highlight a single 0-place property, i.e., a proposition, the alternative question in (41c) highlights two 0-place properties, and the *wh*-question in (41d) highlights a 1-place property.

In terms of these highlighted properties/propositions, we can characterize the positive answers to a sentence in a natural and general way. Namely, for every  $n$ -place property  $P$  that a sentence highlights and any tuple  $t$  of  $n$  individuals, we will say that  $P(t)$  is a positive answer to the sentence.

(46) **Positive answers to a sentence**

The set of positive answers to a declarative or interrogative sentence  $\varphi$  is the set of propositions that can be obtained by applying a property highlighted by  $\varphi$  to the appropriate number of individuals.

This general notion of positive answers captures the fact that the only positive answer to (41a) and (41b) is the proposition ‘that they serve breakfast’, the positive answers to (41c) are the two propositions ‘that they serve eggs’ and ‘that they serve cereals’, and the positive answers to (41d) are the propositions ‘that they serve eggs’, ‘that they serve cereals’, ‘that they serve bread’, ‘that they serve yogurt’, etcetera.

This notion will allow us to give a precise formulation of the positive answer presupposition associated with emotive and epistemic factives, to which we turn now.

### 3.3 The positive answer presupposition

Let us say that an  $n$ -place property  $P$  is *satisfiable* in a world  $w$  just in case there is at least one tuple  $t$  of  $n$  individuals such that  $P(t)$  is true in  $w$ . Then the positive answer presupposition of epistemic and emotive factives can be formulated as follows.

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made available by the question (see, e.g., Merchant, 2005 for such a proposal, and Jacobson, 2012 for a critique of it). On the other hand, some authors have argued that the *exhaustive* interpretation of answers to questions comes about through pragmatic reasoning, rather than a semantic process that involves anaphoric access to the property made salient by the question (see, e.g., Westera, 2013). Be this as it may, it remains plausible to assume that *wh*-questions bring a certain property into salience which *could* in principle serve as the antecedent for subsequent anaphora.

- (47) **The positive answer presupposition of epistemic and emotive factives**  
 An epistemic or emotive factive verb triggers the presupposition that every property highlighted by its complement clause is satisfiable in the world of evaluation.

To see what this characterization amounts to, let us again look at the different types of clauses in (41), but now embedded under *amaze*.

- (48) a. It is amazing that they serve breakfast.  
 b. \*It is amazing whether they serve breakfast.  
 c. \*It is amazing whether they serve eggs for breakfast or cereals.  
 d. It is amazing what they serve for breakfast.

For now, we will just consider the presuppositions that these sentences trigger according to the definition in (47). We will return to the unacceptability of (48b) and (48c) in just a moment.

Both in (48a) and in (48b), the embedded clause highlights the proposition ‘that they serve breakfast’. The presupposition triggered by *amaze* is that this highlighted proposition must be true in the world of evaluation. That is, the semantic value of these sentences is only well-defined in a world  $w$  if the proposition ‘that they serve breakfast’ is true in  $w$ . Note that in cases like (48a), with a declarative complement clause, the positive answer presupposition simply boils down to the familiar *factivity* presupposition.

In (48c), the embedded clause highlights two propositions, namely ‘that they serve eggs’ and ‘that they serve cereals’. The presupposition triggered by *amaze* is that these highlighted propositions are both true, i.e., the sentence only has a well-defined semantic value in worlds where both eggs and cereals are served for breakfast.

Finally, in (48d), the embedded *wh*-clause highlights a 1-place property. The presupposition triggered by *amaze* is that this highlighted property is satisfiable in the world of evaluation, i.e., that something is served for breakfast. So in the case of a *wh*-complement, the positive answer presupposition accounts for the existence requirement observed by d’Avis (2002).

Notice that the definition in (47) requires that *every* property/proposition that is highlighted by the complement clause (rather than, say, *at least one* of these properties/propositions) should be satisfiable in the world of evaluation. To provide justification for this, we have to consider a somewhat more complex case.

- (49) It is amazing what they serve for breakfast and what they serve for lunch.  
 $\rightsquigarrow$  Presupposition: they serve sth for breakfast and they serve sth for lunch

Assuming that the conjunctive embedded clause in (49) highlights two 1-place properties, each contributed by one of the *wh*-clauses, the observed presupposition is predicted by (47). It is crucial in this case that every property highlighted by the complement clause is required to be satisfiable, rather than just one of these properties.

