

# Aren't there multiple causes of bias in polar questions?\*

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## Abstract

In this paper, two distinct explanations are offered for the speaker bias conveyed by two distinct kinds of polar questions: one explanation for bias in polar questions with preposed negation—*high negation questions* (HNQs)—and another explanation for bias in polar questions with prosodic prominence on the auxiliary—*polarity focus questions* (PFQs). The distinct accounts are motivated by novel evidence demonstrating empirical asymmetries between the two kinds of questions. In particular, I show that bias in PFQs is context sensitive while bias in HNQs is context insensitive, and that PFQs require a focus antecedent while HNQs do not. I argue that PFQ bias derives from general pragmatic principles in combination with the conversational contexts that PFQs happen to frequently appear in. An understanding of bias in HNQs requires exploration of a further set of empirical facts, namely asymmetries between HNQs and polar questions with non-preposed negation—*low negation questions* (LNQs)—primary among them that LNQs do not share HNQs' requirement that the speaker is biased. This has been shown to hold crosslinguistically (Romero & Han, 2004), raising the question of why negation in a high structural position in a polar question leads to a necessary inference of speaker bias. To pursue an answer to this question, I present novel evidence demonstrating that HNQs lack propositional negation. This evidence is taken to support an analysis in which negation scopes over an ASSERT operator, which produces a denotation unique to HNQs. To the question of why such a denotation results in the speaker bias inference, I give a novel answer: By combining the unique denotation of HNQs with assumptions about the utility of questions, I show that the only sort of context in which a HNQ is optimal is one in which the speaker is biased. If the speaker is not biased, there is some other question that more efficiently advances the conversation. The resulting account provides an explanation for the crosslinguistic link between structural height, negation, and speaker bias.

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# 1 Introduction

Why do biased questions convey the biases that they do? Consider four kinds of polar questions in (1):

- (1)      a. Isn't Moira home?                                  c. Is Moira not home?  
          b. IS Moira home?                                     d. Is Moira home?

These questions are all about whether or not Moira is home, but they are also meaningfully different from one another. Romero & Han (2004) observe that *high negation questions* (HNQs) as in (1a) and *polarity focus questions* (PFQs) as in (1b) both convey that the speaker is biased toward—believes or expects—the answer with polarity opposite from the question. This kind of speaker bias is the main focus of this paper. *Low negation questions* (LNQs) as in (1c) require compelling contextual evidence for (Büring & Gunlogson, 2000) or at least asker interest in (Van Rooij & Šafářová, 2003) the negative answer. *Positive polar questions* (PPQ) as in (1d) seem to be the unmarked form, requiring either compelling contextual evidence for the positive answer or evidentially neutral contexts (Büring & Gunlogson, 2000).

Classic theories of question semantics do not account for these meaning differences since they model each question in (1) with the same object, a set containing propositions representing the positive and negative answers, as in (2).

- (2)  $\{that\ Moira\ is\ home, that\ Moira\ is\ not\ home\}$ , i.e.  $\{p, \neg p\}$

Hamblin (1973) does this by taking polar questions to denote a function that characterizes the set in (2), while Groenendijk & Stokhof (1984) propose an equivalence relation that partitions the set of possible worlds into the set in (2). If the negations in (1a) and (1c) are taken to modify the propositional cores or prejacentes of the questions, then they have no effect on the set of propositions produced by either theory. I will retain a classical treatment of polar questions as sets of their two answers, but build on it to explain the empirical differences among the questions in (1).

The paper is organized as follows: In section 2, HNQs are distinguished from LNQs by showing that only HNQs necessarily convey a speaker bias, while only LNQs are subject to an evidential condition. I will argue that the empirical claim that HNQs have an evidential condition of their own is mistaken and should be abandoned (*pace* Büring & Gunlogson 2000; Sudo 2013; Northrup 2014; Trinh 2014).

In section 3, I demonstrate novel empirical asymmetries between HNQs and PFQs. The crucial fact is that, unlike in HNQs, bias in PFQs is context sensitive, which leads me to argue in section 4 that PFQ bias derives from general pragmatic principles in combination with the conversational contexts that PFQs happen to frequently appear in.

To get a handle on HNQ bias, we must recall that it is a crosslinguistic generalization: Romero & Han (2004) show that multiple languages display bias in HNQs but not LNQs, and much work since has bolstered this finding (e.g. Hartung, 2009; Ito & Oshima, 2014; Gyuris, 2017; Gökgöz & Wilbur, 2017). This fact leads to the conclusion that the combination of negation and preposing plays a key role in the explanation of HNQ bias (challenges for accounts in which negation does not play a key role are delineated in section 6). To understand why preposed negation has this effect, we need further empirical evidence elucidating the contribution of the negative morpheme to the compositional semantics. In section 5, I deploy a battery of tests for negation in polar questions. The results reveal interesting asymmetries between LNQs and HNQs, namely that while LNQs contain a negation modifying the propositional preagent of the question, HNQs do not. This leads me to flesh out Ladd’s (1981) conjecture that high negation “is somehow outside the proposition” in section 7 by arguing that high negation scopes over a doxastic speech act operator. I analyze this structure as denoting an unbalanced partition, consistent with previous proposals (Romero & Han, 2004; Repp, 2013; Krifka, 2017).

The remaining question is why does such a denotation result in the necessary inference that the speaker is biased for the proposition embedded under the high negation? In section 8, I develop a novel account of this inference, arguing that the unique denotation of an HNQ is only useful to achieving a speaker’s conversational goals if the speaker is biased for *p*. If the speaker is

not biased, some other question will be more useful for advancing the conversation. Since the only contexts in which HNQs are optimal are ones in which the speaker is biased, the bias inference is intuitively necessary. The resulting account provides an explanation for the crosslinguistic link between negation, structural height, and speaker bias.

## 2 Bias, evidence, HNQs, and LNQs

### 2.1 The HNQ bias condition

(3) is a “neutral context” in the sense that A has no expectations about the answer to the polar question, and there is no current contextual evidence supporting one answer or another.

- (3) A has just walked in the front door, and she is looking for her roommate Moira. She has no idea whether Moira is home or not, but their mutual roommate B is, so A says to B:
- a. Is Moira home?
  - b. #Is Moira not home?
  - c. #Isn't Moira home?

In the context of (3), a positive polar question like (3a) is perfectly acceptable, while both kinds of negative questions in (3b) and (3c) are unacceptable. Clearly HNQs and LNQs require a non-neutral context in order to be used. For example, consider the following:

- (4) A has just gotten home, and she is expecting Moira to be there. She looks all around the house and can't find her. However, A does find B in the last room that she checks, so she says to B:
- a. Is Moira not home?
  - b. Isn't Moira home?

Now, both (4a) and (4b) are acceptable. In fact, many contexts that render HNQs acceptable also render LNQs acceptable, and vice versa. However, it turns out that their acceptability depends crucially on different features of the context that can be manipulated independently. In particular, HNQs necessarily require the speaker to have an expectation that the proposition embedded

under negation is true, so-called *speaker bias*. LNQs do not have this requirement. To see this, consider the following:

- (5) A has no expectations about whether Moira is home or not, but she has just gotten home and is looking for her. She looks all around the house and can't find her. However, A does find B in the last room that she checks, so she says to B:
- a. Is Moira not home?
  - b. #Isn't Moira home?

In this context, the LNQ (5a) is perfectly acceptable, however the HNQ (5b) is not. Here is another example demonstrating the asymmetry by removing any expectations on the part of the speaker:

- (6) A has been in a windowless, basement computer lab for the last eight hours. Given her background knowledge, it is equally likely that it could be nice out or not. Then B walks in rubbing her hands together and stamping her feet, and says, "I hate the weather in this town!" A replies:
- a. Is it not nice out?
  - b. #Isn't it nice out?

Again a LNQ (6a) is acceptable while a HNQ (6b) is not. Note that if we were to alter (6) slightly so that A has just checked the weather online before B walked in and has seen that it is supposed to be nice out, now (6b) is a perfectly acceptable response to B's behavior. LNQs on the other hand are completely acceptable in contexts that lack this bias. The following generalization about HNQs can be extracted from these examples:

- (7) *HNQ bias condition:*  
HNQ- $p$  is felicitous only if the speaker is biased for  $p$

I use "HNQ- $p$ " as shorthand for a high negation question with propositional content  $p$ . By "propositional content", I mean the denotation of the constituent embedded under negation, so for example, the propositional content of "Didn't Jane eat?" is the proposition *that Jane ate*; the propositional content of "Didn't Jane not eat?" is the proposition *that Jane did not eat*.

The generalization in (7) is well established in the literature (e.g. Romero & Han, 2004; Sudo, 2013; AnderBois, 2016). Romero & Han further demonstrate that this is not just a quirky fact of English; preposed negation in polar questions correlates with bias in Modern Greek, Spanish, Bulgarian, Korean, and German (see also Hartung 2009 on German HNQs), while non-preposed negation does not. The generalization also holds in Japanese (Ito & Oshima 2014; Shimoyama et al. 2019), and in Hungarian (Gyuris, 2017).

The crosslinguistic stability of the phenomenon leads to the following question: Why is there a correlation between negation, preposing, and speaker bias in polar questions? Since the phenomenon is found in multiple languages, some unrelated to one another, we should expect a deep explanation for this correlation, one that derives the bias from the preposed negation, rather than stipulating it.

## 2.2 The LNQ evidence condition

Büring & Gunlogson (2000) establish the following generalization for LNQs:

- (8) *LNQ evidence condition:*  
LNQs require compelling contextual evidence in favor of  $\neg p$ .

We’ve already seen some data in support of (8) in that the LNQ was unacceptable in the neutral context of (3), but acceptable in (4), (5), and (6), each of which included contextual evidence for the negative answer to the question.<sup>1</sup>

Does (8) apply to HNQs as well? Both Northrup (2014) and Trinh (2014) claim that it does. To check this claim, we can produce contexts that lack the contextual evidence required to satisfy

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<sup>1</sup>For Büring & Gunlogson (2000, 7), compelling contextual evidence for a proposition  $p$  is “evidence that has just become mutually available to the participants in the current discourse situation,” that “would allow the participants to assume  $p$ ”. Goodhue & Wagner (2018, 17) update this by treating evidence for  $p$  as “a change in the context that increases the likelihood that  $p$  is true,” since relatively weak evidence for  $\neg p$  could license a LNQ even if it wouldn’t enable the speaker to assume  $\neg p$ .

Romero & Han (2004); Sudo (2013) point out that LNQs are not only licensed by contextual evidence for  $\neg p$ , but also by relevance of  $\neg p$  to the QUD, or speaker interest in  $\neg p$ . Therefore, it may be that (8) will ultimately be subsumed under a more general condition on the use of LNQs, one that I expect will flow from the markedness of negation.

(8), but that have the speaker bias to satisfy (7). If (8) applies only to LNQs, then HNQs should be felicitous in such contexts while LNQs are not. This is indeed what we find in (9) and (10):

- (9) A asks B what she is up to tonight, and B says, “I’m going to the Alabama Shakes concert.” Suppose A has heard that another band, The Moon and You, are the opening act, and there is no contextual evidence to the contrary. A replies: Oh yeah, I heard about that show...
- a. Aren’t The Moon and You opening?
  - b. #Are The Moon and You not opening?
- (10) A and B have just walked outside together. A says:
- a. Isn’t it nice out?
  - b. #Is it not nice out?

Clearly HNQs are not subject to the same requirement for contextual evidence as LNQs in (8). If they were, then (9a) and (10a) would be infelicitous, contrary to fact. A defense of the view held by Northrup and Trinh would require one to claim that in (9) and (10), the HNQs are felicitous because contextual evidence for  $\neg p$  is accommodated. For example, B’s failure to mention that The Moon and You is opening in combination with the assumed relevance of that fact is taken by A as contextual evidence for  $\neg p$ . In fact, Trinh (2014, 243-244) makes such an argument to explain similar apparent counterexamples to his characterization of the empirical facts. However, if this explanation were correct, then why is the LNQ in (9b) clearly infelicitous? If evidence for  $\neg p$  could be accommodated in these contexts to satisfy the condition in (8), then a LNQ should be felicitous in these contexts as well. Since this isn’t what we find, I take such examples to provide strong evidence against Northrup’s and Trinh’s generalization that HNQs require contextual evidence for  $\neg p$ .

