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Deriving selectional properties of 'exclamative' predicates*

1 Background

This paper discusses two generalizations (see Grimshaw 1979) concerning question embedding predicates. The examples in (1) reveal that predicates expressing surprise (*surprise*-predicates hereafter) do not take polar interrogatives as complements, (1b), although other types of interrogatives are allowed. The examples also show that predicates like *wonder* (*wonder*-predicates hereafter) do embed polar interrogatives but are incompatible with *wh*-interrogatives where the *wh*-phrase is intensified (1d–e). For ease of reference, the generalizations are given as (2) and (3).

(1) a. Peter {✓knows |✓is surprised at[1]| *is wondering} that Erna was at the party.
b. Peter {✓knows | *is surprised at | ✓is wondering} whether Erna was at the party.
c. Peter {✓knows | ✓is surprised at | ✓is wondering} who was at the party.
d. Peter {✓knows | ✓is surprised at | %is wondering[2]} what a great doctor he is.

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[1] There is some variation between speakers concerning the preposition here. For most speakers it is obligatory.

[2] Some speakers report that this sentence sounds fine but that they are at a loss as to what it might mean, for others it is acceptable on the reading *Peter is wondering whether he is a great doctor*, others find it slightly degraded and assign the reading *Peter is wondering how great a doctor he is* to it, yet others find it ungrammatical.

e. Peter {✓knows | ✓is surprised at | %is wondering[3]} how enormously wide the Ganges river is.

(2) Generalization I:
Exclamative predicates do not embed polar interrogatives.

(3) Generalization II:
Interrogative predicates tend not to embed questions with intensified *wh*-phrases.

Grimshaw (ibid.) introduces the features exclamative ([E]), proposition ([P]), and question ([Q]) to describe (1) and (4)–(6). In her system the complements in (1d–e) are unambiguously [E] because root interrogatives with intensified *wh*-phrases cannot function as questions ((4), (5)). The polar interrogative (1b) by contrast is unambiguously [Q] because root polar interrogatives are never exclamative (6).

(4) a. How (%enormously) wide is the Ganges river?[4]
b. ✓(Wow!) How (enormously) wide the Ganges river is!

(5) a. *What a (great) success was the party?
b. ✓What a (great) success the party was!

(6) a. ✓Was Erna at the party?
b. *(Boy,) was Erna at the party!

If the complement in (1c) is ambiguous between [E] and [Q], we can describe the facts in (1) using selection: *wonder* selects [Q], *surprise* [P] and [E], *know* all three. This approach has often been criticized and the necessity of the clausal type feature ([E]) been questioned (see e.g. d'Avis 2001, 2002; Lahiri 2000; Zanuttini & Portner 2000, 2003). I agree with the thrust of this line of criticism (see Abels 2004 for review).

The most commonly criticized points are first that a compositional analysis of exclamatives is not available within Grimshaw's system (d'Avis 2001, 2002; Lahiri 2000; Zanuttini & Portner 2000, 2003). Secondly, there are other classes of predicates beside the 'exclamative' ones mentioned in Generalization I that embed *wh*-interrogatives but do not embed polar interrogatives. The most obvious class is probably the class of predicates of incremental completion such as *auflisten* – 'to list' in example (7) (see for discussion d'Avis 2001, 2002; Schwarz 1993). Clearly, verbs like *auflisten* require as their complement objects that, at least potentially, denote plurals, as (8a). On plausible assumptions the (correct) answer to a *wh*-interrogatives like (7a) are (potentially) pluralities of propositions while the correct answer to a polar interrogative

[3] Some speakers find this type of example acceptable, others don't.

[4] Speakers who accept (1e) with *wonder* typically also accept this example.

(7b) is not. A compositional analysis of such facts in terms of the lexical presuppositions of *list* suggests itself.[5] This, in turn, suggests that a similar analysis might also be available for the paradigm in (1). The present paper is an attempt in that direction, though in the case of *surprise*-predicates it is not the property of being singular but that of having a complement that denotes a singleton set of propositions which is the crucial factor.

(7) a. ✓Peter hat aufgelistet wer (alles) bei der Party war.
Peter has up.listed who all at the party was
Peter listed who was at the party.
b. *Peter hat aufgelistet ob Frank bei der Pary war.
Peter has up.listed whether Frank at the party was.
Peter listed whether Frank was at the party.

(8) a. ✓Peter hat die Teilnehmer der Konferenz aufgelistet.
Peter has the participants the conference up.listed
Peter listed the participants of the conference.
b. *Peter hat den Gastredner aufgelistet.
Peter has the plenary speaker up.listed
Peter listed the plenary speaker.

Thirdly, there are mismatches between the class of *wh*-questions that can function as independent (matrix) exclamatives and those that appear under exclamative predicates as shown in (9). The present approach, admittedly, will not solve this problem, in fact, I concentrate almost exclusively on embedded contexts.

(9) a. *What he bought!
b. ✓I'm surprised at what he bought.

Finally, if [E] is semantically a primitive type, then it is unclear why exclamatives and interrogatives are so similar crosslinguistically.[6]

These considerations suggest that we should try to derive Generalization I and II from independent considerations. Generalization I is the

[5] Alternatively, we could treat this as subcategorization for the feature [plural] or maybe the absence of the feature [singular].

[6] Examples of this are given in Oda (2003, in press). Oda (ibid.) looks at Brasilian Portuguese, Bulgarian, Mandarin Chinese, French, German, Japanese, Rumanian, Spanish, Russian, Thai, and Turkish. The similarity is often less than perfect (e.g. lack of Subject Aux Inversion in English (Grimshaw 1979; McCawley 1973). See also Paduan (Zanuttini & Portner 2000), Japanese (Ono 2003), French (Alter 1994) and Catalan (Villalba 2001, 2003)). However, what we find in these languages are minor modifications to a generally interrogative syntax of exclamatives. In Grimshaw's system this overwhelming generalization is simply stipulated by saying that syntactically (but not semantically) exclamatives are questions.

topic of the first part of this paper (I develop some key ideas from d'Avis 2001, 2002, for an earlier version of this material see Abels 2004). Generalization II is discussed in the second part of the paper (see also d'Avis 2001, 2002; Haida 2003). The generalization is a special case (and a weakened version of) a generalization found already in Grimshaw's work. It is therefore interesting to note that there are a number of exceptions to it. The exceptions appear to be systematic but defy a precise characterization for the moment. Section 3 is therefore much more speculative than section 2 of the paper.