One may perhaps be tempted to object to this argument by suggesting that (49) may actually be seen as an elided version of (50) below, where conjunction does not apply to the interrogative complement clauses but rather to the declarative root clauses (the part that must be elided in order to obtain (49) is displayed in gray).

- (50) It is amazing what they serve for breakfast and it is amazing what they serve for lunch.

One may suspect that, under this analysis, it is possible to derive the conjunctive presupposition of (49) even if the positive answer presupposition associated with verbs like *amaze* just requires that at least one of the properties (rather than every property) highlighted by the complement clause be satisfiable. This is not exactly the case, but the presupposition that would be derived would, together with the at-issue informative content of the sentence, indeed imply the conjunctive presupposition of (49). Namely, under standard assumptions about the presupposition projection behavior of conjunction (see Beaver and Geurts, 2013, for a recent survey), the predicted presupposition of (50) would be (i) that they served something for breakfast, and (ii) that, if it was amazing what they served for breakfast, then they also served something for lunch. Together with the at-issue information provided by the first conjunct that, indeed, it was amazing what they served for breakfast, this implies the presumed conjunctive presupposition of (49).

However, it is easy to construct a variant of (49) which is immune to this objection. One such a variant is given in (51).

- (51) It is only amazing what they serve for breakfast and what they serve for lunch.  
 (... It is not amazing what they serve for dinner)  
 $\rightsquigarrow$  Presupposition: they serve sth for breakfast and they serve sth for lunch

The conjunctive presupposition is still present, and clearly this sentence cannot be analyzed as an elliptical version of (52) below, where conjunction again applies to the declarative root clauses instead of the interrogative complement clauses.

- (52) It is only amazing what they serve for breakfast and it is only amazing what they serve for lunch.

Another kind of objection to our argument may be attempted by suggesting that the two *wh*-complements in (49) first have to be *lifted* before being conjoined (just like a proper name has to be lifted into a generalized quantifier before it can be conjoined with a quantificational noun phrase). Szabolcsi (1997, 2015) calls this the *indirect* method for interpreting coordinated complement clauses, as opposed to the *direct* method which involves immediate coordination of the two clauses, without prior lifting.

- (53) a. Direct method:  
 $amazing (Q_1 \wedge Q_2)$
- b. Indirect method:  
 $amazing (\lambda P [P(Q_1) \wedge P(Q_2)]) = amazing (Q_1) \wedge amazing (Q_2)$

Using the indirect method for interpreting coordinated complement clauses, it is indeed possible to derive the conjunctive presupposition of (49) even if the positive answer presupposition associated with verbs like *amaze* just requires that at least one of the properties (rather than every property) highlighted by the complement clause be satisfiable.

However, this alternative derivation of the conjunctive presupposition of (49) crucially relies on the assumption that coordinated complement clauses are interpreted using the indirect method. Szabolcsi (1997, 2015) argues that in Hungarian one can tell very clearly whether a conjunction of two *wh*-complements is interpreted using the direct or the indirect method. Namely, when both conjuncts are headed by the subordinator *hogy*, as in (54) below, both clauses are first lifted and then conjoined (the indirect method), while if the conjunction as a whole is headed by *hogy*, rather than both conjuncts individually,

as in (55), then the two clauses are immediately conjoined (the direct method); in this case the conjunction as a whole is lifted and then applied to the verb.

- (54) János megtudta, **hogy** hova költöztél és **hogy** kit vettél feleségül.  
 Janos found.out subord where you.moved and subord whom you.took as.wife  
 ‘Janos found out where you moved and who you married.’  
 ↪ both clauses lifted before conjunction applies (indirect method)
- (55) János megtudta, **hogy** hova költöztél és kit vettél feleségül.  
 Janos found-out subord where you.moved and whom you.took as.wife  
 ‘Janos found out where you moved and who you married.’  
 ↪ clauses are conjoined without prior lifting (direct method)

Szabolcsi observes, among other things, that while *conjoined wh*-complements can be interpreted using either the direct or the indirect method, *disjoined wh*-complements can only be interpreted using the indirect method.