### 2.3 There is no HNQ evidence condition

Though other theorists have not gone as far as Northrup (2014) in claiming that HNQs are subject to the same evidence condition as LNQs, many have claimed that HNQs are subject to their own, weaker evidence condition (Büring & Gunlogson, 2000; Sudo, 2013; Trinh, 2014):

- (11) *HNQ evidence condition:*  
HNQ- $p$  is incompatible with contextual evidence for  $p$ .

Another way of stating (11) is that HNQs are only compatible with evidentially neutral contexts and contexts in which there is contextual evidence for  $\neg p$ . We have already seen that HNQs are acceptable in each of these kinds of contexts, e.g. (9) and (4), but we haven't seen that they are unacceptable in contexts with evidence for  $p$ .

Since we know that HNQs with content  $p$  require the speaker to be biased for  $p$ , the most obvious context to use to try to establish (11) is one in which the speaker is biased for  $p$  and there is contextual evidence for  $p$ . For example:

- (12) A believes that Jane is left handed. Then A and B see Jane writing with her left hand. A says to B:  
# Isn't Jane left handed?

(12) is clearly infelicitous. However it seems unlikely that this fact should be explained by a strict connection between HNQs and contextual evidence. Rather, the infelicity seems to result from something much more general, that is, there is no need for A to ask this question. A already has a belief in  $p$  and the evidence supports it, so why ask about it? This view is supported by the observation that it would be equally infelicitous for A to ask *Is Jane left handed?* in the context of (12). Thus, while (12) fits the generalization in (11), I think it is explained on more general grounds. It does not require us to develop a theory specifically aimed at explaining (11).<sup>2</sup>

Here is another context that is meant to support (11), inspired by Sudo (2013, 280, ex. (9)).

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<sup>2</sup>To make matters worse for the viability of the HNQ evidence condition in (11), there are contexts in which there is evidence for  $p$ , and the speaker is biased for  $p$ , in which HNQ- $p$  is felicitous. These cases involve interlocutors agreeing while using sentences containing predicates of personal taste:

- (i) a. A: It's nice out.  
B: Isn't it?  
b. A: Jane is great.  
B: Isn't she?

In such examples, A asserts  $p$ , thus providing contextual evidence for  $p$ , and then B uses the HNQ, expressing her bias for  $p$ . According to (11), the HNQs here should be infelicitous.



Here,  $p$  is the proposition *that Jane is left handed*,  $\neg p$  is the proposition *that Jane is right handed*.

- (13) A believes that Jane is right handed (bias for  $\neg p$ ). Then A and B see Jane writing with her left hand (evidence that  $p$ ). A says to B:
- a. #Isn't Jane left handed?
  - b. Isn't Jane right handed?

In (13), the evidence and the belief conflict, which provides motivation for A's question. Nevertheless, the propositional content of the HNQ is still restricted in that (13a) with propositional content aligned with the contextual evidence is infelicitous, as predicted by the generalization in (11): HNQ- $p$  is incompatible with a context that provides evidence for  $p$ . Meanwhile, (13b) with propositional content aligned with the speaker bias is felicitous. Thus an example like (13) provides *prima facie* evidence for the evidential condition in (11), or so Sudo (2013) claims.

However, there is another, more plausible explanation for the contrast in (13): as laid out in the bias condition in (7), HNQs are infelicitous in contexts in which the speaker is not biased for the propositional content of the question, i.e. the proposition embedded under the high negation. This generalization is established on the basis of examples like (5b), (6b) and (9), examples that meet the purported HNQ evidence condition in (11), therefore the bias condition is clearly needed on independent grounds. Thus, if possible, it would be simpler to explain the infelicity of (13a) on the basis of this independently needed bias condition than to postulate a separate evidence condition on the use of HNQs. And such an explanation can be given. The infelicity of (13a) is caused by the mismatch between the speaker bias (for  $\neg p$ ) and the propositional content of the HNQ ( $p$ ), violating the bias condition in (7). In (13b) on the other hand, there is no such mismatch and the question is felicitous.

From these facts, I conclude the following: while the LNQ evidence condition in (8) is the primary empirical fact about LNQs that distinguishes them from other polar questions and therefore requires a direct explanation, the HNQ evidence condition in (11) requires no single explanatory theory. Rather, the fact that the HNQ generalization in (11) holds is accidental, with heterogeneous explanations such as those that I offered for the two previous examples. Thus the puzzle

raised by Büring & Gunlogson (2000) and echoed by Sudo (2013) is dissolved. Both seek—but fail to find—a satisfying unified account of evidence conditions holding on all kinds of positive and negative polar questions including HNQs. The search for such an account should be abandoned. HNQs require speaker bias for  $p$ , and this in combination with general facts about the utility of asking questions in various contexts eliminates the need for an explanation of the generalization in (11). With HNQs out of the way, I believe an explanation for the asymmetry between PPQs and LNQs will follow straightforwardly from a more general theory of the markedness of negation (Horn, 1989), though a precise account is beyond the scope of this paper.

In this section, I have been crossing two contextual factors—speaker bias and contextual evidence—to observe their effects on the acceptability of polar questions. The findings are summarized in Table 1.<sup>3</sup>

Table 1: The relationship between speaker bias, contextual evidence, and the felicity of positive and negative polar questions

	Bias for $p$	no bias	Bias for $\neg p$
Evidence for $p$	1. empty (12)	2. PPQ	3. HNQ- $\neg p$ /PPQ (13)
No evidence	4. HNQ- $p$ (9), (10)	5. PPQ (3)	6. HNQ- $\neg p$
Evidence for $\neg p$	7. HNQ- $p$ /LNQ (4)	8. LNQ (5), (6)	9. empty

The HNQ bias condition in (7) is clearly reflected in Table 1: HNQs are only felicitous in the second and fourth columns in which the speaker is biased toward the propositional content of

<sup>3</sup>I have not given an example instantiating each cell of Table 1, leaving out those that are not crucial to the narrative of the main text. For completeness: an example of cell 2 can be found in Büring & Gunlogson 2000, 7, ex. (18). Cell 6 can be found in Romero & Han 2004, 619, ex. (28). A PPQ for cell 3 can be found by considering that “Is Jane left handed?” would be felicitous in the context of (13). A moment’s reflection suffices to produce an example that satisfies cell 9 much like (12) satisfies cell 1.

Note Table 1 is used to make both positive and negative claims. E.g. cell 8 contexts allow LNQs to be used felicitously, but not PPQs or HNQs (neither HNQs with propositional content  $p$  nor  $\neg p$ ). These claims may be a bit idealized in some cases, for example, one could perhaps imagine A felicitously asking the PPQ “Is Moira home?” in the context of (4). Should PPQ therefore be added to cell 7? One has the feeling that such behavior is acceptable only because it seems possible to imagine A ignoring both her bias and the contextual evidence, thus turning the example into one that properly belongs in cell 5. Such nuances are interesting and deserve further attention, but I believe they can all be set aside given the present focus on HNQs (and how they differ from LNQs). In other words, I believe that Table 1 provides a general picture of the interaction between bias, evidence, and the use of positive and negative polar questions that is accurate in its broad strokes, but I take it to provide a detailed and complete picture of the use of HNQs, which can *only* appear in cells 3, 4, 6, and 7.

the HNQ. The key question motivating this paper is, why must HNQs convey bias toward the propositional content of the question (rather than bias toward the negation of the propositional content or no bias at all)? In pursuit of an answer, I turn now to exploring asymmetries between speaker bias as it appears in HNQs and PFQs.

### 3 Two empirical asymmetries between polarity focus and high negation

Romero & Han (2004) observe that both high negation questions (HNQs) and polarity focus questions (PFQs) convey that the speaker is biased: The speaker has a previous belief or expectation that the answer with opposite polarity from that of the question is true. For example:

- (14) A: Ok, now that Stephan has come, we are all here. Let's go!  
 B: Isn't JANE coming?  
 $\rightsquigarrow$  B previously believed that Jane is coming (Romero & Han, 2004, 610)
- (15) B: Ok, now that Stephan has come, we are all here. Let's go!  
 A: Wait, Jane's coming too.  
 B: IS Jane coming?  
 $\rightsquigarrow$  B previously believed that Jane isn't coming

In both (14) and (15), B conveys a speaker bias in asking her question. Given the strikingly similar pragmatic effect of these two question types, Romero & Han pursue a unified analysis of high negation and verum/polarity focus (Höhle, 1992). They propose that an epistemic operator with a conversational twist—*VERUM*—is introduced to the LF by both high negation and verum/polarity focus. This operator plays a crucial role in the derivation of speaker bias, and its use is subject to discourse constraints that are meant to explain the restricted distributions of both kinds of questions. However, Romero & Han are the first to acknowledge that the link between high negation and *VERUM* remains an unexplained assumption of their account. This stipulation is problematic since it offers no explanation for why preposing of negation would trigger the presence of an

epistemic conversational operator in multiple unrelated languages. Therefore, it offers no explanation for the crosslinguistic link between high negation and bias.

Besides this explanatory challenge, the account also faces an empirical challenge: a closer examination of HNQs and PFQs reveals two empirical asymmetries that speak against a unified account.

### 3.1 Asymmetry 1: Polarity focus is focus; high negation is not

PFQs, like all instances of polarity focus and all instances of focus more generally, require an antecedent in order to be licensed. However HNQs place no such requirement on the previous context. For example, in (15), B's use of polarity focus is licensed by A's utterance, which provides the required antecedent for the prominence shift. Compare this to (14), repeated below with added example sentences, in which the antecedent for polarity focus is missing from the context.

- (16) A: Ok, now that Stephan has come, we are all here. Let's go!
- a. B: Isn't JANE coming? (Romero & Han, 2004, 610)
  - b. B: # ISN'T Jane coming?
  - c. B: # IS Jane coming?
  - d. B: Is JANE coming?

As we saw above, the HNQ (16a) is felicitous in this context, however if we try to shift prominence to the auxiliary as in (16b), the result is infelicitous. The PFQ (16c) is also infelicitous, even though the same question without polarity focus in (16d) is felicitous. If we thought that HNQs and PFQs both introduced the VERUM operator, which in turn subjects them to the same licensing requirements, then their distributions should not come apart in this way.

Another example demonstrating the different licensing restrictions on HNQs and PFQs is given in (17).

- (17) Dialog between two editors of a journal in 1900:  
 A: I'd like to send this paper out to a senior reviewer, but I'd prefer somebody new.  
 a. B: Hasn't Frege not reviewed for us? He'd be a good one. (Romero & Han, 2004, 619)  
 b. B: # HAS Frege reviewed for us? He'd be a good one.

According to Romero & Han (2004), B's goal in (17) is to use question bias to answer A's implicit question, "Who hasn't reviewed for us?". Their theory predicts both (17a) and (17b) to convey that B is biased for  $\neg p$ , *that Frege has not reviewed for them*, thus achieving the goal. Nevertheless, only (17a) is felicitous. Any account of HNQs will have to make the licensing requirements loose enough that examples like (16a) and (17a) are predicted to be felicitous in their respective contexts. But if those same licensing requirements are then meant to predict the distribution of PFQs, they will incorrectly predict (16b), (16c), and (17b) to be felicitous. Clearly, since polarity focus is a kind of focus, it cannot be used in the contexts of (16) or (17) since the antecedent for a polarity focus prominence shift is missing. High negation on the other hand is not a kind of focus, thus it can be used even when there is no focus antecedent.

How could the unified VERUM theory of HNQs and PFQs be rescued from the data establishing this first asymmetry? One would minimally need to make the auxiliary assumption that verum/polarity focus has extra licensing requirements above and beyond those that exist for use of the VERUM operator. However, the distribution of verum/polarity focus can be explained entirely in terms of the more general theory of focus and the contextual restrictions it places on the use of prosodic prominence shifts (Wilder, 2013; Goodhue, 2018, revise and resubmit). If an independent account of bias in PFQs can be developed, then the VERUM theory becomes redundant. I offer such an account of PFQ bias in section 4.