Matrix exclamatives raise a number of further issues that I would like to sidestep here: What is the relation of sentence meaning and illocution? Which role does intonation play in constituting illocution (see e.g. Altmann 1993; Batliner 1988a, b, c; Oppenrieder 1988, 1989 for French Alter 1994)? How does intonation interact with the syntax? Etc.

2 Polar interrogatives under *surprise*-predicates

Let me sketch the intuitive content of the account to be developed below. *Surprise*-predicates are relations between the subject and two propositions, namely the proposition that the subject expected to come true and the proposition that the subject knows to have actually come true.

This is easy to see in the case of a declarative complement to *surprise*. If John is surprised that Mary left, then John must have expected her not to leave and he must know that as a matter of fact she did leave. The two propositions contradict each other; if the subject expected what actually happened, then he or she is not surprised. But what happens when a *surprise*-predicate embeds an interrogative complement?

One might expect that the proposition known to the subject is simply the true answer to the complement question and that the expectation might be any proposition contradicting that answer. However, the facts are slightly more complicated. First of all the subject need not know the complete answer to the embedded question to be surprised; even extremely fragmentary knowledge of the answer is sufficient to lead to surprise. Thus, one can be surprised about who was at the party even if one knows about only a handful of the potentially many guests. Formally this will be implemented by assuming that the subject need only know a so-called *mention-some* answer to the question. If we assume a Hamblin-style denotation for *wh*-questions, i.e., if we assume that questions are sets of propositions,

then a *mention-some* answer is simply the intersection of a number of propositions in the denotation of the question.

Secondly, not every expectation is as good as any other. Suppose for example that Peter didn't expect the computer equipment in his office to be replaced by new equipment, but in fact it did get replaced. Suppose moreover that the replacement was made by the single person in charge of computer equipment at Peter's institution. In this case one could not say: "Peter was surprised about who replaced his computer." Rather one would have to say: "Peter was surprised that his computer was replaced." This indicates that the subject's expectation must be compatible with a *mention-some* answer in the denotation of the question, different from the one known to be true and false in the actual world.

I will treat these two conditions as felicity conditions on the use of a question as the complement of a *surprise*-predicate: (i) the subject must know a *mention-some* answer to the embedded question, and (ii) the subject's expectation must contradict the *mention-some* answer from (i) and must be compatible with some *mention-some* answer to the same question.

We can now look at polar interrogatives. On the assumption that polar interrogatives are a degenerate type of questions, namely singleton sets of propositions, the fact that they cannot be embedded under *surprise*-predicates follows from the assumption in the previous paragraph. By assumption (i), the subject will have to know a *mention-some* answer to the embedded question. If polar interrogatives are singletons, then there is only a single *mention-some* answer.[7] The subject will therefore have to know this proposition. By assumption (ii), the subject must have expected a state of affairs that contradicts what he/she knows and which is compatible with some other *mention-some* answer. Since there is no other *mention-some* answer, these felicity conditions can never be met. Therefore, polar interrogatives cannot be embedded under *surprise*-predicates.

The rest of this section makes this reasoning formally precise and takes care of a number of limiting and special cases.

I will first lay out my assumptions about interrogative semantics (section 2.1). The main non-standard point here is the assumption that polar interrogatives are treated as singleton sets of propositions. Section 2.2 reviews the felicity conditions of *surprise*-predicates and casts them

[7] As I show in detail at the end of section 2.1., this is technically false. Even if a polar question has only a single member, there are two *mention-some* answers: the proposition in the question's denotation and the tautology. Nevertheless, I hope that the intuition of the account is captured by the more intuitive, non-technical, but strictly speaking false paraphrase given here.

formally as presuppositions. In section 2.3 I show how the assumptions from sections 2.1 and 2.2 together entail that the embedding of a polar interrogative under a *surprise*-predicate leads to a presupposition failure in any context. This, I claim, is the reason why polar interrogatives are not embeddable under *surprise*-predicates.

2.1 Assumptions about questions and answers

I assume that *wh*-interrogatives and polar interrogatives denote (functions from possible worlds to) sets of propositions. The idea is essentially Hamblin's (1973). While I follow Hamblin (ibd.) in the treatment of *wh*-interrogatives as in (10a), I depart from his treatment in one crucial respect. While Hamblin treats polar interrogatives as two membered sets of propositions, I treat them as singletons as in (10b) (see also d'Avis 2001; Roberts 1998). The interpretation of (10b) is derived by applying the question forming operator ($[[?]]=\lambda q_{<s,\,t>}.\lambda p_{<s,\,t>}.q=p$) to the proposition *that Frank bought milk*. The interpretation of (10a) can then be interpreted by λ-abstracting over the trace of the *wh*-phrase and assuming that *wh*-phrases are functions from λ-abstracts over questions (<e, <<s, t>, t>>) to questions (<<s, t>, t>), that means: $[[\text{what}]]=\lambda\Re_{<e,\,<<s,\,t>,\,t>>}.\lambda p_{<s,\,t>}.\exists x\,[\text{thing}(x) \wedge \Re(x)(p)]$.[8]

(10) a. Q = [[What did Frank buy]]
= {p | ∃x [thing'(x) & p = {w'| bought(x)(f')(w')}]}

b. Q = [[Did Frank buy milk]]
= {p | p = {w'| bought(m')(f')(w')}}
= {{w'| bought(m')(f')(w')}}

There is a large body of research indicating that a number of different notions of answerhood to a question are needed (Beck & Rullmann 1999; Groenendijk & Stokhof 1982, 1984; Heim 1994 among many others). Thus we need to distinguish at least between mention some answers and strongly exhaustive answers. There is some debate whether the notion of weakly exhaustive answerhood (going back to Heim 1994) is necessary. The approach to the interpretation of inter-

[8] I switch freely between a set notation and lambda notation. The former is exemplified in (10) the latter in the text. The lambda terms are simply the characteristic functions of the set-theoretic expressions. I hope that this will not create any confusion.