- (56) János megtudta, **hogy** hova költöztél vagy **hogy** kit vettél feleségül.  
 Janos found-out subord where you.moved or subord whom you.took as.wife  
 ‘Janos found out where you moved and who you married.’
- (57) #János megtudta, **hogy** hova költöztél vagy kit vettél feleségül.  
 Janos found-out subord where you.moved or whom you.took as.wife

Now, with this background, let us return to cases involving verbs like *surprise*, *amaze*, and *realize*. The conjoined *wh*-clauses in the following Hungarian examples, where *hogy* does not precede each individual conjunct but just the conjunction as a whole, have to be interpreted using the direct method. In both examples, however, a conjoined presupposition is still present.<sup>9</sup>

- (58) János meglepődött azon, **hogy** hova költöztél és kit vettél feleségül.  
 Janos surprised at subord where you.moved and whom you.took as.wife  
 ‘Janos was surprised by where you moved and who you married.’  
 ↪ Presupposition: you moved somewhere and you married someone
- (59) J. már rég rájött arra, **hogy** hova költöztél és kit vettél feleségül.  
 J. already long realized onto subord where you.moved and whom you.took as.wife  
 ‘J. has long realized where you moved and who you married.’  
 ↪ Presupposition: you moved somewhere and you married someone

Thus, if Szabolcsi’s analysis of the subordinator *hogy* is correct, these examples counter the possible objection to our argument considered above. That is, they provide evidence for our formulation of the positive answer presupposition: every property highlighted by the complement of an epistemic or emotive factive verb must be satisfiable.

With this justification for our characterization of the positive answer presupposition in hand—plus the fact that it boils down to a plain factivity presupposition in the case of a declarative complement and predicts the existence requirement observed by d’Avis in the case of a plain *wh*-complement—we are now ready to provide full semantic entries for emotive and epistemic factive verbs.

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<sup>9</sup>We thank Donka Farkas and Anna Szabolcsi for discussion of these data.

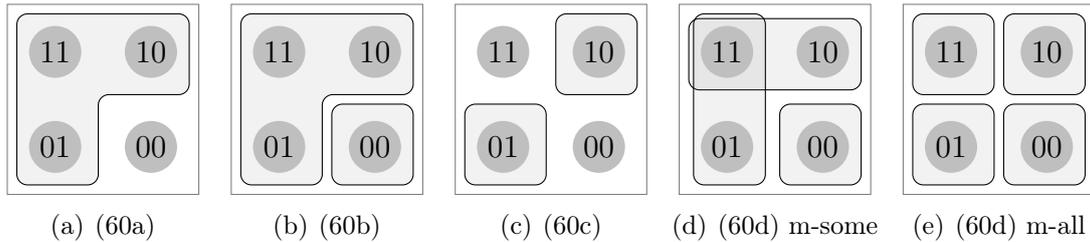


Figure 1: Propositions expressed by simple declaratives and interrogatives in inquisitive semantics. In each diagram, 11 is a world where both eggs and cereals are served for breakfast, 10 a world where only eggs are served, etcetera.

### 3.4 Semantic entries for *amaze* and *realize*

We will consider *amaze* as a representative of the class of emotive factives, and *realize* as a representative of the class of epistemic factives. We will provide semi-formal entries for these verbs in inquisitive semantics.<sup>10</sup> In this framework, the meaning of a sentence is not primarily taken to lie in its truth conditions, but rather in its *support* conditions. This way, declarative and interrogative sentences can be treated in a uniform way, using a single notion of meaning. Support is not specified relative to a single possible world, but rather relative to an information state, which is modeled as a set of possible worlds. To make this concrete, consider our four running example sentences, repeated below.

- (60) a. They serve breakfast.  
 b. Do they serve breakfast?  
 c. Do they serve eggs for breakfast, or cereals?  
 d. What do they serve for breakfast?

An information state  $s$  supports the declarative in (60a) just in case  $s$  contains enough information to establish that they serve breakfast, i.e., if every world in  $s$  is one where breakfast is served. Similarly, an information state  $s$  supports the polar question in (60b) just in case it contains enough information to establish either that they do serve breakfast or that they don't, i.e., if every world in  $s$  is one where breakfast is served, or every world in  $s$  is one where breakfast is not served.

Assuming that alternative questions generally presuppose that exactly one of the disjuncts holds (and not both) (see, e.g., Karttunen and Peters, 1976; Biezma and Rawlins, 2012), a state  $s$  supports the alternative question in (60c) just in case  $s$  contains enough information to establish that they serve eggs and no cereals, or to establish that they serve cereals and no eggs.