### 3.2 Asymmetry 2: Bias is context sensitive in polarity focus, but not high negation

The second empirical asymmetry between HNQs and PFQs is that the former necessarily convey a speaker bias, while the speaker bias conveyed by the latter is context sensitive. We already saw an example in which a PFQ displays a speaker bias in (15). (18a) demonstrates a PFQ that is felicitous but does not convey any bias.

- (18) B wants to know whether Jill will be at a meeting for members. But B lacks an opinion about whether Jill is a member.  
B: Will Jill be at the meeting?  
A: If she's a member, she will.
- a. B: IS she a member?  
 $\nearrow$  B believes she isn't a member
  - b. B: # ISN'T she a member?  
 $\leadsto$  B believes she is a member

The context of (18) stipulates that B lacks a bias about whether Jill is a member. Nevertheless, the PFQ in (18a) is perfectly felicitous, despite this lack of bias. The HNQ in (18b) on the other hand is infelicitous in this context. Intuitively, this is because it conveys that B is biased toward the positive answer despite that the context stipulates her lack of bias. Without this contextual stipulation, (18b) would be perfectly felicitous. If both of these question types introduce a VERUM operator that triggers speaker bias, as Romero & Han (2004) claim, then this asymmetry is unexpected.

(19) is another example demonstrating the felicitous but unbiased use of a PFQ, heard on NPR:

- (19) The interviewee is a Californian rancher whose ranch was engulfed by a wild fire.  
Interviewee: Some of the horses, you know, they're used to being in their stalls, and they're a little afraid to come out, too, [...] so we had to make sure they'd get out of the barn in time.  
Journalist: DID they all make it out of the barn in time?  
Interviewee: I hope so, I don't know if all the horses made it or not, I know a lot of them did, I hope they did. (Kelly, 2017, @1:31)

Suppose the journalist intends not to convey any bias via her PFQ in (19). Intuitively, the PFQ is perfectly felicitous. Compare this to the use of the HNQ *Didn't they (not) all make it out of the barn in time?*, which clearly can only convey a positive bias (or negative bias with the added parenthetical *not*).<sup>4</sup>

The central fact about HNQs is that they *always* convey a bias for the answer with the same propositional content of the question, as laid out in (7). Meanwhile, examples like (18) and (19) show that it is an equally crucial fact about PFQs that they do not always convey a speaker bias, but that that bias instead seems to be conditioned by the particular context in which they appear. We will consider more data in the next section to demonstrate this latter claim.

How could we salvage the unified VERUM theory of HNQs and PFQs from this second empirical asymmetry? Since the account predicts the presence of VERUM to necessarily correlate with bias, one would have to claim that while HNQs necessarily have a VERUM operator at LF, PFQs do not necessarily have one. In fact, Romero & Han make this claim, saying that in some contexts, prominence on the auxiliary merely indicates contrast, while in other contexts it conveys verum focus. However, one expects principled differences between contexts in which auxiliary prominence is interpreted as verum focus and contexts in which it is interpreted as non-verum polarity focus. Romero & Han (2004, 630) attempt to demonstrate the difference, but (18) and (19) call the reality of the distinction into question. In (18), we simply stipulated that B is unbiased, and the PFQ in (18a) was perfectly felicitous without conveying a bias. Note that if we lift that stipulation without changing any other features of the context, (18a) could optionally be taken to convey that B is biased. Likewise for (19). Thus under this approach, there is nothing about the context (independent of stipulations about B's bias) that causes us to hear the PFQ as conveying verum focus as opposed to non-verum polarity focus. The account has to stipulate the presence/absence of VERUM in PFQs. Moreover the HNQ in (18b) does not allow for this flexibility. Try to force B to be unbiased, and the HNQ just sounds odd. It's not clear how the VERUM approach could explain

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<sup>4</sup>In my opinion, the journalist in Kelly 2017 does not intend to convey a bias, however given the title of the piece, she may have had a previous expectation for the truth of the negative answer to her question. Or perhaps an editor simply opted for an attention-grabbing lede. The key point is that if we take the journalist to be unbiased, then the PFQ is perfectly felicitous and unbiased, while an HNQ is infelicitous and biased.

rather than stipulate this asymmetry between PFQs and HNQs.

To recap, to save the unified VERUM theory of HNQs and PFQs from these two empirical asymmetries, we need to assume (i) that auxiliary prominence has extra licensing requirements above and beyond whatever the requirements of the VERUM operator are, and (ii) that auxiliary prominence only sometimes correlates with the presence of the VERUM operator at LF. In other words, the VERUM operator does both too little and too much when it comes to predicting the PFQ facts. Given this, I believe we should pursue a theory of the distribution of auxiliary prominence as polarity focus, explained entirely by a broader theory of focus (Goodhue, 2018), and a theory of speaker bias in PFQs that predicts its context dependence. HNQs, on the other hand, require a separate theory that predicts its broader distribution and context *independent* bias. In the next section, I develop a context sensitive account of bias in PFQs.

## 4 Deriving bias in polarity focus questions

Since speaker bias appears in some polarity focus questions but not others, the presence of the speaker bias inference should not be explained as a reflex of polarity focus. Instead, I will argue that PFQ bias arises as a result of unique features of some of the conversational contexts PFQs happen to appear in, in combination with general pragmatic principles. It is coincidental that these contexts also license polarity focus.

### 4.1 Account of speaker bias in PFQs

Consider the following biased PFQ:

- (20)    A: Dinah likes Ivy.  
          B: DOES Dinah like Ivy?  
           $\rightsquigarrow$  B believes that Dinah does not like Ivy

Let  $p$  be the proposition *that Dinah likes Ivy*. Using “ $\Box$ ” to represent “B believes that”, we can



abbreviate the goal of our bias derivation as  $\Box\neg p$ . Let's examine the various pragmatic principles in play to see how they might lead to this bias inference. First, A asserts  $p$ . Given Grice's (1989, 27) maxim of quality, "Try to make your contribution one that is true," including the first submaxim, "Do not say what you believe to be false," A conveys that she believes  $p$ . According to Stalnaker's (1978) theory of assertion and common ground, A also intends her interlocutor to accept  $p$  as true, and to update the common ground with  $p$ . The common ground is a set of propositions representing the mutual beliefs of the interlocutors. The context set  $c$  is the conjunction of these propositions, the set of all worlds compatible with all of the interlocutors' mutual beliefs.

If B were to accept A's assertion, she would update the common ground with  $p$ . The context set  $c$  would be updated with  $p$  by reducing the worlds it contains to just those in which  $p$  holds. But this is not what happens in (20). Instead, B asks  $?p$  (*Does Dinah like Ivy?*). Crucially, there are constraints on asking questions: both Roberts (1996/2012, 14) and Büring (2003, 541) propose versions of a principle that I will call *interrogativity* that is similar in spirit to Stalnaker's (1978) informativity principle:<sup>5</sup>

- (21) *Interrogativity principle:*  
Ask a question  $?p$  only if the context set  $c$  does not entail a complete answer to  $?p$ .

If  $p$  were mutually believed, then the common ground would have been updated with  $p$ ,  $c$  would entail  $p$ , and  $?p$  would be infelicitous by (21). Thus, by asking  $?p$ , B signals that  $c$  does not entail  $p$ , that  $p$  is not mutually believed. Since A believes  $p$  and has asserted it to B with the intention of making  $p$  common ground, the reason that  $c$  does not entail  $p$  must be that B does not believe it,  $\neg\Box p$ .<sup>6</sup>

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<sup>5</sup>Stalnaker's (1978) informativity principle constrains when a proposition can be asserted relative to the context set:

- (i) *Informativity principle:*  
A proposition asserted is always true in some but not all of the possible worlds in the context set. (Stalnaker, 1978, 88)

<sup>6</sup>There's an alternative way of getting to  $\neg\Box p$  that can be rejected, namely requiring that a speaker who asks  $?p$  is ignorant (or lacks an opinion) about the answer. If we sketch ignorance as  $\neg\Box p \wedge \neg\Box\neg p$ , then  $\neg\Box p$  follows anytime a

So far we are only part way to our goal, since the speaker bias inference in (20) is something stronger than  $\neg\Box p$ , namely  $\Box\neg p$ . In order to bridge the gap from the first statement to the second, I will make a move familiar from the quantity implicature literature that derives strong or secondary implicatures from weak or primary implicatures (Sauerland 2005; Fox 2007; Geurts 2010; also used in explanations of neg-raising in Bartsch 1973; Horn 1989). The inference  $\neg\Box p$  is strengthened to  $\Box\neg p$  only when the context supports the assumption that the speaker is *opinionated* about  $p$ , which is to say that she either believes  $p$  or  $\neg p$ , i.e.  $\Box p \vee \Box\neg p$ . Combining  $\neg\Box p$  and  $\Box p \vee \Box\neg p$ , the bias inference  $\Box\neg p$  is produced.<sup>7</sup>

To see this last step of reasoning in action, suppose that B in (20) is as close with Dinah and Ivy as A. Therefore, B can be expected to have an opinion about whether Dinah likes Ivy,  $\Box p \vee \Box\neg p$ . Putting the first inference ( $\neg\Box p$ ) together with B's contextually-provided opinionatedness, the speaker bias inference  $\Box\neg p$  is produced.

## 4.2 When the speaker is not opinionated

Now suppose instead that A knows Dinah and Ivy quite a bit better than B, and they both know this. In such a context, it is plausible to imagine B using the PFQ in (20) without conveying the bias inference, but instead conveying something weaker, like surprise. This is because we do not take B to be opinionated, and so only derive  $\neg\Box p$ . The two different readings of (20) could be brought out by possible continuations. In the first context, B could follow her PFQ with, "I don't think she does." In the second context she could follow the PFQ with, "I didn't know that."

Here is another example demonstrating the weaker, surprise inference:

- (22) A is telling B about a new club she has joined. Both know that B knows little about it.  
A: And Jill is a member too.  
B: IS she? That's nice!

---

speaker asks  $?p$ . The problem with deriving  $\neg\Box p$  this way is that it obviously conflicts with the bias inference we are trying to derive. E.g. (20) conveys  $\Box\neg p$ , which contradicts ignorance,  $\neg\Box p \wedge \neg\Box\neg p$ , thus the ignorance requirement is a nonstarter.

<sup>7</sup>See Reese (2007) for a similar explanation for bias in other kinds of questions that contain prominence shifting, though not polarity focus.

↗ B believes that Jill isn't a member.

In (22), A asserts  $p$ , but B is not opinionated about  $p$ , so strong speaker bias is not derived.

### 4.3 When the antecedent for polarity focus is not an assertion of $p$

Consider again (18), in which the PFQ conveys no bias, repeated here:

- (18) B wants to know whether Jill will be at a meeting for members. But B lacks an opinion about whether Jill is a member.  
B: Will Jill be at the meeting?  
A: If she's a member, she will.  
B: IS she a member?  
↗ B believes she isn't a member

This context is lacking two crucial conditions for the bias derivation laid out above. The first is that no one expresses a belief in the prejacent of the question  $p$ . The second is that B lacks an opinion about  $p$ . As a result, the bias derivation outlined above cannot get off the ground, and we do not infer that B is biased. A similar example is found in the dialogue taken from a TV show in (23). The characters are journalists discussing the Deepwater Horizon oil spill before the news has been made public.

- (23) A: It's a week before the oil reaches Louisiana's shores. Three days if the wind shifts.  
B: IS the wind gonna shift?  
↗ B believes the wind isn't going to shift  
From the pilot episode of "The Newsroom" @ 47 mins.

One can imagine contexts for the dialogue in (23) in which B is biased against the possibility that the wind could shift. However, in the context given, B is not biased either way, she is merely interested in the answer to her question given its relevance in the context.

#### 4.4 Not a sufficient condition

The derivation I have outlined above is not a sufficient condition for rendering a biased PFQ contextually felicitous. Thus, just because speaker bias can be derived from a PFQ in a context does not mean that the PFQ is predicted to be felicitous in that context.

- (24) A: Ivy is not coming to the party.  
a. B: # IS Ivy coming to the party?  
b. B: IS Ivy not coming to the party?  
     $\rightsquigarrow$  B believes that Ivy is coming to the party.