I assume furthermore that propositions are modeled as sets of possible worlds, that is, every proposition is a subset of the domain of possible worlds W. W itself is therefore the proposition true in every world, the tautology. Similarly the empty set of worlds is the contradictory proposition.

rogatives pursued here has the property that while none of the kinds of answer is treated directly as the denotation of the question, all kinds of answers that have been evoked in the literature can be derived. In that sense the question denotation that I am using is the generator set for the various kinds of answers. It is important to note that while the denotation for questions assumed here can easily generate the mention some, weakly exhaustive and strongly exhaustive answers, the opposite is not true (see Heim 1994). In that sense the present (and Hamblin's closely related) semantics is the most basic denotation we can give to a question.[9]

If these considerations are taken as a guideline, then it is natural to construe polar interrogatives as singleton sets as in (10b). This is surely the minimal denotation a polar interrogative could have. In Hamblin's original formulation the denotation of the polar interrogative is more complex and contains both p and ¬p as shown in (11). Nothing is lost if we replace (11) by (10b) though and much is gained. Nothing is lost since the negation of the single proposition in the denotation of the question is still derivable. Technically it is the strongly exhaustive answer in the worlds where the proposition itself is not true (this is discussed in d'Avis 2001, see fn. 11).[10]

(11) Q = [[Did Frank buy milk]] = {p | p = {w'| bought(m')(f')(w')}
∨ p = {w'| ¬bought(m')(f')(w')}}

From the denotation for questions assumed here, (10), we can derive all relevant types of answers. The weakest kind of answer is the *mention-some* answer. Some proposition p is a *mention-some* answer to Q iff p is the conjunction of an arbitrary subset of members of the question,

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[9] If there are reasons to believe that in other cases interrogatives actually denote various kinds of answers, then this might be achieved by adding in the syntax the operators that generate answers from the basic denotation of the question. This would entail, then, that exclamatives are syntactically smaller than interrogatives, a conjecture that might be supported by the fact that in Germanic languages matrix exclamatives do not trigger verb second (see also Westergaard & Vangsnes 2005 for a related proposal).

[10] I am assuming that *wh*-words range over (possibly plural) individuals (not quantifiers as the infelicity of many answers with quantifiers to questions shows). Furthermore, I assume that questions with simplex *wh*-words do not presuppose that there is a p in Q such that p is true in the evaluation world – *which*-interrogatives, on the other hand, are probably presuppositional. Witness the different status that the dialogues in (i) and (ii) have without special stress on *anybody/any student*.

i. A: Who did Mary invite to the party?
B: Mary didn't invite anybody.

ii. A: Which students did Mary invite to the party? –
B: Mary didn't invite any students.

(12), and it is a true mention-some answer in world w if it is true in that world.

(12) p is a *mention-some* answer to Q iff $\exists S \in \wp Q$ such that $p = \bigcap S$.

Given their construction, the set of mention some answers with the subset relation form a lattice and the *mention-some* answers true in some evaluation world form a sub-lattice. This sub-lattice contains as the most informative (smallest) member Heim's (1994) *weakly exhaustive* answer. I will refer to the weakly exhaustive answer as $answ_1^w$. It is the conjunction of all answers true in the evaluation world.[11]

(13) $answ_1^w = \bigcap \{p \mid p \in Q \,\&\, w \in p\}$

I will show now that technically the tautology is a *mention-some* answer to every question – and of course it is true in every possible world. It is the least informative member both of the lattice of *mention-some* answers and of the lattice of true *mention-some* answers. *Mention-some* answers were defined above in (12) as the generalized intersection of a member of the power-set of the question denotation. Since the empty set of propositions is a subset of every question, the intersection of the empty set of propositions is a *mention-some* answer to every question. By the standard definition of the generalized intersection given below in (14), the intersection of the empty set of sets is the domain, (15). In our case the domain is the set of worlds, the intersection of the empty set of propositions is therefore the set of all possible worlds, the tautology. The tautology is therefore a *mention-some* answer to every question, and, of course, it is true in every world.

(14) $\bigcap S =_{def} \{x \in D \mid \forall M \in S \rightarrow x \in M\}$
(15) $\bigcap \varnothing = D$

This point is stressed here, because in what follows I will on several occasions discuss the special case where the denotation of the question does not contain any true members. This special case occurs for (10a) iff Frank didn't buy anything and for (10b) iff Frank didn't buy milk. In this case, the question denotation contains only false propositions. The

[11] The weakly exhaustive answer allows us to derive the strongly exhaustive answer ($answ_2^w$) straightforwardly. The strongly exhaustive answer can be defined in two ways: either as the intersection of the weakly exhaustive answer with the negations of all the false members in the Hamblin set or, more elegantly but equivalently, as in (i) (see Heim 1994).

(i) $answ_2^w = \{w' \mid answ_1^{w'} = answ_1^w\}$

set of true propositions in the question denotation is empty in this case. From the reasoning in the previous paragraph it follows that just in case the question denotation does not contain a true proposition, the tautology is the only true *mention-some* answer.

In other words, if the question denotation as given in (10) does not contain a member which is true in the evaluation world, the weakly exhaustive answer (which is then also the only true mention some answer) is the tautology. The tautology is of course not an informative answer. In the case of a polar question "no" would be informative and in the case of a *wh*-question "nobody" or "nothing" would be. These answers are not *mention-some* answers, they are strongly exhaustive.[13] This can easily be verified using e strongly exhaustive answer, Heim's definition of the strongly exhaustive answer, $answ_2^w$, from fn. 11.

As a final note on the denotation of questions note that for any question and any world $answ_2^w$ entails $answ_1^w$ and that $answ_1^w$ entails all mention some answers.

2.2 The presuppositions of exclamative predicates

With this as background, we are ready to consider the semantics of *surprise*-predicates (see d'Avis 2001, 2002; Heim 1994). In this paper I mainly discuss their presuppositions, not their assertive content. To be sure, they have assertive content, but it is irrelevant for what follows.[14] I will use example (16) for illustration in my discussion.

(16) a. Heinz is surprised (at) who upgraded his computer.
b. Heinz is surprised (at) Q.

The predicate *to be surprised* expresses a relation between an individual and two propositions: One of the propositions describes a state of affairs that the individual, the referent of the subject of the *surprise*-predicate, knows. The other proposition contradicts the first one and the referent of the subject of the *surprise*-predicate would have

[13] There is thus an asymmetry between the tautology and the contradiction. The tautology is (technically) a true mention some answer to every question and an upper bound to any set of mention some answers. The contradiction is never a true mention some answer. The lower bound of the lattice of true mention-some answers is the weakly exhaustive answer. In the limiting case the two are identical.