Finally, the *wh*-question in (60d) has two possible readings. On a *mention-some* reading it is supported by an information state just in case that state contains enough information to establish of something (e.g., eggs or cereals) that it is served for breakfast, or else to establish that nothing is served at all. On a *mention-all* reading it is supported by an information state just in case all worlds in that state agree on which types of food are served for breakfast.

The proposition expressed by a sentence in inquisitive semantics is the set of all

<sup>10</sup>For a general exposition of the basic features of inquisitive semantics see Ciardelli *et al.* (2012, 2013a). We specifically build here on the inquisitive treatment of embedded declaratives and interrogatives in Theiler (2014) and Roelofsen *et al.* (2014).

information states that support it, just like in classical semantics it is the set of all worlds where the sentence is true. Thus, since information states are sets of worlds, propositions in inquisitive semantics are sets of sets of worlds.<sup>11</sup> Figure 1 displays the propositions expressed by (60a-d). Only the maximal elements of each proposition are depicted. These maximal elements are called the *alternatives* in the proposition. Since support is *persistent*—i.e., if a state  $s$  supports a given sentence than any stronger state  $s' \subset s$  supports it as well—a proposition is fully determined by the alternatives in it.<sup>12</sup>

Now let us return to *amaze* and *realize*. On first approximation (and without taking the positive answer presupposition into account yet), a sentence of the form  $x$  *realized*  $\varphi$ , where  $x$  is the subject of the verb and  $\varphi$  a declarative or interrogative complement clause, can be taken to be supported by a state  $s$  if every world  $w$  in  $s$  satisfies two conditions: (i)  $x$  believes the true answer to  $\varphi$  in  $w$ , and (ii) at a previous time,  $x$  did not believe the true answer to  $\varphi$  in  $w$ . A similar approximative informal entry can be given for *amaze*. To make this more precise, however, we need to see in more detail what we mean by the ‘true answer’ to  $\varphi$  in  $w$ .

Several notions of answerhood have been considered in the literature (strongly exhaustive, weakly exhaustive, intermediate exhaustive, mention-some), and in fact there is no general agreement as to which of these notions is most suitable for verbs like *amaze* and *realize*.<sup>13</sup> Some have argued that these verbs operate on weakly exhaustive answers (Berman, 1991; Heim, 1994; Guerzoni and Sharvit, 2007), others claim that they operate on mention-some answers (George, 2011), and yet others claim that strongly exhaustive answers in the spirit of Groenendijk and Stokhof (1984) play a role as well (Spector and Egré, 2015).

We will assume that *amaze* and *realize* operate on weakly exhaustive answers, though nothing hinges on this choice, and our main reason for making it is just that it keeps the presentation of our account simple and transparent.

In inquisitive semantics, the weakly exhaustive answer to a complement clause  $\varphi$  in a world  $w$  is naturally defined as the intersection of all alternatives in  $\llbracket \varphi \rrbracket$  that include  $w$ , provided that there are such alternatives (otherwise the weakly exhaustive answer to  $\varphi$  in  $w$  is undefined) (cf., Theiler, 2014; Roelofsen *et al.*, 2014).<sup>14</sup> That is, if we let  $\mathbf{alt}_w(\varphi)$  denote the set of alternatives in  $\llbracket \varphi \rrbracket$  that include  $w$ , and  $\mathbf{ans}_w(\varphi)$  the weakly exhaustive answer to  $\varphi$  in  $w$ , we have that:

$$\mathbf{ans}_w(\varphi) = \begin{cases} \bigcap \mathbf{alt}_w(\varphi) & \text{if } \mathbf{alt}_w(\varphi) \neq \emptyset \\ \text{undefined} & \text{otherwise} \end{cases}$$

With this notion of answerhood in place, we can finally formulate our semantic entries for

<sup>11</sup>In the remainder of the paper we will talk both about classical propositions, i.e., simple sets of worlds, and about propositions in the sense of inquisitive semantics. In each case it will be clear from the context which notion of propositions is intended.

<sup>12</sup>Strictly speaking, this only holds for propositions that do not contain infinite sequences of ever weaker information states. All examples discussed here satisfy this property. See Ciardelli (2010); Ciardelli *et al.* (2013b) for discussion of cases that don’t.