Applying the derivation I have given, (24a) is predicted to convey a  $p$  bias: A has asserted  $\neg p$ ; given (21), by asking  $?p$  in (24a), B conveys that she doesn't believe  $\neg p$ ; this combined with an opinionatedness assumption should lead to a positive  $p$  bias. So why doesn't (24a) felicitously convey this bias? The answer is that (24a) is infelicitous for an independent reason, namely it runs afoul of the positive question counterpart of the LNQ evidence condition in (8) discussed in section 2: positive polar questions are incompatible with contextual evidence for  $\neg p$  (Büring & Gunlogson, 2000; Sudo, 2013; Trinh, 2014; Roelofsen & Farkas, 2015). A has asserted  $\neg p$ , which provides contextual evidence for  $\neg p$ , so if B wants to ask a polar question about  $p$ , she has to phrase it negatively, as in (24b). As such, (24b) is perfectly felicitous and leads to the predicted speaker bias.

#### 4.5 Biased PQs without polarity focus

We have seen that the presence of polarity focus in a PQ does not entail speaker bias, and the account given above predicts this context dependent bias. Polarity focus is licensed in all of the contexts above because the proper antecedent for focus marking is provided by the context, whether it be a previous assertion of  $p$ , or a conditional with  $p$  in the protasis. It is just a coincidence that many contexts in which polarity focus is licensed by a previous assertion of  $p$  also happen to have the ingredients necessary to derive speaker bias. This is why bias in PFQs is

context sensitive.

Another prediction of this theory is that, if we can find a context that provides all of the necessary inputs for a bias derivation but that does *not* license polarity focus, then bias should still be derived. This is indeed what we find.

- (25) A context where Jane is not present:  
A: Everyone's here, let's go!  
B: Wait. Is JANE coming?  
 $\rightsquigarrow$  B believes that Jane is coming.

In (25), A's assertion along with Jane's absence implies that A believes that Jane is not coming, or  $\neg p$ . If  $c$  entailed  $\neg p$ , then by (21) B shouldn't be able to ask  $?p$ . So since she does, B conveys that  $c$  does not entail  $\neg p$ , and this is because  $\neg \Box \neg p$ . Finally, if we combine this inference with an opinionatedness assumption, we derive the bias implicature,  $\Box p$ .

Two remarks about (25): First, despite this speaker bias, B's polar question in (25) could not have borne polarity focus, since the proper antecedent for a prominence shift is absent. So speaker bias can arise even in the absence of polarity focus as predicted.

Second, the polarity of the bias in this case is actually identical to the polarity of the polar question. This is not so in any of the previous cases we have looked at. So we learn from this example that opposing polarity between the overt question and the implied bias is not required. The polarity of the bias inference is conditioned by the context—in this case, the implication arising from A's utterance that Jane is not coming. Note that B could have asked a low negation question instead, "Is JANE not coming?", and this would have had exactly the same bias inference.<sup>8</sup>

The independence of bias and polarity focus can be further demonstrated without getting into issues of polarity and the evidential condition. For example:

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<sup>8</sup>This variation in possible polarities suggests that at least in rare cases the evidential conditions on polar questions may be violated. In this case, A's utterance can be taken to provide contextual evidence that Jane is not coming, thus the evidential conditions should require B not to use the positive PQ, but instead use the LNQ. Perhaps the reason is that the inference to  $\neg p$  arising from A's utterance is relatively implicit, perhaps implicit enough to allow the evidential condition to be obviated. However, a complete explanation of this fact requires a complete theory of the evidential condition on polar questions. Since I am not offering such a theory here, I leave this issue to future work.

- (26) A and B are planning a potluck.  
A: Mark is bringing a salad, and Jane baked a pie.  
B: Wait. Is JANE coming?  
↪ B believes that Jane isn't coming.

B can take A's utterance to imply that Jane is coming. If so, the bias can again be derived along the lines I have outlined above, assuming that B is opinionated. Again, polarity focus would be infelicitous here, but the bias can be derived independently, as predicted.

## 4.6 Section conclusion

With this account of speaker bias in PFQs in hand, we now have a partial answer to the question I posed at the beginning of this paper: Why do biased questions convey the biases that they do? For PFQs, the bias conveyed does not depend directly on unique aspects of their prosody or syntax. Rather, the speaker bias of these questions is derived entirely via independent pragmatic principles. Semantically and syntactically (F-marker notwithstanding), PFQs are no different from polar questions that lack polarity focus. The account proposed allows us to keep a classic semantics for polar questions in place.

In the following, I will argue that we need to give a different answer for HNQs, namely that they have a syntax and semantics all their own that plays a direct role in the speaker bias they convey.

## 5 The prejacent of HNQs are not negated

Given the correspondence between negation, preposing and bias in high negation questions, it is important to understand what negation does in such questions. Where is negation in the structure, and what effect does it have on interpretation? In declarative sentences, negation reverses truth values. But since polar questions do not have truth values, it is less straightforward to determine the effect of negation.

Ladd (1981) claims that HNQs are ambiguous between an inner negation reading in which propositional, sentential negation is present, and an outer negation reading in which negation “is somehow outside the proposition...” Another way he states the ambiguity is that (27a) questions  $p$ , while (27b) questions  $\neg p$ . Ladd uses the negative polarity item *either* and the positive polarity item *too* to bring out the two supposed readings:

- |      |                              |                |
|------|------------------------------|----------------|
| (27) | a. Isn't Jane coming too?    | outer negation |
|      | b. Isn't Jane coming either? | inner negation |

Many speakers find (27b) infelicitous; more on that in a moment. Whatever intuitive contrast there is between (27a) and (27b), it's not immediately clear that it is due to an ambiguity in the scope of negation. As pointed out by AnderBois (2016), the claim that preposed negation questions are ambiguous between outer and inner negation readings is almost always supported using examples with and without the NPI *either*. For example, Sudo (2013) demonstrates the asymmetry between the inner and outer readings using *either*, and claims that the inner reading requires contextual evidence for  $\neg p$  while the outer reading does not. However, Rullmann (2003) observes that *either* itself may have a licensing condition that requires some evidence that *either*'s complement clause is false. He then demonstrates that *either* can even appear in positive polar questions, but notes that there is always a negative implication. For example:

- (28) Nixon's not very bright, but does Agnew have any brains either? (Rullmann, 2003, 347)

Given this fact, we may wonder whether *either* is really bringing out an ambiguity in HNQs. Perhaps we are instead observing an effect of *either* itself (cf. Jeong 2019 for a similar idea about the effect of strong NPIs in HNQs more generally). This is especially worrying given that the semantics of *either* is still not completely understood. Rullmann himself points out several challenges for his own licensing condition for *either*. Ahn (2015) offers a new account of the licensing of *either*, but does not completely settle the matter, in particular leaving open the question of

why *either* behaves like a strong NPI, the answer to which will be crucial to understanding how *either* affects the interpretation of polar questions. Moreover, many native speakers of American English, including AnderBois (2016), myself and all other native speakers of American English I have consulted, find HNQs with *either* such as (27b) to be either infelicitous or at least severely degraded. This fact is demonstrated experimentally by Hartung (2006) as well Sailor (2013).<sup>9</sup> Clearly an explanation of the intuitions about *either* in polar questions will require a complete theory of *either* itself.

We could try to use other NPI/PPI pairs to bring out the purported ambiguity, for example *yet* vs. *already*.

- (29)    a.    Didn't Katie eat already?  
           b.    Didn't Katie eat yet?

Each question conveys the speaker's bias for the positive answer. However there may also be an intuitive contrast that corresponds to Ladd's claim about (27): perhaps (29a) questions  $p$  while (29b) questions  $\neg p$ . But note that these polarity items can also appear in positive polar questions, with similar effects.

- (30)    a.    Did Katie eat already?  
           b.    Did Katie eat yet?

Given that NPIs such as *yet* make their own contributions to meaning, and that overt negation is not required to license *yet* in polar questions, we cannot take any intuitive contrast between (29a) and (29b) as evidence for an ambiguity in the scope of negation in HNQs.

In order to get a handle on whether the negation in HNQs is propositional or not, a set of diagnostics that goes beyond *either* and other NPIs is needed. In the following, I will consider

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<sup>9</sup>The experimental work suggests that while HNQs with *either* are severely degraded, they are not at floor. Moreover, informal discussion with a small number of British English speakers suggests that HNQs with *either* such as (27b) are acceptable in at least some dialects. More work is needed on this variation. Interestingly, there seems to be no dialectal variation for the key data I introduce below, which suggests that the variation may be in the interpretation of *either* rather than the interpretation of HNQs.



expressions that contribute projecting content such as presuppositions and conventional implicatures, expressions that are sensitive to aspect, and polarity particle responses. Each of these kinds of expressions will enable us to probe polar questions for negation. I will argue that taken together the diagnostics militate in favor of an analysis of HNQs in which the prejacent is not negated. But whereas Ladd claimed that this is just one reading of HNQs, I claim that it is a fundamental characteristic of HNQs. Once these facts are established, we can then ask the question, if negation is outside of the propositional core in HNQs, then where is it?

## 5.1 Projecting content

Not-at-issue content (presuppositions and conventional implicatures) projects out of questions. The word *again* presupposes that the proposition denoted by its complement has happened before (see e.g., von Stechow, 1996; Pedersen, 2015). For example:

- (31) Did Danielle come to class again?  
*presupposes*: Danielle has come to class before

If *again*'s complement contains negation, then negation can be part of the presupposition. For example:

- (32) Did Danielle not come to class again?  
*presupposes*: Danielle did not come to class at least once before.

This is indeed what we find with a low negation question like (32).<sup>10</sup>

Now consider *again* in a HNQ:

- (33) Didn't Danielle come to class again?  
*presupposes*: Danielle has come to class before.

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<sup>10</sup>(32) has another reading in which the presupposition is *that Danielle came to class before*, which we can safely ignore here. The key fact is that it is able to presuppose the negative proposition.

Interestingly, the HNQ in (33) does not presuppose the negative proposition that (32) can presuppose. Instead it patterns with (31), presupposing *that Danielle has come to class before*.

These effects can be demonstrated in context:

- (34) B knows that A's student Danielle did not do the first assignment this semester, and that A is worried about her. B also knows that the second assignment was due today. A gets home from teaching and says, "I don't know what to do about Danielle." B replies:
- a. B: # Did she do the assignment again?
  - b. B: Did she not do the assignment again?
  - c. B: # Didn't she do the assignment again?

What these examples show is that the presuppositional operator *again* can scope over a propositional negation in LNQs but not in HNQs. It may be that the negative morpheme in HNQs contributes propositional, sentential negation, but the negation is too high for these operators to scope over. Another possibility is that the prejacent of HNQs are not negated at all, and thus there is no negation for the operator to scope over. I will pursue the latter explanation below.

*As*-parentheticals provide another test involving non-at-issue content projecting out of questions, this time conventional implicatures. The content of the claim in the *as*-parenthetical in (35) could either include or exclude negation (Potts, 2002).

- (35) Ames did not steal the documents, as the senators claimed.  
*can implicate*: The senators claimed that Ames did not steal the documents  
or  
*can implicate*: The senators claimed that Ames stole the documents (Potts, 2002, 625)

Potts shows that the complement of the *as*-parenthetical projects through various presupposition holes including questions:

- (36) Is it said that, as Joan claims, you are an excellent theremin player?  
*implicates*: Joan claims that the addressee is an excellent theremin player (Potts, 2002, 652)

As above, we can check to see what content projects out of LNQs and HNQs:

- (37) Did Zoe not win, as Joy predicted?  
*can implicate*: Joy predicted that Zoe did not win  
or  
*can implicate*: Joy predicted that Zoe won
- (38) Didn't Zoe win, as Joy predicted?  
*implicates*: Joy predicted that Zoe won  
but  
*cannot implicate*: Joy predicted that Zoe did not win

Again, we find that the projected content can contain negation in a LNQ, but not a HNQ. These facts suggest that *again* and *as*-parentheticals cannot scope over high negation.

## 5.2 Negation sensitivity

*Until*- and *for*-adverbials only combine with clauses that have durative rather than punctual aspect (de Swart, 1996):

- (39) Punctual aspect:
- #Liv discovered the thief until 9.
  - #The ball hit the ground for two minutes.

Negating a verb with punctual aspect creates durative aspect:

- (40) Durative aspect:
- Liv didn't discover the thief until 9.
  - The ball didn't hit the ground for two minutes.