[14] See Sharvit (2002) and references cited there for discussion of the assertive content of *surprise*.

deemed it more likely. When a *surprise*-predicate embeds a question both propositions stand in particular relation to that question: one of the propositions is a *mention-some* answer to the question, the other one is a proposition which contradicts the first and which is compatible with some member of the question denotation.

Let's call the relevant proposition that Heinz knows (p_2) and the proposition that expresses his expectations (p_1). If the question does not allow the construction of two contradictory propositions in the way described below, the *surprise* relation cannot hold. We therefore start with an existence presupposition for two contradictory propositions (17).[15]

(17) $\exists p_1, p_2 \in D_{<s,t>}\ p_1 \cap p_2 = \varnothing$ Condition I

p_1, the expectation, must be compatible with some member of the question denotation, (18).

(18) Q contains members which are compatible with p_1 (with Heinz' expectation). Condition II
$\exists p_1, p_2 \in D_{<s,t>,}\ \exists q \in Q\ [p_1 \cap p_2 = \varnothing \wedge q \cap p_1 \neq \varnothing]$

To see this, consider again the scenario described in the introduction to this section. Heinz has a computer at work. He did not expect his computer to be upgraded but one day his computer gets upgraded. The person doing the upgrading is the person expected to perform such tasks, namely, the guy responsible for computers and technology at Heinz' workplace. In this scenario Heinz' expectation to the effect that his computer would not be upgraded is broken, but his expectation regarding the person doing the upgrading is not broken. In this a scenario (16a) is neither true nor false. It is infelicitous. Instead something like (19b) would have to be said (see d'Avis 2001, 2002; Heim 1994).[16]

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[15] The existence of a p_2 with the relevant properties is probably linked to the fact that *surprise* is factive. We can express the fact that p_1 must contradict p_2 by saying that p_1 must contrast with p_2. I hope that it can be shown that all of the further properties of p_1 and p_2 can be made to follow from factivity and contrastiveness, though the details remain to be worked out.

[16] To be sure, with heavy stress on *who* the negation of (19a) is felicitous and true, (i). I assume that this is a case of metalinguistic negation. This type of example is irrelevant, because metalinguistic negation, unlike normal negation, can be used to negate presuppositions.

(i) Heinz is not surprised about WHO upgraded his computer but about the fact THAT it was upgraded.

The anonymous reviewer judges example (23a) to be acceptable in a scenario where Heinz

(19) a. #Heinz is surprised (at) who upgraded his computer.
b. ✓Heinz is surprised (about the fact) that his computer was upgraded.

Let's turn to p_2 now, the proposition that Heinz knows. Condition (20) demands that an example like (16a) presuppose that Heinz knows a *mention-some* answer to Q. If he were totally oblivious about who upgraded his computer, he could not be surprised about it or, for that matter, fail to be surprised. (Heim 1994 assumes a much stronger condition here, but without empirical support, I believe.)

(20) Condition III
p_2 is the most informative *mention-some* answer to Q known by the referent of the subject of *be surprised.*[17]

p_2 is not Heinz' total knowledge. Rather, it is the most informative *mention-some* answer entailed by Heinz' total knowledge.[18] We can never posit a proposition for p_2 which is not a *mention-some* answer. Suppose we tried. Suppose for example that nobody upgraded Heinz' computer and that Heinz knows this. No matter what Heinz' expectation might have been, whether he expected an upgrade or not, (16a) is infelicitous in this situation – it is neither true nor false. Instead we have to describe this situation with (21a) or (21b) depending on the facts.

(21) a. Heinz is surprised that nobody upgraded his computer.
b. Heinz is not surprised that nobody upgraded his computer.

Condition III captures this fact since 'that nobody upgraded his computer' is not a *mention-some* answer to Q. If Heinz' computer in fact was not upgraded, then technically, the only available true

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expected Mary to invite nobody. I suspect that this is a case of presupposition accommodation. The original expectation that nobody would be invited is broken. Given this, Heinz can still be surprised at who was invited. The context in the text appears to me to block such accommodation.

17 It is cumbersome but straightforward to cast this condition formally. p_2 is the single member in the set of *mention-some* answers that is (i) true, (ii) known by the referent of the subject, and (iii) entails all other members of the set of *mention-some* answers that fulfill (i) and (ii). In the limiting case, Heinz will know Heim's weakly exhaustive answer.

18 Under certain circumstances it might be necessary to take recourse to disjunctions of *mention-some* answers (e.g. Heinz knows that Mary invited Harry or Sally but not which one of the two but both invitations would occasion surprise). Here disjunctions of *mention-some* answers seem to be required for p_2. I will ignore this complication since it is irrelevant to the point of this paper as far as I can see.

mention-some answer, that is, the only *mention-some* answer that Heinz could know, is the tautology. Recall that I assume that *wh*-words range over individuals, not generalized quantifiers (fn. 10). The proposition *that nobody upgraded his computer* is therefore not a member of the question denotation. The question denotation, in fact, does not contain any true propositions in this case. Recall from the discussion at the end of section 2.1, that if the denotation of the question does not contain a true proposition, then the tautology is the only true *mention-some* answer to the question. So p_2 is the tautology.

Now, if p_2 is the tautology, then there is no p_1 which both contradicts p_2 and is compatible with some member of the question denotation. To fulfill the first requirement, p_1 must be the empty set (the contradiction) and to fulfill the second one p_1 must not be the empty set.

Since p_2 represents something that the referent of the subject of *surprise* knows, it follows that p_2 contains the evaluation world (factivity), which, in turn, entails that p_2 is not empty. From this and the discussion immediately above we derive Corollary I (22).

(22) $\varnothing \neq p_2 \neq W$ Corollary I

The point that p_2 must be a true *mention-some* answer, can be shown in a number of additional ways. The following argument is essentially Heim's (1994) argument against allowing *surprise* to operate on strongly exhaustive answers. Consider a scenario where Heinz expected Mary to invite Peter and Frank, but in reality she invited only Peter, and Heinz knows this. In such a situation, (23a) is according to Heim false. Instead (23b) might be uttered.[19]

(23) a. Heinz is surprised at who Mary invited.
b. Heinz is surprised at who Mary didn't invite.