<sup>13</sup>The relevant debate actually mostly revolves around examples involving the verb *surprise*; however, all the relevant observations seem to carry over straightforwardly to analogous examples with *amaze* and *realize*.

<sup>14</sup>Note that under this definition, the weakly exhaustive answer to a declarative  $p$  in a world  $w$  is the set of all worlds where  $p$  is true if  $w$  itself is such a world, and undefined otherwise. The weakly exhaustive answer to a polar or *wh*-question is never undefined; the weakly exhaustive answer to an alternative question is undefined in worlds that do not make exactly one of the disjuncts true.

*amaze* and *realize*.<sup>15</sup> At this point we also incorporate the positive answer presupposition.

(61) **Amaze**

*Presupposition.* Whether a sentence of the form  $\varphi$  *amazes*  $x$  is supported by an information state  $s$  is defined only if for every world  $w$  in  $s$ :

1. Every property highlighted by  $\varphi$  is satisfiable in  $w$
2.  $x$  believes  $\text{ans}_w(\varphi)$  in  $w$

*Assertion.* A sentence of the form  $\varphi$  *amazes*  $x$  is supported by an information state  $s$  just in case the above two conditions are fulfilled and, moreover, every world  $w$  in  $s$  is one in which  $x$  did not expect  $\text{ans}_w(\varphi)$ .

(62) **Realize**

*Presupposition.* Whether a sentence of the form  $x$  *realizes*  $\varphi$  is supported by an information state  $s$  is defined only if for every world  $w$  in  $s$ :

1. Every property highlighted by  $\varphi$  is satisfiable in  $w$
2.  $x$  believes  $\text{ans}_w(\varphi)$  in  $w$

*Assertion.* A sentence of the form  $x$  *realizes*  $\varphi$  is supported by an information state  $s$  just in case the above two conditions are fulfilled and, moreover, every world in  $s$  is one where  $x$  did not believe  $\text{ans}_w(\varphi)$  at a previous time.

Notice that the entries are almost exactly identical. The only difference is that *amaze* conveys that  $x$  did not expect  $\text{ans}_w(\varphi)$ , while *realize* conveys that  $x$  did not believe  $\text{ans}_w(\varphi)$  at a previous time. We are now ready to return to the *wh*/*\*whether* puzzle.

### 3.5 Back to the *wh*/*\*whether* puzzle

There are three cases to consider, exemplified in (63a-c), respectively.

- (63)
- |    |  |               |
|----|--|---------------|
| a. | *It is amazing whether they serve eggs for breakfast or cereals. | [alternative] |
| b. | *It is amazing whether they serve breakfast.                     | [polar]       |
| c. | *Every guest was amazed whether he got breakfast.                | [quantified]  |

Let us consider each case in turn.

**Alternative questions.** First consider (63a). In this case, the embedded question is an alternative question. Recall that the meaning of this question, depicted in Figure 1(c), contains two disjoint alternatives, one consisting of all worlds where breakfast includes eggs but no cereals, and the other consisting of all worlds where breakfast includes cereals but no eggs. Moreover, recall from our discussion on page 8 that this question highlights two propositions, namely the proposition ‘that they served eggs’ and the proposition ‘that they serve cereals’.

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<sup>15</sup>While these entries are sufficient for our current purposes, we do by no means claim that they are completely realistic. Various refinements have been suggested in recent work of George (2011), Theiler (2014), Spector and Egré (2015), and Uegaki (2015), among others. However, we do not implement such refinements here because they address issues that are orthogonal to our main concern, and we want to keep the presentation as transparent as possible.

Now let us consider the presuppositions that are triggered by the verb *amaze* when it takes this alternative question—let’s call it  $\varphi_a$ —as its complement. First, it is presupposed that, in every world  $w$  in the information state of evaluation  $s$ , every property/proposition highlighted by  $\varphi_a$  is satisfiable. This means that every world  $w$  in  $s$  must be one where both the proposition ‘that they served eggs’ and the proposition ‘that they serve cereals’ are true, i.e., a world where both eggs and cereals were served. The only world that satisfies this requirement is 11.

On the other hand, it is also presupposed that, in every world  $w$  in the information state of evaluation  $s$ , the individual to whom amazement is ascribed, in this case the speaker, believes  $\text{ans}_w(\varphi_a)$ . For this,  $\text{ans}_w(\varphi_a)$  has to be well-defined to begin with, which means that there has to be at least one alternative in  $\text{alt}_w(\varphi_a)$  that includes  $w$ . This condition is only fulfilled if  $w$  is a world in which either eggs or cereals were served for breakfast, not both. In Figure 1(c), these worlds are the ones labeled 10 and 01.