Turning to negative questions, LNQs license *until*- and *for*-adverbials:

- (41)
  - Did Liv not discover the thief until 9?
  - Did the ball not hit the ground for two minutes?

However, HNQs do not:

- (42) a. #Didn't Liv discover the thief until 9?  
b. #Didn't the ball hit the ground for two minutes?

These facts again suggest that certain expressions, *until*- and *for*-adverbials, cannot scope above high negation.<sup>11</sup>

### 5.3 Inversion is not enough

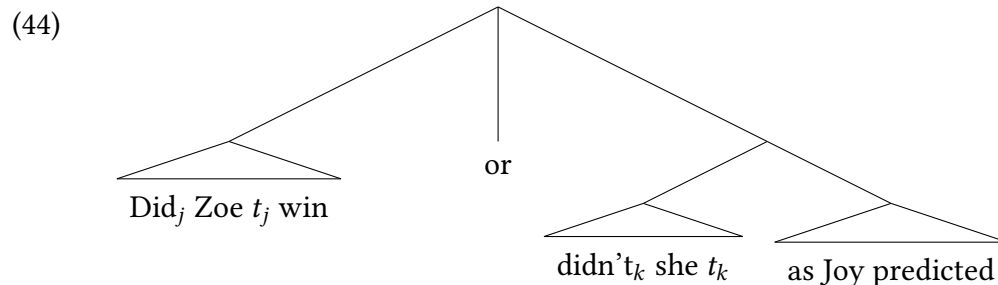
The empirical facts examined so far demonstrate that the relevant operators—*again*, *as*-parentheticals, *until*- and *for*-adverbials—cannot scope above negation in HNQs. Ultimately, I will claim that this is because high negation does not modify the prejacent of the question, and is instead above a speech act operator, putting it well out of reach of the relevant operators. However, it is worth asking if these scope observations are simply due to the fact that the negative morpheme *n't* inverts with the auxiliary. That is, perhaps the landing site of an inverted auxiliary is too high for these operators to reach, and no speech act operator is needed to explain the HNQ facts above. To test this idea, we can look at other examples of inversion of *aux-n't* to see whether they behave like HNQs with respect to these operators. Here is an example with an *as*-parenthetical:

- (43) Did Zoe win or didn't she, as Joy predicted?  
*implicates*: Joy predicted that Zoe didn't win

Unlike in HNQs, the *as*-parenthetical scopes over negation in (43), suggesting a structure like (44):

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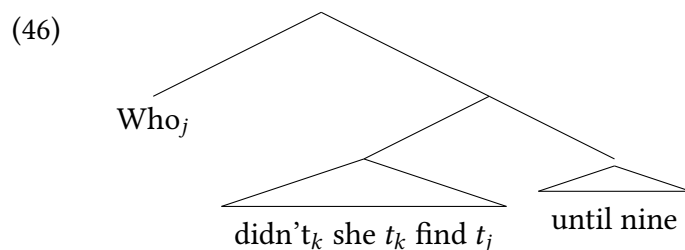
<sup>11</sup>It has been debated whether *until* is sensitive to negation because the latter changes punctual aspect to durative, or if it is because *until* is ambiguous between a durative version and a strong NPI version (Karttunen, 1974; Mittwoch, 1977; de Swart, 1996; Giannakidou, 2002; Gajewski, 2011). The outcome of this debate might affect how we interpret the *until*-data above, however it has no effect on the *for*-data, since *for*-adverbials are not thought of as NPIs.



Here is an example with *until*:

- (45) *A game of hide & seek*  
 A: Liv found most of them quickly, but she didn't find some of them until nine.  
 B: Who didn't she find until nine?

Unlike in HNQs, the *until*-phrase scopes over negation in (45), suggesting a structure like (46):



These results demonstrate that the HNQ data considered so far are not simply due to the inversion of *aux-n't*. Something different is going on in HNQs than in other sentences in which *aux-n't* is inverted.

## 5.4 Responses to negative sentences

As has been explored in recent work (Kramer & Rawlins 2009; Krifka 2013; Roelofsen & Farkas 2015; Holmberg 2016; Goodhue & Wagner 2018), negative polar questions have a noteworthy effect on English polar particle responses. While *yes/no* responses to positive polar questions as in (47) convey unambiguous answers, they are interchangeable in response to LNQs, as in (48).

- (47) A: Is Jane here?
- a. B: Yes
    - (i) *can mean*: She is here
    - (ii) *cannot mean*: She is not here
  - b. B: No
    - (i) *cannot mean*: She is here
    - (ii) *can mean*: She is not here

- (48) A: Is Jane not here?
- a. B: Yes
    - (i) *can mean*: She is here
    - (ii) *can mean*: She is not here
  - b. B: No
    - (i) *can mean*: She is here
    - (ii) *can mean*: She is not here

Accounts of these facts in the work cited above differ in interesting ways, however they all agree that a crucial component of the explanation for the contrast between (47) and (48) is that the sentence that B responds to in (48) is negative, i.e. it contains propositional negation, while that in (47) is not.

Krifka (2017) points out that responses to HNQs pattern with (47) rather than (48):

- (49) A: Isn't Jane here?
- a. B: Yes
    - (i) *can mean*: She is here
    - (ii) *cannot mean*: She is not here
  - b. B: No
    - (i) *cannot mean*: She is here
    - (ii) *can mean*: She is not here

Again, the HNQ patterns with the positive polar question rather than the LNQ. Whatever the negative morpheme in the HNQ is doing, it clearly is not contributing the propositional negation necessary to condition the interchangeable behavior of *yes* and *no* as seen in (48).

Further evidence along similar lines is adduced based on an example from Grimshaw (1979, 294).

- (50) A: Is Jane here?
- a. B: It's possible.
- (i) *can mean*: It's possible Jane is here
- (ii) *cannot mean*: It's possible Jane is not here

The null complement clause of B's response has to have the content  $p$ , not  $\neg p$ . Compare this to (51):

- (51) A: Is Jane not here?
- a. B: It's possible.
- (i) *cannot mean*: It's possible Jane is here
- (ii) *can mean*: It's possible Jane is not here

Now the null complement clause has to have the content  $\neg p$ , not  $p$ .

Responses to HNQs again pattern with the positive polar question, not the LNQ.

- (52) A: Isn't Jane here?
- a. B: It's possible.
- (i) *can mean*: It's possible Jane is here
- (ii) *cannot mean*: It's possible Jane is not here

The null complement clause has to have the content  $p$ , not  $\neg p$ , again suggesting that the negative morpheme in HNQs does not contribute a propositional negation.

## 5.5 Combining *any* and *again*

Despite the preceding evidence, let's make one last attempt to show that there is an ambiguity in the scope of negation in HNQs. Perhaps a well placed NPI will help to force an inner reading, which in combination with one of the tests from above will reveal a propositional negation. For example, while *any* is acceptable in positive polar questions as in (53b), it nevertheless is at least possible that it creates the intuitive contrast in HNQs that Ladd was after as in (54).

- (53) a. Did she buy (some) apples?  
b. Did she buy any apples?
- (54) a. Didn't she buy (some) apples?  
b. Didn't she buy any apples?

Let's add *again* to see if *any* has any effect:

- (55) a. Didn't she buy (some) apples again?  
b. ?Didn't she buy any apples again?

The sentences in (55) can only presuppose that she bought apples before. Moreover, (55b) sounds somewhat odd. This may be due to competition between the two sentences: if she bought apples before, then the use of *any* is out of place and (55a) is preferred. The same intuitions hold for the positive PQ variants in (56).

- (56) a. Did she buy (some) apples again?  
b. ?Did she buy any apples again?

Compare (55) and (56) against the low negation variants in (57), which are perfectly natural.

- (57) a. Did she not buy (? some) apples again?  
b. Did she not buy any apples again?

While (57a) is compatible with either the positive or the negative presupposition, (57b) is only compatible with the negative presupposition, that she did not buy apples before. The NPI *any* clearly has an effect, but does not force negation in HNQs to scope low, below *again*.

## 5.6 Section conclusion

The various data points in this section demonstrate that HNQs pattern with positive polar questions to the exclusion of LNQs. What this boils down to is that LNQs contain a propositional



negation within the prejacent of the question, while HNQs—like positive polar questions—do not, contrary to what some authors have previously claimed (e.g. Ladd, 1981; Büring & Gunlogson, 2000; Van Rooij & Šafářová, 2003; Romero & Han, 2004; Trinh, 2014). These empirical results are thus novel, advancing our understanding of HNQs.

## 6 Against analyzing high negation as a discourse particle

If the high negation does not contribute a negation to the prejacent, then what does it do? One possibility not mentioned so far is that high negation does not contribute a negation of any kind, and merely bears a formal resemblance to the negative morpheme for accidental (perhaps historical) reasons. On this view, high negation behaves like a kind of discourse particle that adds a non-at-issue bias meaning to the question.

Recall the bias generalization to be explained, repeated here:

- (7) *HNQ bias condition:*  
HNQ- $p$  is felicitous only if the speaker is biased for  $p$

There is a kind of analysis that could be given for HNQs that captures (7) along with the data from section 5, but that I won't pursue. The idea is that high negation does not contribute negation, but instead contributes a non-at-issue bias meaning. For example, high negation might be analyzed as a discourse particle with the relevant meaning:

- (58)  $\llbracket \text{high negation} \rrbracket = \lambda p_{\langle s,t \rangle} . \lambda w_s : \text{the speaker is biased for } p \cdot p(w)$

(58) contributes no negation, but is instead an identity function that adds the non-at-issue bias meaning to the question (while remaining agnostic about how to flesh out the non-at-issue content “the speaker is biased for  $p$ ”). The proposition  $p$  will be passed up the structure by (58) to a  $Q$ -morpheme, which produces the denotation of a polar question. The advantage of such an approach is that it explains why HNQs seem to lack negation relative to the tests in section 5,

and it provides the bias meaning.

One salient way to implement the non-at-issue component of (58) is to make use of the discourse table representation proposed by Farkas & Bruce (2010). For example, Hartung (2009) treats high negation in German as a pragmatic operator that directly manipulates the discourse table by adding  $p$  to the speaker's commitments list. Northrup (2014) analyzes utterances of HNQs as having the not-at-issue discourse effect of committing the speaker to  $p$  on the basis of prior, weak evidence.

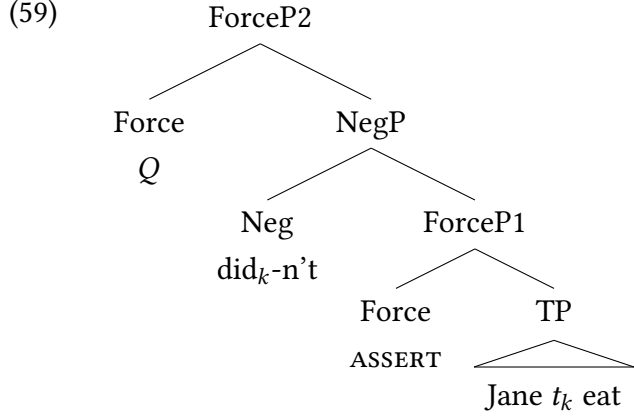
While such approaches provide a precise formal characterization of the discourse effects of HNQs, it's not clear that they provide any insight into the phenomenon that goes beyond the empirical generalizations of it. In particular, a theory of high negation as a discourse particle that manipulates a discourse representation leaves at least two questions unanswered: why does the combination of negation and preposing trigger bias crosslinguistically, and why is the bias for  $p$  and not  $\neg p$ ? Taking these questions in reverse order, if high negation is a discourse particle that just contributes bias via brute force, then there is no reason in principle why the bias shouldn't be against the propositional content of HNQ- $p$  rather than for it. That is, the theory predicts languages in which HNQs convey  $\neg p$  bias to be possible in principle, but no such language is known to exist. Second, the fact that the formal property of preposed negation leads to bias in multiple languages, some of them unrelated, suggests that this formal property plays a key role. Yet a discourse particle theory has nothing to say about the roles that negation and preposing play in triggering bias.