Heinz' total knowledge is that Mary invited only Peter, which contradicts his expectation that she would invite both Peter and Frank. However, the most informative *mention-some* answer entailed by Heinz' knowledge, i.e. p_2, is the proposition that Mary invited Peter. This proposition is compatible with Heinz' expectation, hence (23a) is false

[19] Not all speakers share Heim's judgment. The crucial point though is that there is an asymmetry between a positive and a negated embedded question. This asymmetry exists for all speakers one way or another. In a context where the actual invitees are a superset of those that Heinz had expected only (16a) is acceptable and (23b) is felt to be wrong. Full access to strongly exhaustive answers would lead to a total symmetry between positive and negative *wh*-questions contrary to fact.

or possibly infelicitous. In other words, assuming that *surprise*-predicates access *mention-some* answers we can explain why (23a) does not work in the context given: there is simply no contradiction between the proposition known by Heinz and the one expected by him.

If on the other hand *surprise*-predicates accessed strongly exhaustive answers rather than mention some answers, Heinz expectation that Peter and Frank get invited and the reality that only Peter got invited contradict each other. While the *mention-some* answer *that Mary invited Peter* is compatible with the expectation *that Mary invited Peter and Frank*, the strongly exhaustive answer *that Mary invited only Peter* is incompatible with the expectation *that Mary invited Peter and Frank. The strangeness of* (23a) in the given context can therefore only be explained if *surprise*-predicates may not have access to the strongly exhaustive answers to the questions that they embed.

A final illustration comes from scalar predicates. Consider a scenario where Heinz expected Mary to be 6ft tall, but really she is just under 4.5ft tall, and Heinz knows this. While (24b) can be truthfully uttered in this situation, (24a) cannot.[20]

(24) a. Heinz is surprised at how tall Mary is.
b. Heinz is surprised at how short Mary is.

The explanation for this is straightforward if we assume that *tall* is scalar and *short* means 'not tall' (see Heim 2000). Consider (24a) first. Assuming downward monotonicity for *tall*, Heinz' expectations entail that Mary is 4.5ft tall, i.e., he expects what he knows. This is true whether we describe Heinz' expectations by

a. that Mary is tall to degree δ=6ft or
b. that the maximal degree δ to which Mary is tall is equal to 6ft or
c. that the maximal degree δ to which Mary is tall is at least 6ft.

No matter which one we choose, the expectation does not contradict the knowledge; hence, (24a) is false in the scenario given.[21] This only works because the maximality operators in (a), (b), and (c) apply to

[20] This contrast appears is more stable than the one between (23a) and (23b) discussed above, see also fn. 19.

[21] Only the proposition *that Mary is tall at least to degree δ, δ = 6ft* would contradict what Heinz knows, but, given the assumed scalarity of the predicate *tall*, this proposition is the contradiction.

Heinz' expectation not to his knowledge. If Heinz' knowledge lost scalarity (as they would if we used answ$_2$) (24a) would become true.[22]

Consider now (24b). The most informative *mention-some* answer to Q that Heinz knows is that Mary is not tall to degree δ, δ = 4.5ft. Heinz' expectation can again be coded in various forms: (a) *that Mary is not tall to degree δ = 6ft* or (b) *that the minimal degree to which Mary is not tall is equal to 6ft* or *(c) that the minimal degree to which Mary is not tall is at least 6ft*. These correspond to the options given above for (24a). Under the first option Heinz' expectation does not contradict his knowledge. The two other options however lead to a contradiction as desired – one of them must be what is actually used by speakers. The asymmetry between (24a) and (24b) can thus easily be accounted for by crucially assuming that p_2 is a *mention-some* answer.

Briefly consider what conclusions we can draw from the above about the status of p_1. It is probably uncontroversial to assume that Heinz can only be surprised if the expectation he was harboring was contingent. This is stated in (25), but it need not be stipulated. Condition (25) follows from what we have already. $p_1 \neq W$, because otherwise p_1 could not contradict p_2 (p_2 is not empty by Corollary I above (22)). $p_1 \neq \varnothing$, because otherwise p_1 would not be compatible with any member of Q. Thus (25) is derived.

(25) $\varnothing \neq p_1 \neq W$ Corollary II

It further follows from (18) that Heinz expectation must be compatible with the presuppositions of some member of the question.

I summarize again the presuppositions of *surprise*-predicates as (26). It says that there must exist two propositions that contradict each other. One of them is the most informative *mention-some* answer known by Heinz, the other one is consistent with some member of Q. Given that the actual knowledge (p_2) is the most informative *mention-some* answer known by the referent of the subject of the *surprise*-predicate and given that the weakly exhaustive answer is the most informative *mention-some* answer, period, we can conclude the second line of (26): *surprise*-predicates presuppose that it must be possible to construct p_1 in such a way as to be incompatible with the weakly exhaustive answer while being compatible with some member of Q.

[22] The present analysis is therefore unavailable if exhaustivity is built into the denotation of questions as in e.g. Groenendijk and Stokhof 1982, 1984.

(26) $\exists p_1, p_2 \in D_{<s,t>}$ [$p_1 \cap p_2 = \varnothing \wedge \exists q \in Q$ [$q \cap p_1 \neq \varnothing$] $\wedge$ p_2 is the maximally informative *mention-some* answer to Q known by the referent of the subject of *surprise*]
$\Rightarrow \exists p_1 \in D_{<s,t>}$ [$p_1 \cap [\bigcap\{q \mid q \in Q \wedge q(@) = 1\}] = \varnothing \wedge \exists q \in Q$ [$q \cap p_1 \neq \varnothing$]]

2.3 Why 'exclamative' predicates do not embed *whether*-complements

In this short section I demonstrate that Generalization I, follows from (26) together with the assumption that polar interrogatives are singleton sets. The idea is that example (27) is excluded because of contradictory presuppositions.

(27) *Heinz is surprised (at) whether Mary invited Fritz.
(28) $Q^{(27)} = \{q \mid q = \{w' \mid \text{invited}(f')(m')(w')\}\}$.

Given our assumptions, the embedded interrogative is interpreted as (28). There are two possibilities to consider now: either (i) Mary did invite Fritz in the evaluation world (@) or (ii) Mary didn't invite Fritz in the evaluation world.

Suppose the former is true, i.e., $q(@) = 1$. There are only two *mention-some* answers to this question: the tautology[23] (W) and the proposition q, that Mary invited Fritz. p_2 is not the tautology by Corollary I (22); thus, $p_2 = q$. Since p_2 must be incompatible with p_1 by Condition I (17), $p_1 \cap q = \varnothing$. However, Condition II (18) demands that p_1 be compatible with some member of Q. Q being a singleton set with the single member q, $p_1 \cap q \neq \varnothing$. Obviously, there is no p_1 that fulfills both requirements.