Notice that the two requirements are incompatible. Thus, our account predicts that (63a) has a contradictory presupposition, and this explains its infelicity in any possible context of utterance. Notice that it is crucial here, as anticipated above, that the positive answer presupposition requires of *every* property/proposition highlighted by the complement clause that it is satisfiable.

**Polar questions.** Now consider (63b). In this case the complement of the verb is a polar question, whose meaning is depicted in Figure 1(b). Moreover, recall that this question—let’s call it  $\varphi_b$ —highlights a single proposition, ‘that they serve breakfast’.

What are the presuppositions that are triggered by *amaze* when it takes  $\varphi_b$  as its complement? First, it is presupposed that in every world  $w$  in the information state of evaluation  $s$ , every property/proposition highlighted by  $\varphi_b$  is satisfiable. This means that every  $w \in s$  must be one in which breakfast is indeed served. Second, it is presupposed that in every world  $w \in s$ , the individual to whom amazement is ascribed, i.e., the speaker, believes  $\text{ans}_w(\varphi_b)$ . Together, the first and second requirement imply that every  $w \in s$  must be one in which breakfast is served and the speaker knows this.

Suppose that our state of evaluation  $s$  satisfies this presupposition. Then, for  $s$  to *support* (63b) it is further required that every world  $w \in s$  is one where the speaker did not expect  $\text{ans}_w(\varphi_b)$ . This means that every world  $w \in s$ , which is already guaranteed to be a world in which breakfast is served and the speaker knows this, is furthermore one in which the speaker did not expect breakfast to be served.

Now, there is nothing contradictory about these requirements. The problem, however, is that both the presuppositions and the support conditions for (63b) would be exactly the same if we replaced the *whether*-complement by a simple *that*-complement, as in (64).

(64) It is amazing that they serve breakfast. [declarative]

Moreover, this equivalence does not rely on any specific feature of our example; it occurs systematically, due to the positive answer presupposition of *amaze*. To see this, let  $\varphi$  be any sentence radical,  $?\varphi$  the corresponding polar interrogative, and  $!\varphi$  the corresponding declarative. First of all, notice that  $?\varphi$  and  $!\varphi$  highlight the same proposition—let’s call it  $|\varphi|$ —and that if *amaze* takes either  $?\varphi$  or  $!\varphi$  as its complement, the positive answer presupposition forces us to only consider worlds where this proposition  $|\varphi|$  is true. Let  $w$  be such a world. Then we always have that  $\text{alt}_w(? \varphi) = \text{alt}_w(! \varphi) = \{|\varphi|\}$  and therefore  $\text{ans}_w(? \varphi) = \text{ans}_w(! \varphi) = |\varphi|$ . And thus, both the presuppositions and the support conditions of *amaze*( $?\varphi$ ) and *amaze*( $!\varphi$ ) coincide.

We propose that this systematic equivalence, together with the fact that declarative complements are less complex than polar interrogative complements in terms of processing (the latter involve an operation that adds an additional alternative to the proposition expressed) and therefore more likely to be interpreted as intended, explains why verbs like *amaze* do not license polar interrogative complements.

Our account is somewhat reminiscent of the pragmatic approach discussed above, in that it involves ‘competition’ between declarative and polar interrogative complements. But there are two crucial differences. First, on our account the competition is not with one out of two declarative complements, depending on which one is true in the world of evaluation, but rather always with the same declarative complement, which is simply obtained by replacing *whether* with *that*. As a consequence of this, we do not need to include speaker factivity as an additional assumption, something we identified as a weakness of the pragmatic approach. Second, our semantics predicts that replacing a polar *whether*-complement by the corresponding *that*-complement does not yield a stronger meaning, but rather leaves the meaning of the given sentence in tact. This renders a polar *whether*-complement systematically dispreferred w.r.t. the corresponding *that*-complement, whose semantic computation involves less effort and is therefore more likely to be interpreted as intended. Thus, while our account can be thought of as having a pragmatic component, it is not *quantity* based, like the approach of Guerzoni (2007) reviewed above (“the speaker should have been more informative”), but rather *manner* based (“the speaker could have expressed the same meaning in a way that would have been easier to process and would thus have been more likely to be interpreted as intended”).<sup>16</sup>

**Quantificational cases.** Finally, consider (63c). Our explanation for the infelicity of this sentence is essentially the same as that for the infelicity of (63b). Namely, due to the positive answer presupposition, our semantics predicts that (63c) is semantically equivalent with (65), which involves a simple declarative complement rather than a polar interrogative complement.