## 7 Speech act operators and unbalanced partitions

Our goal should be to find a theory of HNQs in which negation and preposing play a direct, non-arbitrary role in deriving bias for the propositional content of the question, while still explaining the lack of propositional negation in such questions as indicated by the evidence in section 5. Given that the bias conveyed by HNQs is mandatory, Lauer (2014) suggests an optimization-based

theory of implicature. The idea is that an expression obligatorily gives rise to an implicature if the only contexts in which the expression is optimal are contexts in which the implicature arises. Whether an expression is optimal is determined by the speaker's beliefs in concert with a set of pragmatic constraints or maxims. Lauer demonstrates how this approach can explain necessary ignorance inferences associated with assertions of disjunctions, and then suggests that it may be fruitfully extended to a theory of HNQs. However, while his sketch argues that a speaker needs a special reason to use a HNQ-*p* (as opposed to a standard polar question), it remains to be explained why the reason needed is that the speaker is biased for *p*. To get there, we need a syntax and semantics for HNQs (this section), plus a relevant set of pragmatic constraints the speaker is trying to satisfy (section 8).

The approach I will pursue starts with Ladd's (1981) suggestion that high negation is "somehow *outside* the proposition". However, given the evidence in section 5, I claim that this is the only reading that HNQs have (*pace* Ladd). I put flesh on the bones of Ladd's idea by giving an analysis of HNQs in which negation scopes over a high operator. Romero & Han (2004) were the first to pursue this kind of analysis by claiming that high negation scopes over their epistemic, conversational VERUM operator. A substantively different take on the same basic idea is put forth by Krifka (2017), who argues that high negation scopes above an ASSERT speech act operator, defined in terms of a commitment space semantics. Building on these ideas, I analyze HNQs as containing a negation that scopes above a doxastic speech act operator ASSERT. Assertoric operators along these lines have been proposed for independent reasons in the prior literature (e.g. Krifka, 2001; Kratzer & Shimoyama, 2002; Chierchia, 2006; Alonso-Ovalle & Menéndez-Benito, 2010; Hacquard, 2010; Meyer, 2013). Here is the structure I assume for a high negation question like "Didn't Jane eat?"



One advantage of analyzing high negation as scoping over ASSERT is that it explains the facts from the previous section if (i) the relevant phrases naturally cannot scope above the ForceP layer, and (ii) polarity particle responses are only sensitive to discourse referents introduced by constituents below the ForceP layer, as argued by Krifka (2013, 2017). Moreover, it has a second advantage in that high negation contributes a semantic negation. As such, if the denotation of (59) enables a derivation of speaker bias (I will argue it does), then the account can explain the crosslinguistic correlation between negation, structural height, and bias.

First however, an interpretation for the structure in (59) is needed. I will assume that ASSERT has the denotation of a doxastic necessity operator, as in (60).

$$(60) \quad \llbracket \text{ASSERT} \rrbracket = \lambda p_{\langle s, t \rangle} . \lambda w_s . \forall w' \in \text{Dox}_x(w) [p(w') = 1]$$

$\text{Dox}_x(w)$  is the set of worlds compatible with  $x$ 's beliefs in  $w$ .<sup>12</sup>  $x$  is a free variable for individuals whose value is contextually determined. When ASSERT appears in high negation questions,  $x$  is the addressee. In the following, I will frequently abbreviate doxastic necessity with “ $\Box$ ” for ease of exposition.<sup>13</sup>

Following Romero & Han (2004) and Dayal (2016), I assume the denotation for  $Q$  in (61),

<sup>12</sup>Instead of expressing beliefs, it may turn out to be more fruitful to characterize the ASSERT operator as expressing commitments. For a commitment based framework that is compatible with the account outlined here, see Krifka (2017). Alternatively, one might use a discourse table notion of assertion in the style of Farkas & Bruce (2010), although as far as I know, there is no extant proposal for a negation defined to operate on assertions of this kind.

<sup>13</sup>So, if  $\llbracket \phi \rrbracket = p$  (where  $p$  is a proposition), then  $\llbracket \text{ASSERT } \phi \rrbracket = \Box p$ , and  $\llbracket [\text{not}[\text{ASSERT } \phi]] \rrbracket = \neg \Box p$ .

which, when combined with a proposition, provides the standard denotation for polar questions reviewed in section 1.

$$(61) \quad \llbracket Q \rrbracket = \lambda p_{\langle s,t \rangle} . \lambda q_{\langle s,t \rangle} . [q = p \vee q = \lambda w_s . \neg p(w)]$$

The interpretation for each node of the LF in (59) is demonstrated in (62).<sup>14,15</sup>

$$(62) \quad \begin{aligned} \text{a.} \quad & \llbracket \text{TP} \rrbracket = \lambda w_s . \text{jane ate in } w \\ \text{b.} \quad & \llbracket \text{ForceP1} \rrbracket = \llbracket \text{ASSERT} \rrbracket (\lambda w_s . \text{jane ate in } w) = \\ & \lambda w_s . \forall w' \in \text{Dox}_A(w) [\text{jane ate in } w'] \\ \text{c.} \quad & \llbracket \text{NegP} \rrbracket = \llbracket \text{did}_k\text{-n't} \rrbracket (\lambda w_s . \forall w' \in \text{Dox}_A(w) [\text{jane ate in } w']) = \\ & \lambda w_s . \neg \forall w' \in \text{Dox}_A(w) [\text{jane ate in } w'] \text{ ss} \\ \text{d.} \quad & \llbracket \text{ForceP2} \rrbracket = \llbracket Q \rrbracket (\lambda w_s . \neg \forall w' \in \text{Dox}_A(w) [\text{jane ate in } w']) = \\ & \lambda q_{\langle s,t \rangle} . [q = \lambda w_s . \neg \forall w' \in \text{Dox}_A(w) [\text{jane ate in } w']] \\ & \vee q = \lambda w_s . \forall w' \in \text{Dox}_A(w) [\text{jane ate in } w'] = \\ & \{ \neg \Box_A \text{ that Jane ate, } \Box_A \text{ that Jane ate} \} \end{aligned}$$

The denotation for high negation questions produced in (62) is similar to Romero & Han's proposed interpretation for their outer negation polar questions in that it yields what they call an

<sup>14</sup>I assume that the auxiliary *did* is vacuous, and that *not/n't* is defined for propositions:  $\llbracket \text{not} \rrbracket = \llbracket \text{n't} \rrbracket = \lambda p_{\langle s,t \rangle} . \lambda w_s . \neg p(w)$ . Set-theoretically, negation returns the complement of the set of worlds characterized by the input proposition  $p$ , that is  $W \setminus p$ .

<sup>15</sup>On a naïve view, questions such as

- (i) Do you think/believe Jane ate?

should produce the same interpretation as “Didn’t Jane eat?” in (62). However, they are clearly empirically distinct from HNQs (I leave it to the reader to convince themselves of this; note that high negation can even be added to (i), drastically changing the meaning), so we should expect them to have distinct denotations. One way to ensure this might be to pursue a semantics for *ASSERT* distinct from belief, as mentioned in fn. 12. However, given the explanation for speaker bias that I develop in section 8 below, such a move is not enough—questions like (i) crucially must not denote unbalanced partitions similar to (62d), otherwise they will be incorrectly predicted to have a bias and distribution similar to HNQs, even if *ASSERT* is distinguished from belief via a commitment based semantics. While it is beyond the scope of this paper to give an analysis of PQs like (i), I see two possibilities for future exploration: (a) they may involve neg-raising, denoting the partition  $\{ \Box_A \text{ that Jane ate, } \Box_A \neg \text{that Jane ate} \}$ ; (b) the matrix clause may serve a purely evidential function (the interrogative counterpart to declaratives discussed by Simons, 2007), added by the speaker to express that she doesn’t think the addressee is in a position to know the answer for sure.

unbalanced partition. Whereas a positive polar question presents a partition that is balanced between  $p$  and  $\neg p$ , a high negation question presents an unbalanced possibility space, partitioned between doxastic necessity for  $p$  ( $\Box_A p$ ), and a lack of doxastic necessity for  $p$  ( $\neg\Box_A p$ ). Krifka (2017) refers to the  $\neg\Box_A p$  cell as one in which the addressee refrains from committing to  $p$ . Romero & Han say that  $\neg\Box_A p$  covers any other degree of belief in  $p$  besides belief in  $p$  itself. Meyer (2013) points out that  $\neg\Box_A p$  is a weak claim, since it includes a wide range of situations, which can be further partitioned into two sorts.

1. Lack of belief either way, neither  $p$ , nor  $\neg p$   $(\neg\Box_A p \wedge \neg\Box_A \neg p)$
2. Belief that  $\neg p$   $(\Box_A \neg p)$

Despite that Romero & Han and Krifka both posit such unbalanced partitions, neither derives the speaker bias associated with high negation questions from the way in which the partition is unbalanced. In section 8, I derive the bias of high negation questions from the way in which the possibility space is unbalanced, with the speaker expressing bias for the more precise, more narrowly defined cell,  $\Box p$ .

## 8 Explanation of speaker bias in HNQs

The guiding idea in the following is that high negation questions are about determining whether or not an interlocutor agrees with the speaker's bias. If this is right, then the question is, why is the syntax and semantics posited in the previous section uniquely appropriate for that function? In particular, why does the partition of HNQ- $p$  necessarily convey speaker bias for  $p$ ? My answer in a sentence: if the speaker weren't biased for  $p$ , some other question would be more useful than HNQ- $p$ , making HNQ- $p$  infelicitous unless the speaker is biased. The reason that HNQs are useful only if the speaker is biased has to do with the way in which HNQ partitions are unbalanced. When the speaker is not biased for  $p$ , the problem will be that the less specific cell of the partition ( $\neg\Box_A p$ ) won't provide useful information to the speaker, or at least, not as much

useful information as a different partition could produce. In other words then, we can compare the utility of competing question partitions, and what we will find is that the HNQ partition is only useful when the speaker is biased.

Recall the generalization about speaker bias in HNQs from section 2, repeated here:

- (63) *HNQ bias*:  
HNQ- $p$  is felicitous only if the speaker  $S$  is biased for  $p$

The goal is to derive (63) from the unbalanced partition of HNQs and general pragmatic principles. To derive (63), we need to say what it means for  $S$  to be biased for  $p$ . Based on the various examples of HNQs above, it is clear that being biased for  $p$  means either believing  $p$ , or at least taking  $p$  to be highly likely. Either formulation would work for the derivation developed below; for simplicity, I will take bias to be identical to the doxastic necessity operator already introduced in (60):<sup>16</sup>

<sup>16</sup>The precise characterization of bias—whether as belief or merely credence above a high threshold—isn’t of primary interest. What is interesting is to explain why the unique denotation of HNQs is necessarily associated with bias, however the latter is characterized. The explanation I give below is designed for a treatment of bias as belief, but could be altered minimally so as to work with a slightly weaker characterization of bias.

That said, there is some evidence for treating bias as belief. For example, the same sorts of evidence that support belief in  $p$  and assertion of  $p$  can also support the use of HNQ- $p$ :

- |     |   |      |   |
|-----|---|------|---|
| (i) | A and B checked the weather forecast when they woke up, and it said the sun would come out and it would be a nice day. A couple hours later, they look out the window and see bad weather. B says, “It’s gross out.” A replies: | (ii) | A heard that the rock band Alabama Shakes are playing a concert tonight and that The Moon and You is the opening act. Then A runs into B, who says, “Did you hear that Alabama Shakes are playing a concert tonight?” |
| a.  | A: I know. The forecast said it would be nice out.  | a.   | A: Yeah. The Moon and You is opening.   |
| b.  | A: I know. Didn’t the forecast say it would be nice out?  | b.   | A: Yeah. Isn’t The Moon and You opening?  |

A clearly believes  $p$  on the basis of her experience in (i) and (ii), and can assert it as in (ia) and (iia). However the contexts are such that A can also use HNQ- $p$  as in (ib) and (iib). This shows that the belief supporting HNQ bias *can* be as strong as the kind of belief that licenses assertion. But does HNQ- $p$  *require* belief in  $p$ ? Consider a context in which the evidence is too weak to license belief or assertion, and note that the HNQ is also odd:

- (iii) A is in a windowless basement computer lab. She reads the weather online, which says that there is a 75% chance that it’s raining. B comes in and says, “Want to go outside and play frisbee?”
- |    |                         |
|----|-------------------------|
| a. | A: ?? It’s raining.     |
| b. | A: ?? Isn’t it raining? |
| c. | A: Is it not raining?   |

A’s utterances in (iiia) and (iiib) are out of place in this context. In each, A seems to have assumed that it is raining,

S is biased for  $p$  if and only if  $p$  holds throughout the worlds compatible with S's beliefs.<sup>17</sup>

The first main step of the derivation of (63) is to establish that the felicity of a question depends on comparing the relative utility of different questions given the speaker's goals (cf. Van Rooij & Šafářová, 2003). I assume the following condition on the felicitous use of questions:

- (64) *Question utility:*  
A question  $Q$  is felicitous only if  $Q$  is at least as useful as other questions  $Q'$

Much depends on how the phrase “at least as useful as” in (64) is understood; more on that in just a moment. With (64) in hand, deriving (63) reduces to the second main step of the derivation, which is showing that the following statement holds:

- (65) *The lemma:*  
HNQ- $p$  is at least as useful as other  $Q$ s only if S is biased for  $p$ .