Suppose now that q is false in the evaluation world, i.e., $q(@) = 0$. Since Q is a singleton and q is, by assumption, false, the only true *mention-some* answer to Q in this case is W (see the discussion above). It follows that $p_2 = W$. By assumption there must be a p_1 such that $p_1 \cap p_2 = \varnothing$, but if $p_2 = W$, then $p_1 = \varnothing$. This contradicts the demand of Condition II (18), according to which there is some member q' in Q such that $p_1 \cap q' \neq \varnothing$. Clearly there is no p_1 that can fulfill the require-

[23] Recall from the discussion around (14) that it follows from the definition of a *mention-some* answer as the intersection of a possible empty subset of the question denotation that the tautology is always a (degenerate) *mention-some* answer, namely, the intersection of the empty set of propositions.

Recall also that just in case the question denotation does not contain a true proposition, the tautology is the only true *mention-some* answer. This fact will become important immediately below.

ments and the presupposition comes out false again. The fact that p_2 = W also contradicts Corollary I (22) of course.

This short proof by case is the formal rendition of the conclusion reached informally above: The presupposition of *surprise* cannot be satisfied just in case Q is a singleton. This explains Generalization I: the presupposition is necessarily false; there is no context in which the presuppositions of (27) are fulfilled. Example (27) is unusable because it has unsatisfiable presuppositions. This type of account is not novel. The idea that necessarily contradictory presupposition render a sentence unusable has previously been pursued successfully, in the study of negative polarity items (see Krifka 1995; Lahiri 1998).

It is crucial for my proposal that polar interrogatives are singleton sets. If they were two-membered sets as in Hamblin's original proposal ($Q_{\text{polar-Hamblin}} = \{p, \neg p\}$), the above reasoning would not go through any more. If we followed Hamblin, then p_1 could be equated with p in $Q_{\text{polar-Hamblin}} = \{p, \neg p\}$ and p_2 with $\neg p$ (or the other way around). In the general case, neither of them is tautology or the contradiction, and one of them is always guaranteed to be true. Under this scenario all the conditions discussed in the previous subsection would be satisfied. Both p_1 and p_2 are *mention-some* answers; p_2 could be picked to be the true one of the pair p and $\neg p$; p_1 contradicts p_2. Habmlin's approach therefore does not derive the fact that polar questions are impossible as the complements of *surprise*-predicates while the current slight modification does derive this fact from independently required lexical properties (presuppositions) of *surprise*-predicates.

It is instructive to look at *wh*-questions that plausibly have a two-membered denotation. Under present assumptions their behavior should differ from that of polar questions, because as shown in the previous paragraph, a two-membered denotation for the question is sufficient to construct p_1 and p_2 which meet all presuppositions of *surprise.* An example is given in (29).

(29) a. ✓I am surprised at which of the two teams won the finals.
b. $[[Q]] = \{p \mid \exists x\, [[x = \text{Greece} \vee x = \text{Italy}] \wedge p = \{w \mid x \text{ won the finals in } w\}]\}$
= {that Greece won the finals, that Italy won the finals}

If we are talking about, say, the European soccer championship, then (29) is in relevant ways like Hamblin's original denotation for a polar interrogative. There are two possible answers, (29b). These two answers exclude each other and exhaust the space of possibilities: if Greece won, then Italy didn't win and if Greece didn't win, then Italy won. In this particular context, the two propositions in (29b) are each other's

contradictory negations. Yet (29) is acceptable unlike (30), which has exactly the same denotation in this context. Such a distinction is unexpected if polar interrogatives are two-membered sets, but is expected under the present approach.

(30) *I am surprised at whether Greece won the finals.

Several speakers tell me (Gillian Ramchand, Bruce Morén) that for them the following variation of (1b) is acceptable:

(31) Peter is surprised at whether Erna was at the party or not.

Again this follows straightforwardly if the disjunction with *or not* creates a two-membered question set minimally distinct from that found in simple *whether* complements.

The last three examples thus strengthen the argument for the present theory. If polar interrogatives are treated as singletons, Generalization I follows directly from the presuppositions of *surprise*-predicates without recourse to the clause type feature [E].

2.4 Remarks on Alternative Questions

The approach developed so far runs into difficulties with alternative questions (see (32)). *Surprise*-predicates do not embed alternative questions although they can plausibly be analyzed as two- (or more-) membered sets of propositions. We expect alternative questions to behave like example (29) and be acceptable. For certain cases like (31) and some speakers this seems to be the correct prediction. In addition to (31) Gillian Ramchand (p.c.) finds example (32a) only slightly degraded, but even for her (32b) is considerably worse. As for myself, I find the German equivalents of (31) and (32) unacceptable.

(32) a. *Ian was surprised at whether Amy drinks tea or whether she drinks coffee.
b. *Ian was surprised at whether Amy drinks tea or coffee.

This is somewhat of a problem. To understand it, consider the following simplistic theory of alternative questions: The disjunction takes two sets

and forms their union[24]. In example (32b) disjunction might be assumed to be able to take scope in various positions.

- First, *or* could disjoin *tea* and *coffee*. This leads to the polar interrogative reading of (32b) (33a). Like all polar interrogatives under *surprise*-predictes, this reading leads to contradictory presupposition and is therefore unusable.
- Second, *or* could take scope above the question forming operator (which outputs a set of propositions: [[?]]=λpλq:p=q) and below *surprise*.

The disjunction of two polar interrogatives is a two-membered set of propositions.[25] This is the problematic case (33b). Third, *or* could scope above *surprise* (33c). In this case *surprise* would have to embed polar interrogatives, which is again ruled out because within each disjunct, the *surprise*-predicate illicitly takes a polar interrogative as its complement.

(33)

	Scope	Prediction	Comment
a.	surprise > Q_{OP} > or	*	Q_{OP} returns a singleton
b.	surprise > or > Q_{OP}	✓	*Or* forms the union of two singleton sets. This situation is expected to be admissible counter to fact.
c.	or > surprise > Q_{OP}	*	The disjuncts are ill-formed individually

To pursue the present theory, we would need to find out why disjunction cannot scope between the question-forming operator and *surprise*- for the speakers for which it can't. I do not have an answer to this, but I would like to point out that the observed restriction on the scope of disjunction is part of a larger generalization that extends to *wh*-questions. Consider example (34).