(65) Every guest was amazed that he got breakfast.

This equivalence, together with the lower complexity of the declarative complement, accounts for the infelicity of (63c). Thus, quantified cases do not require any additional stipulations—another difference between our account and the pragmatic approach reviewed in Section 2.

Finally, there is one additional prediction that is worth mentioning before concluding the paper. Consider the following contrast, pointed out to us by Martin Stokhof:

- (66) a. \*Whether they serve breakfast is amazing.  
 b. The answer to the question whether they serve breakfast is amazing.

This example shows that, whereas *amaze* does not license a plain polar question as its complement, it does license a so-called ‘concealed question’ concerning the answer to that polar question. While perhaps surprising at first, the contrast is in fact expected on our

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<sup>16</sup>Our account is compatible with the view that the infelicity of polar interrogatives under emotive and epistemic factives is highly grammaticalized. It may be that the competition between polar interrogative complements and declarative complements has been the driving force behind this grammaticalization process diachronically, while no longer playing a role in the actual processing of these constructions synchronically.

view, under the assumption that concealed questions involve a type-shifting operation that turns the determiner phrase (here, *the answer to the question whether they serve breakfast*) into a *wh*-question concerning the identity of the referent of that phrase (*What is the answer to the question whether they serve breakfast*), an assumption that has been argued for in some detail in Aloni and Roelofsen (2011).<sup>17</sup> Concealed questions are, under this assumption, expected to pattern with *wh*-questions rather than with *whether*-questions, and thus correctly predicted to be licensed under verbs like *amaze*.

### 3.6 Further motivation for the relevance of anaphoric potential

Our account crucially rests on a particular characterization of the set of *positive answers* to a given declarative or interrogative clause, and we provided motivation for this characterization by considering the ‘anaphoric potential’ of declaratives and various types of interrogatives—the set of properties/propositions that they make available for subsequent anaphoric reference. On the other hand, our account also assumes a characterization of the informative and inquisitive content of the various sentence types involved.

One may wonder whether it is possible to derive the anaphoric potential of a given sentence from its informative and inquisitive content, or the other way around, whether it is possible to derive the informative and inquisitive content of a sentence from its anaphoric potential. Showing that this is in fact *not* the case adduces further motivation for the general strategy that we have pursued here to account for the *wh*/*\*whether* puzzle.

Let us first consider the hypothesis that the informative and inquisitive content of a sentence could in general be derived from its anaphoric potential. It is straightforward to find a counterexample to this hypothesis. Consider the declarative in (67a) and the corresponding polar interrogative in (67b).

- (67) a. Bill called.  
b. Did Bill call?

These sentences have the same anaphoric potential: they both highlight the proposition that Bill called. This can be seen by considering, for instance, the interpretation of *yes* and *no* in responses to these two sentences, or the interpretation of *if so* and *otherwise* in continuations by the same speaker. On the other hand, the two sentences clearly differ in informative and inquisitive content: (67a) is informative and not inquisitive, while (67b) is inquisitive and not informative.

Next, consider the dual hypothesis that the anaphoric potential of a sentence can be derived from its informative and inquisitive content. To see that this hypothesis fails as well, consider the following contrast:

- (68) *Context: Ann and Chris have placed an order online. They are kept up to date about the status of the order, which is first ‘in progress’ and then at some point turns into ‘sent’. Ann hasn’t looked at her email for a while so she asks Chris about the status of the order.*
- a. Ann: Is the order still in progress?  
Chris: Yes, it is. / No, it isn’t.
- b. Ann: What is the status of the order?  
Chris: \*Yes, it is. / \*No, it isn’t.

<sup>17</sup>Several other approaches to concealed questions exist as well (see, e.g., Nathan, 2006; Schwager, 2007; Romero, 2010; Frana, 2013). We refer to Aloni and Roelofsen (2011) for comparison.