Question utility and the lemma together entail the HNQ bias condition. I will show that (65) holds via *reductio*: supposing that S isn't biased for  $p$ , it will turn out that there is some other  $Q$  more useful than HNQ- $p$ , which contradicts the antecedent that HNQ- $p$  is at least as useful as other  $Q$ s. Put another way, I'll show that the contrapositive of the lemma holds:

- (66) *Contrapositive of (65):*  
If S is not biased for  $p$ , then some other  $Q$  is more useful than HNQ- $p$ .

Once (65)/(66) is established, it will combine with (64) to derive the bias requirement of HNQs in

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despite that her evidence is not strong enough for that assumption. Compare these to (iiic), which is perfectly felicitous, and does not imply that A believes that it is raining. The bias that the HNQ conveys seems to require stronger evidence and belief than A has in (iii). The above evidence suggests that HNQ bias may be akin to belief.

<sup>17</sup>Sometimes the bias associated with HNQs is described as a *previous* belief (e.g. Romero & Han, 2004). This observation is empirically accurate for many uses of HNQs, for example when the bias for  $p$  is contradicted by new, immediate contextual evidence such as (4), (13), and (14). In these examples, the speaker has a prior belief in  $p$ , but since they are confronted with evidence to the contrary, it's plausible to think of their belief as loosening before the HNQ is asked, making their belief previous but not necessarily current. However, this cannot be a requirement on the use of HNQs, since they are also acceptable when there is no evidence to the contrary, as discussed for (9) and (10). The previousness of the belief in  $p$  seems to be no different than the previousness of belief undergirding assertion—sometimes  $p$  is directly challenged before S asserts it, other times not.



(63).

How should the key phrase “at least as useful as” in (64) and (65) be understood? In a nutshell, the utility of one question can be compared to that of another by considering the partitions denoted by each question, along with the speaker’s conversational goals, and asking which partition’s cells are better designed to advance the speaker’s goals.

Crucially, a speaker’s goals are different in different contexts, which affects the way in which we evaluate the utility of a partition. Which contexts matter to us here? Given the need to show that (66) holds, we need to consider situations that satisfy the antecedent so we can show that the consequent follows. Thus we need to consider situations in which it’s not the case that  $S$  believes  $p$  ( $\neg \Box_S p$ ), and demonstrate that some other  $Q$  is more useful than  $\text{HNQ-}p$  in those situations.

As said in section 7,  $\neg \Box_S p$  situations can be partitioned into two subkinds of situations:

1. Lack of belief either way, neither  $p$ , nor  $\neg p$   $(\neg \Box_S p \wedge \neg \Box_S \neg p)$
2. Belief that  $\neg p$   $(\Box_S \neg p)$

Situation 1 includes a wide array of degrees of belief about  $p/\neg p$ .  $S$  may be leaning toward  $p$ , or toward  $\neg p$ , or completely split between the two, and anything else in between. However, this variation is not relevant. What matters is that in none of these states of affairs is  $S$  leaning so far one way or the other as to exhibit belief in  $p$  or in  $\neg p$ —otherwise we would say that  $S$  is biased for  $p/\neg p$ , and the situation would not fall into category 1. Situation 2 is much more narrow, covering only cases in which  $\neg p$  is a doxastic necessity for  $S$ .

Now we can see that only two sorts of contexts are relevant to determining the utility of HNQs relative to other  $Q$ s. We need to show that in each of the kinds of situations in 1 and 2, some other  $Q$  would be more useful than  $\text{HNQ-}p$ . I assume that the relative utility of questions depends in part on a speaker’s goals, so the question we need to ask is, what are a speaker’s goals in each of these two kinds of situations, and in light of these goals, what makes a question partition useful? In situations of type 1, the speaker lacks belief either way about  $p$ . Assuming  $p$  is relevant, I claim that the speaker’s goal is to gain information about  $p$  from the addressee. In situations of type 2,

the speaker believes  $\neg p$ . One could imagine different reasons for  $p$ 's relevance in such a context, but the main one I'll focus on is that the speaker has the goal of determining whether or not the addressee shares her belief in  $\neg p$ . In the following two subsections, I take each of these in turn, demonstrating that in each case, some other partition is more useful than the HNQ- $p$  partition.

### 8.1 Situation 1: lack of belief either way ( $\neg \Box_S p \wedge \neg \Box_S \neg p$ )

When S lacks belief about  $p$  either way, her goal is to gain information about  $p$  from her addressee.<sup>18</sup> Given this goal, the relative utility of two questions can be compared by considering which one is better designed to produce more information about  $p$ . If the cells of one question partition produce more information about  $p$  in the context than the cells of another, the first question is more useful.

A simple model of information states and their update will help us state this more precisely. Suppose  $Dox_X$  is a set of worlds representing X's information state—those worlds in which all of X's beliefs are true. The relative informedness of two information states is modeled as the proper subset relation:

- (67) *Relative informedness of information states:*  
 $Dox_X^1$  is more informed than  $Dox_X^2$  iff  $Dox_X^1 \subset Dox_X^2$

In considering the relative utility of a partition to S, we need to examine how S's information state would be updated were A to assert any given cell of the partition. Crucially, this update is different depending on both context and the cell under consideration. The most basic case is one in which a cell is just a proposition  $p$ . Since A is the answerer, update with  $p$  technically transits through A's assertion of the cell, which I modeled in section 7 as doxastic necessity. So S learns that A believes the propositional content of the cell, and assuming that S wants to take on A's beliefs as her own, S will also update her information state with the propositional content itself.

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<sup>18</sup>Of course, whether or not  $p$  holds also needs to be relevant at this point. I assume this is taken care of by normal conversational relevance constraints (Grice, 1989; Roberts, 1996/2012).

Treating this update as intersection, we get the following:

$$(68) \quad \text{Information state update with an assertion of } p: \\ \text{Update}(\text{Dox}_S, p) = \text{Dox}_S \cap \Box_A p \cap p$$

With these notions in hand, when S's goal is to gain information, the relative utility of two question partitions is settled as follows (in the following the variable 'c' stands for the cell of a partition):

$$(69) \quad \text{Gain information strategy:} \\ Q_1 \text{ is more useful than } Q_2 \text{ iff the following two conditions are satisfied:} \\ \text{a. } \exists c \in Q_1 [\exists c' \in Q_2 [\text{Update}(\text{Dox}_S, c) \subset \text{Update}(\text{Dox}_S, c')]] \\ \text{b. } \forall c \in Q_1 [\neg \exists c' \in Q_2 [\text{Update}(\text{Dox}_S, c') \subset \text{Update}(\text{Dox}_S, c)]]$$

(69) says that a question  $Q_1$  is more useful than another question  $Q_2$  if and only if two conditions are satisfied: First, some cell of  $Q_1$  produces a more informed information state than some cell of  $Q_2$ , and second, no cell of  $Q_2$  produces an information state that is more informed than any cell of  $Q_1$ .

Consider the positive polar question in (70):

$$(70) \quad \llbracket \text{Did Jane eat} \rrbracket = \{ \text{that Jane ate, that Jane did not eat} \}$$

S began with a lack of belief either way about  $p$ , which is to say that  $\text{Dox}_S$  contains both  $p$ -worlds and  $\neg p$ -worlds. Using the above definitions, we can see that either of the cells in the partition in (70) would increase S's information.

$$(71) \quad \text{Update with each cell of a PPQ:} \\ \text{a. } \text{Update with first, positive cell:} \\ \text{Dox}_S^{\text{pos}} = \text{Update}(\text{Dox}_S, p) = \text{Dox}_S \cap \Box_A p \cap p \\ \text{b. } \text{Update with second, negative cell:} \\ \text{Dox}_S^{\text{neg}} = \text{Update}(\text{Dox}_S, \neg p) = \text{Dox}_S \cap \Box_A \neg p \cap \neg p$$

Either update in (71) produces an information state that is more informed than S's initial information state according to (67).

Now consider the HNQ in (72):

$$(72) \quad \llbracket \text{Didn't Jane eat} \rrbracket = \{ \Box_A \text{ that Jane ate}, \neg \Box_A \text{ that Jane ate} \}$$

The first cell of the partition increases S's information just as much as the first cell of the PPQ partition in (70), since it conveys A's belief that  $p$ , and given S's lack of belief and desire to gain the relevant information, we can assume that S will take on the belief in  $p$  herself, just as in (71a).<sup>19</sup>

The second cell of (72), however, is not ideal: since  $\neg \Box_A p$  is compatible with both A's lack of belief about  $p$  ( $\neg \Box_A p \wedge \neg \Box_A \neg p$ ), as well as A's belief in  $\neg p$  ( $\Box_A \neg p$ ), S wouldn't learn much about  $p$  from this cell. S learns that it's not the case that A believes  $p$ , but S doesn't learn why that is, that is S doesn't learn whether or not  $p$  holds according to A.

$$(73) \quad \begin{aligned} & \text{Update with the second, weak cell of a HNQ:} \\ & \text{Dox}_S^{\text{weak}} = \text{Update}(\text{Dox}_S, \neg \Box_A p) = \text{Dox}_S \cap \neg \Box_A p \end{aligned}$$

By (67), the information state  $\text{Dox}_S^{\text{weak}}$  that results from the update in (73) is more informed than S's original information state  $\text{Dox}_S$ . However,  $\text{Dox}_S^{\text{weak}}$  is not as informed as  $\text{Dox}_S^{\text{neg}}$ , the information state produced by the update with the second cell of the PPQ in (71b). This is because  $\Box_A \neg p$  entails  $\neg \Box_A p$ , therefore  $\text{Dox}_S^{\text{neg}} \subset \text{Dox}_S^{\text{weak}}$ .

Therefore, by (69), the positive polar question in (70) is more useful than HNQ- $p$  in (72) when S lacks a belief either way about  $p$ .

## 8.2 Situation 2: belief that $\neg p$ ( $\Box_S \neg p$ )

S believes  $\neg p$ , which is to say that  $\neg p$  holds through out  $\text{Dox}_S$ .

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<sup>19</sup>The HNQ builds the assertive component of A's response into the partition. I do not assume that A's choice of one of the cells adds a second layer of assertion.

$$(74) \quad \Box_S \neg p \text{ iff } Dox_S \subseteq \neg p$$

In some contexts of this sort, S may be unlikely to want to ask a question at all. After all, she already has a belief about the answer. However, if her interlocutor is (or should be) in a position to know the answer as well, then S could ask a question with the goal of determining whether or not she and her addressee hold the same view about  $\neg p$ .<sup>20, 21</sup> That is, S's goal is to find out whether or not  $\neg p$  holds throughout  $Dox_A$  as well. Therefore, a question partition will be more useful than another if it makes it easier for S to compare A's beliefs against her own. An ideal question can be straightforwardly defined as follows:

$$(75) \quad \begin{array}{l} \text{Determine identity of belief strategy:} \\ Q \text{ is ideal iff } \exists q [Dox_S \subseteq q \wedge \\ \quad \exists c, c' \in Q [Update(Dox_S, c) \subseteq \Box_A q \wedge Update(Dox_S, c') \subseteq \neg \Box_A q]] \end{array}$$

In this case, we do not need a comparative strategy for determining the relative utility of questions such as we had in (69).  $HNQ-p$  will not be ideal according to (75) whereas some alternative  $Q$  will be ideal, so it will be simple to see that  $Q$  is more useful than  $HNQ-p$ . For example, consider the  $HNQ$  with an added low negation in (76):

$$(76) \quad \llbracket \text{Didn't Jane not eat} \rrbracket = \{ \Box_A \text{ that Jane did not eat}, \neg \Box_A \text{ that Jane did not eat} \}$$

Either one of the cells in (76) would enable S to learn whether or not A holds the same belief in  $\neg p$  as S. The first cell ( $\Box_A \neg p$ ) would clearly indicate that they hold the same belief. The second cell ( $\neg \Box_A \neg p$ ) would clearly indicate that A does not hold the same belief as S since it is the negation of S's position,  $\Box_S \neg p$ . In other words, according to (75), (76) is the ideal question given S's goals.