(34) John was surprised about who stayed long or who left early.

Again there are three logical possibilities for the scope of *or*:

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[24] The conjunctive interpretation of alternative questions (see Boërs 1978) is presumably an effect of the strong contexts in which they often appear.

[25] This suggestion incidentally invalidates one of Krifka's (2001:302-303) objections to the proposition set approach to questions. Krifka claims that questions of the type *Did Mary arrive or not?* should be formally distinguished from simple polar interrogatives like *Did Mary arrive?* Usual approaches following Hamblin do not draw this distinction, but the present approach does.

- First, *or* could take scope below the question forming operator, but this is ruled out here syntactically because we are dealing overtly with CP-disjunction (35a).
- Second, *or* could take scope between *surprise* and the question forming operator.

This is the configuration that must be disallowed for alternative questions. Allowing it for *wh*-questions would make the following wrong prediction. Disjunction forms the union of both *wh*-questions. The result is the set of propositions *that Andrew stayed long, that Barbara stayed long, that Chris stayed long, ... that Andrew left early, that Barbara left early, that Chris left early,...* . Suppose John knows p_2 = *that Andrew stayed long and that Barbara left early*. Clearly, p_2 is a *mention-some* answer to the disjoined question. Suppose furthermore that John expected p_1=*that Andrew would stay long or that Barbara would leave early but not both*. Under this scenario p_1 is incompatible with p_2 and p_1 is compatible with some member(s) of the combined Q_H. Thus (34) is predicted to be true in this situation. However, surprisingly, it is not.[26] Example (34) cannot be used in this situation. Finally, *or* could scope above *surprise*. In this case the sentence means that John was surprised who stayed long or that John was surprised who left early. The sentence, in fact, has only this meaning (35).

(35)

	Scope	Prediction	Comment
a.	surprise > Q_{OP} > or	*	Syntactically unavailable for (34)
b.	surprise > or > Q_{OP}	✓	***or* forms the union of two sets. This situation is expected to be admissible counter to fact.**
c.	or > surprise > Q_{OP}	✓	This reading (matrix disjunction) is possible.

It follows from this discussion that intermediate scope for disjunction is apparently impossible both in *wh*-questions and in alternative questions. The problem thus reduces to a more general question concerning the

[26] This is plausible if Andrew usually stays long and Barbara usually leaves early and additionally, Barbara is in love with Andrew which gives rise to the expectation that she will stay unusually late if Andrew stays late, too. The sketched scenario is parallel to the case where (i) is uttered truthfully in a situation where John knows p_2 = *that Mary invited Frank and Sue* and he expected p_1= *that Mary invites Frank or Mary invites Sue but not both*. But (i) is true in this case while (34) is not in the case described.

i. John is surprised (at) who Mary invited.

scope of disjunction. Why the scope of disjunction is restricted in this particular way remains an open question, but clearly the facts from alternative questions cannot be used to argue against the present theory.

3 Questions with intensifiers under *wonder*-predicates

Let's turn to questions with intensifiers now. They occur under *surprise*-predicates but not under *wonder*-predicates. This was illustrated in example (1d) and (1e) above, where it was also noted that the judgments are fare less clear and stable than those for (1b). Below I concentrate on German. English is subtly different in ways that I do not quite understand.

The basic facts for German parallel the English facts above. It is usually impossible to use an intensified wh-phrase in a root question (36–37a) or as the complement of a *wonder*-predicate (36–37b), but as an exclamative (36–37c), as the complement of a *surprise*-predicate (36–37d), and under a verb like *know* (36–37e) they can occur. The examples show that adjectival and nominal intensifications show parallel behavior.[27]

(36) a. *Wie enorm groß ist Maria?
how enormously tall is Maria
b. *Heinz fragt sich, wie enorm groß Maria ist.
Heinz asks self how enormously tall Maria is
c. ✓Wie enorm groß Maria ist!
How enormously tall Maria is!
d. ✓Heinz ist überrascht, wie enorm groß Maria ist.
Heinz is surprised how enormously tall Maria is
e. ✓Ich weiß, wie enorm groß Maria ist.
I know how enormously tall Maria is

(37) a. *Welche Bullenhitze herrscht im Kino?
Which bull's heat reigns in.the cinema
b. *Heinz möchte wissen, welche Bullenhitze im Kino herrscht.
Heimz wants to know which bull's heat in.the cinema reigns
c. ✓Welche Bullenhitze im Kino herrscht!
which bull's heat in.the cinema reigns
d. ✓Es ist erstaunlich, welche Bullenhitze im Kino herrscht.
It is surprising which bull's heat in.the cinema reigns
e. ✓Ich habe erfahren, welche Bullenhitze im Kino geherrscht hat.
I have found out which bull's heat in.the cinema reigned has

[27] The unacceptable examples improve if the *wh*-word is heavily stressed (see d'Avis 2001, 2002).

3.1 A note on syntax

It has occasionally been suggested that the clauses in question, the intensified *wh*-questions are really free relatives (Rosengren 1992). The suggestion has little plausibility. D'Avis (2001 chapter 6.3–4) gives a number of convincing arguments against the free-relative analysis, I will briefly add a two of my own. The first argument concerns the distribution of interrogatives vs. free relatives. While free relatives can appear in the middle field in German, interrogatives cannot (38a–b). If what I have been calling *intensified wh-questions* really are free relatives, they should be able to occur in the middle field – counter to fact (38c):

(38) a. ✓Ich wollte, was du gekocht hast, stets (ohne Murren) essen.
I wanted what you cooked have always (without complaints) eat
I have always wanted to eat without complaints whatever you cooked.

b. *Ich wollte, was du gekocht hast, stets (auf dem Heimweg) wissen.
I wanted what you cooked have always (on the way home) know
I always wanted to know on the way home what you had cooked.

c. *Ich bin, was für eine Bullenhitze im Kino herrscht, stets
I am what for a bull's heat in.the cinema reigns always
(auf's Neue) überrascht.
(anew) surprised
I am always surprised again what an unbearable heat there is in the cinema.

The second argument comes from scope-marking. Interrogatives in German allow scope marking under the *was-w*-construction, while relatives never do. Consider against this backdrop example (39). The example involves an embedded intensified interrogative with scope-marking, clearly not a free relative.