In the given context, the two questions have precisely the same inquisitive (and informative) content, each of them requests information as to whether the order is still in progress or not. However, they differ in anaphoric potential, which is witnessed by the fact that the first licenses *yes/no* responses while the latter does not.

Thus, neither component of the meaning of declarative and interrogative sentences can be reduced to the other. Incidentally, note that the contrast between the polar question in (68a) and the *wh*-question in (68b) directly correlates with *wh*/*\*whether* contrast that we have been concerned with: even though the two questions have exactly the same inquisitive content, only the latter is licensed under verbs like *amaze*.

- (69) a. \*It is amazing whether the order is still in progress.  
 b. It is amazing what the status of the order is.

This example shows that it is impossible to solve the *wh*/*\*whether* puzzle, either semantically or pragmatically, as long as the meaning of *wh/whether* complements is identified just with their inquisitive content. It is really necessary to adopt a more fine-grained perspective on semantic content, and the idea that anaphoric potential may play a decisive role immediately comes to mind when the parallel contrast in (68) is taken into consideration.

With hindsight, the proposal of Abels (2004) that we discussed in Section 2 can be seen as relying on a semantics that captures more than just informative and inquisitive content as well. In particular, the semantics that Abels assumes for polar interrogatives involves a clear asymmetry between the ‘positive answer’ and the ‘negative answer’, which would be impossible to justify if the meaning of a sentence were to capture just informative and inquisitive content. However, the insight that it is really necessary to go beyond informative and inquisitive content is not made explicit and the adopted semantics is, at least without further motivation, rather *ad hoc*. We have seen that an approach which explicitly takes anaphoric potential into account besides informative and inquisitive content does not only lead to a more principled theory, but also to broader empirical coverage (recall that the infelicity of alternative questions under verbs like *amaze* was not covered on Abels’ account).

## 4 Concluding remarks

We will conclude with some remarks about the scope of our account, as well as some open questions. We have posited that ‘emotive’ and ‘epistemic’ factive verbs, such as *amaze*, *surprise*, *bother*, *realize*, and *anticipate* trigger a positive answer presupposition. When the complement of these verbs is declarative, then the positive answer presupposition—as we have characterized it—simply amounts to the requirement that the complement clause is true—a requirement that is characteristic for factive verbs in general, including for instance *know* and *remember*. Thus, the positive answer presupposition can be seen as a strengthened version of plain factivity.

One question that seems natural to ask, then, is *why* emotive and epistemic factives would come with a stronger presupposition than other factive verbs. Is this connected in some way or other to their ‘emotive’ or ‘epistemic’ nature? This question can only be meaningfully addressed, however, given a precise characterization of emotive and epistemic factives, which indeed lines up with the class of verbs that exhibit a positive answer presupposition, and which, to avoid circularity, does not itself make reference to positive

answer presuppositions. As far as we are aware, such a characterization has not been given in the literature, and in fact we suspect that it will be difficult to do so in a principled way. To see why, consider a verb like *find out*. Pre-theoretically, this verb seems very close in meaning to *realize*. Certainly, if *realize* is classified as an epistemic factive then one would expect that *find out* would be classified as such as well. However, it is not so clear whether *find out* generally triggers a positive answer presupposition. It seems that sentences like (70) are perfectly coherent, in contrast with (71), which would indicate that *find out* does not generally involve a positive answer presupposition.

(70) I want him to find out what the pitfalls of the approach are, if any.

(71) I want him to realize what the pitfalls of the approach are, \*if any.

Certainly, *find out* does not pattern with *realize* when it comes to the *wh*/*\*whether* puzzle: it routinely occurs with *whether*-complements, as exemplified in (72).

(72) I want him to find out whether the approach has any pitfalls.

(73) \*I want him to realize whether the approach has any pitfalls.

Perhaps, then, it would be better not to refer to the class of verbs that exhibit a positive answer presupposition and do not accept *whether* clauses as their complement as epistemic or emotive factives, but rather to use a more technical term, like ‘strong factives’. The question remains of course, why these particular verbs are strongly factive, and for that matter, why certain verbs are factive at all (cf., Anand and Hacquard, 2014). Are these properties related to other properties of the relevant verbs? An answer to this question is beyond the scope of the present paper. We hope, however, that the characterization of ‘strong factives’ that we have given here in terms of the positive answer presupposition, and its connection to the *wh*/*\*whether* puzzle, does contribute to a better understanding of embedded questions more generally.

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