(39) Context: Martin suggests to Tanja to go to the movies together. Tanja, who apparently has not caught on to the fact that movie theaters are usually air-conditioned nowadays, answers: "I don't want to go to the movies. In this weather there must be at least 40° C in there." Martin is baffled…
✓Martin ist erstaunt, was Tanja denkt, was für eine Affenhitze im
Martin is surprised what Tanja thinks what for a bull's heat in.the
Kino herrscht.
cinema reigns
Martin is surprised what an unbearable heat Tanja thinks there is in the cinema.

We thus have strong evidence both from the internal and the external syntax to treat intensified *wh*-questions as *wh*-questions.

3.2 Deficient questions?!

Once we treat intensified *wh*-questions as questions, it is a natural move to treat them as somehow deficient. D'Avis (2001) makes a concrete proposal along these lines. For him they are semantically interrogatives (type <<s, t>, t>) which are deficient in the sense that they presuppose their own answer. D'Avis (ibd.) further assumes restriction (40), which is fairly natural, given that questioning requires indeterminacy, an open choice.[28]

(40) Restriction: *Wh*-clauses that presuppose their own answer cannot occur in question contexts (d'Avis 2001: 67).

Although I agree with some of d'Avis' intuitions, his implementation contradicts both the results from section 2.3 of this paper and, in fact, d'Avis' own assumptions. He treats intenstified *wh*-questions as singleton sets of propositions (he calls this the 'one-proposition-interpretation' d'Avis 2001: 66). There are two main problems with this. First of all, we have seen that independently motivated presuppositions on predicates like *be surprised* bar such predicates from taking interrogatives denoting singletons as their complement. This should then rule out (36d) and (37d). Another way to put it is that for d'Avis intensified *wh*-questions come out as (a special kind of) polar questions, but since he himself treats polar questions as singletons, it is unclear how they could ever comply with the rationale given for (40), namely, that questioning requires choice. What is needed is a different way of stating the deficiency of intensified *wh*-questions.

I will not attempt to do so in any serious way. I do believe, though, that the facts suggest an approach in terms of presuppositions, (41) and (42). The former show that intensified *wh*-questions can actually be used as real questions and the latter show that intensified *wh*-questions can be embedded under *wonder*-predicates after all. The question is thus, what distinguishes these examples from unacceptable ones?

(41) a. In the theater:
✓Wenn's hier im Parkett schon so heiß ist, welche Bullenhitze herrscht dann (wohl/erst/wohl erst) oben auf dem Rang?
If it is already this hot down here on the main floor, what unbearable heat must there be up on the balcony?

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[28] D'Avis' independent justification for (40) rests on contrasts like (i) and (ii) that go back to Grimshaw's work.
i. ✓I wonder who went to the movies – John or Mary.
ii. *I wonder who went to the movies – (namely) John and Mary.

b. A river 10m deep and 20m wide that flows at 0.3km/h transports about 16m^3 water per second.
✓Wie enorm breit müsste ein Fluss gleicher Tiefe und Fließgeschwindigkeit sein, um 100 000 m^3 Wasser pro Sekunde zu führen? – 6km.
How enormously wide would a river of the same depth and speed have to be to transport 100 000 m^3 of water/second? – 6km.

(42) Embedded Questions:
a. ✓Wenn die Temperaturen in Gujarat schon im Winter 30° übersteigen, fragen sich unsere Hörer natürlich, was für eine Bullenhitze dort im Sommer herrscht.
If the temperature in Gujarat is above 30° C even in winter, our listerners of course wonder what unbearable heat there is there during the summer.
b. ✓Mein Physiklehrer hat mich heute gefragt, wie enorm breit ein Fluss sein müsste, um bei einer Tiefe von 10m und einer Fliessgeschwindigkeit von 0,3km/h 1 000 000 m^3 Wasser pro Sekunde zu führen.
My physics-teacher asked me today how enormously wide a river would have to be in order to carry 1 000 000 m^3 water/second at 0.3km/h and a width or 10m.

Andreas Haida (p.c.) suggests the following generalization: *wh*-questions with intensifiers can appear under *wonder*-predicates and as matrix questions if they occur with a filter for presuppositions (for the concept of 'filter' see Heim 1983; Karttunen and Peters 1979).[29] *If*-clauses and *in order to* clauses filter presuppositions (43). In (43a) the existence presupposition of the definite description is not fulfilled. This presupposition is filtered in (43b–c), which makes them acceptable (if tedious without the epithet).

(43) a. #You have to lure the alien into the trap.
b. If you want to catch an alien, you have to lure the alien/sucker into the trap.
c. In order to catch an alien, you have to lure the alien/sucker into the trap.

The fact that intensified *wh*-questions are sensitive to presupposition-filters suggests that a treatment in terms of presuppositionality ought to be sought. Intensified *wh*-questions have presuppositions that make

[29] Examples like (i) seem to be a different class of exceptions to generalization (3) since *dass* clauses do not seem to plug presuppositions. I do not currently have an analysis for these cases.
i. ✓Mit welchem Affenzahn rast du denn/eigentlich durch die Stadt, dass du jetzt schon hier bist?
At what breakneck speed do you blow through town that you are here already?'

them incompatible with questioning. These presuppositions are filtered in (41) and (42), which ought to explain the felicity of these examples.

However, unlike d'Avis we cannot treat this as a presupposition of the members of the Hamblin set. If we did so, the Hamblin set would shrink to a singleton with the consequences noted. Instead we need to treat the presuppositions of the question as an object separate from the presuppositions of the members of the Hamblin set. Once these types of presuppositions are properly distinguished, the contradiction that d'Avis proposal gave rise to can be avoided. At the moment I do not have a concrete implementation of this proposal, however.

4 Conclusion

In this paper the question was raised whether Grimshaw's clause type feature [E] is necessary to capture Generalizations I and II. Generalization I follows directly from independently motivated presuppositions of *surprise*-predicates once the (nonstandard) assumption is made that polar interrogatives are singleton sets of propositions. The first part of this paper thus constitutes an argument for this approach to polar interrogatives. In fn. 25 we noted that this approach to polar interrogatives also solves one of Krifka's objections to the proposition set approach to questions.

There are indications from counterexamples to Generalization II that here, too, a treatment in terms of presuppositions ought to be sought, those of *wonder*-predicates and intensified questions. D'Avis' intuition that intensified questions are defective might lead to a workable result once his specific implementation is abandoned. A compositional analysis of Generalization II and its counterexamples is yet to be provided, though.

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