Now consider the  $HNQ$  in (77):

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<sup>20</sup>Again, whether or not  $p$  holds also needs to be relevant at this point.

<sup>21</sup>Another situation in which the speaker believes  $\neg p$  but it is relevant to ask about it anyway is an exam question context. Given the purpose of exams however, a positive PQ will be preferred to avoid conveying any biases.

$$(77) \quad \llbracket \text{Didn't Jane eat} \rrbracket = \{\Box_A \text{ that Jane ate}, \neg\Box_A \text{ that Jane ate}\}$$

The first cell ( $\Box_A p$ ) would convey that A holds a different belief about  $\neg p$  than S, since S has the contrary belief,  $\Box_S \neg p$ . The second cell ( $\neg\Box_A p$ ), however, is again not ideal: it would leave S uncertain as to whether or not they hold the same belief, since it is consistent with both belief in  $\neg p$  and lack of belief either way. A's belief in  $\neg p$  ( $\Box_A \neg p$ ) would mean A and S have identical beliefs—but A's lack of belief ( $\neg\Box_A p \wedge \neg\Box_A \neg p$ ) would mean that A and S have contradictory beliefs, since A's lack of belief entails  $\neg\Box_A \neg p$ , the negation of S's belief. So from the second cell, S doesn't learn whether or not A and S share identical beliefs about  $\neg p$ .

In sum, while the first cell of (77) satisfies the role of  $c'$  in (75), clearly indicating that A and S have different beliefs about the prejacent, the second cell of (77) is too weak, compatible both with A and S having identical and different beliefs about the prejacent. Thus by (75), given S's belief in  $\neg p$ ,  $\text{HNQ-}p$  as in (77) is not ideal, while  $\text{HNQ-}\neg p$  as in (76) is, making the latter more useful than the former.

### 8.3 Putting it together

Recall the contrapositive of the lemma that we set out to prove:

$$(66) \quad \text{Contrapositive of (65):} \\ \text{If S is not biased for } p, \text{ then some other } Q \text{ is more useful than HNQ-}p.$$

I pointed out that the antecedent, *S is not biased for p*, is consistent with exactly two states of affairs, lack of bias either way ( $\neg\Box_S p \wedge \neg\Box_S \neg p$ ), and bias for  $\neg p$  ( $\Box_S \neg p$ ). In section 8.1 and section 8.2, I argued that in each of these states of affairs some other question is more useful than  $\text{HNQ-}p$ . Therefore, (66) holds, which means the lemma itself in (65) holds. The lemma together with question utility in (64) entails the bias condition on HNQs in (63).

- (78) (64) *Q Utility*: A question  $Q$  is felicitous only if  $Q$  is at least as useful as other  $Q$ s.  
 (65) *The lemma*:  $\text{HNQ-}p$  is at least as useful as other  $Q$ s only if  $S$  is biased for  $p$ .  
 $\therefore$  (63) *HNQ bias*:  $\text{HNQ-}p$  is felicitous only if  $S$  is biased for  $p$ .

The bias of HNQs falls out from the fact that the unbalanced partition of  $\text{HNQ-}p$  is not useful when the speaker is not biased for  $p$ . Instead, other questions are more useful as demonstrated in section 8.1 and section 8.2. Relative utility is determined on the basis of the goals one has, given their beliefs. Once we fix  $S$ 's beliefs and goals, what we find is that there are other question partitions that serve  $S$ 's goals better than that of  $\text{HNQ-}p$ . The crux of the matter is the  $\neg\Box_A p$  cell of  $\text{HNQ-}p$ , which does little to increase  $S$ 's information when she lacks belief either way about  $p$ , and does not settle whether or not  $S$  and  $A$  are in the same belief state when  $S$  believes  $\neg p$ . Therefore, the only kind of context in which  $\text{HNQ-}p$  is useful is one in which  $S$  is biased for  $p$ .

## 9 The point of HNQs

To round out the discussion, consider the sort of context that  $\text{HNQ-}p$  is felicitous in. The speaker  $S$  is biased for  $p$ , so her goal is to determine whether her and her addressee hold the same bias about  $p$ . Consider the  $\text{HNQ-}p$  partition in (79)

- (79)  $\llbracket \text{Didn't Jane eat} \rrbracket = \{\Box_A \text{ that Jane ate}, \neg\Box_A \text{ that Jane ate}\}$

Either one of the cells in (79) would enable  $S$  to learn whether or not  $A$  holds the same bias for  $p$  as  $S$ . The first cell ( $\Box_A p$ ) would clearly indicate that they hold the same belief. The second cell ( $\neg\Box_A p$ ) would clearly indicate that  $A$  does not hold the same belief as  $S$  since it is the negation of  $S$ 's position,  $\Box_S p$ .

What HNQs are useful for is determining whether an interlocutor shares the speaker's bias for the prejacent of the question. But there are different sorts of contexts in which one might use an HNQ to do this. In some contexts, there is contextual evidence that challenges  $p$ :

- (4) A has just gotten home, and she is expecting Moira to be there. She looks all around the house and can't find her. However, A does find B in the last room that she checks, so she says to B:
- b. Isn't Moira home?
- (13) A believes that Jane is right handed. Then A and B see Jane writing with her left hand. A says to B:
- b. Isn't Jane right handed?

In other contexts, the evidence that challenges *p* comes directly from the interlocutor:

- (14) A: Ok, now that Stephan has come, we are all here. Let's go!  
 B: Isn't Jane coming? (Romero & Han, 2004, 610)

Given Jane's absence, A's utterance implies that Jane is not among those who will be joining. In the same vein, Bledin & Rawlins (2018) demonstrate that HNQs can be used to resist acceptance of an interlocutor's utterance by drawing attention to a possibility that may conflict with the content of the original utterance.

- (80) A: Do you want to go see a movie?  
 B: No.  
 A: Isn't there a romcom that you wanted to see? (Bledin & Rawlins, 2018, 4)

In yet other contexts, *p* hasn't been mentioned at all, and there's no reason for S to think that A doesn't agree with her. For example, here are three contexts from above:

- (9) A asks B what she is up to tonight, and B says, "I'm going to the Alabama Shakes concert." Suppose A has heard that another band, The Moon and You, are the opening act, and there is no contextual evidence to the contrary. A replies: Oh yeah, I heard about that show...
- a. Aren't The Moon and You opening?
- (10) A and B have just walked outside together. A says:
- a. Isn't it nice out?



- (17) Dialog between two editors of a journal in 1900:  
A: I'd like to send this paper out to a senior reviewer, but I'd prefer somebody new.  
a. B: Hasn't Frege not reviewed for us? He'd be a good one.  
(Romero & Han, 2004, 619)

So there are many reasons why a speaker might seek to determine whether an interlocutor shares the speaker's bias for the prejacent of the question. What they all share in common is the unique utility of the partition of HNQ-*p* to convey S's belief in *p* while asking A's opinion about it.

Note though that HNQs are still questions, thus they require the speaker to have some reason to ask them as opposed to just asserting *p*. Minimally this is a requirement that S thinks that A has enough information to answer the question, maximally that S thinks that A has at least as much information about the issue as S does. For example, let's reimagine (9) as follows:

- (81) Suppose A bought tickets to see an Alabama Shakes concert tonight, and The Moon and You are opening. B asks A what she is up to tonight, and A says: I'm going to the Alabama Shakes concert...  
a. ??Aren't The Moon and You opening?  
b. The Moon and You are opening.

A believes the prejacent, so why is the HNQ in (81a) odd here? Well, she has no reason to ask this question in this context. She is merely informing B about her plans, and so the assertion in (81b) is preferred.

The point of a HNQ is to determine whether an interlocutor shares the speaker's bias for the prejacent. The reason for this is traceable directly to the syntax and semantics of HNQs, which produces a uniquely unbalanced partition. The HNQ carves up possibility space in a particular way, and in using it to do so, S signals that she holds a belief in *p*, and is interested in A's view on it.

## 10 Conclusion

There have been several novel results of this paper, both empirical and theoretical. First, the empirical:

1. HNQs and PFQs are distinct phenomena: while HNQs necessarily convey speaker bias, the bias of PFQs is context sensitive; moreover, only PFQs require a focus antecedent (section 3).
2. A battery of tests reveals that the prejacent of HNQs are not negated (section 5).
3. HNQs are not subject to an evidential condition (section 2).

These empirical results guided novel theoretical proposals:

1. The speaker bias of PFQs is derived from more general facts about asking questions in some contexts that happen to also license polarity focus. If polarity focus was licensed by a claim that  $p$ , then asking  $?p$  leads to a  $\neg p$  speaker bias (section 4).
2. The lack of propositional negation in section 5 supports the view that negation scopes over an ASSERT operator, yielding an unbalanced partition (section 7), an idea in line with previous work (Romero & Han, 2004; Krifka, 2017).
3. The speaker bias of HNQs is explained by considering the conversational utility of such an unbalanced partition (section 8). The partition of logical space  $\{\Box_A p, \neg\Box_A p\}$  only advances a conversation in which the speaker is biased for  $p$ . In particular, if the speaker is not biased for  $p$ , it is either because they lack a bias either way, or they are biased for  $\neg p$ . Either way, the cell  $\neg\Box_A p$  will not help them advance the conversation:
  - If they lack a bias either way, the cell  $\neg\Box_A p$  will not help them advance the conversation because it does not increase their information (section 8.1).
  - If they are biased for  $\neg p$ , the cell  $\neg\Box_A p$  will not help them advance the conversation because it does not reveal whether their interlocutor has the same belief as them (section 8.2).

The advantage of this account is that it explains the crosslinguistic connection between negation, height, and bias. In the future, more work is needed on high negation in languages other than English, especially unrelated languages. Japanese and Korean provide an interesting avenue for further research, as there appears to be a similar asymmetry between two kinds of negative polar questions, one of which lacks propositional negation and conveys a speaker bias toward the prejacent (Ito & Oshima 2014; Shimoyama et al. 2019).

Another important avenue for future research is embedded negative polar questions. Consider the following examples:

- (82) [An NPR story about how the court system has become more lenient in Seattle, causing many defendants to choose normal court over mental health court.]  
If the prosecutors [in the normal courts] are less likely to send [defendants] to jail, why should they stay [in mental health court] for this laborious two-year commitment to a process of treatment and probation? Even the person who just graduated [from mental health court] today [...] wonders if she shouldn't have done the same. Kaste (2019)
- (83) B walks into A's auto parts store:  
A: What brings you in?  
B: I need a fuel pump for a 2005 Chevy Cavalier.  
A: Okay, let's see if we don't have one of those in stock for you.
- (84) An unusually large number of grad students show up to the faculty meeting looking hungry. One professor says to another:  
I wonder if we shouldn't feed them.

Examples (82)–(84) are HNQ-like in that a positive bias seems to be conveyed. When there is a matrix subject, the bias seems to belong to its referent (which happens to also be the speaker in (84)); in the “let's see if” construction in (83), the bias is the speaker's. The contextual manipulation in (85), on the other hand, seems to shift the question in (84) to a more LNQ-like interpretation:

- (85) A large number of grad students show up to a departmental party. The professors had been planning on treating them to dinner, but as the grad students arrive, they are talking about how stuffed on pizza they are. One professor says to another:  
I wonder if we shouldn't feed them.

But are these intuitions due to a real syntactic ambiguity in embedded negative PQs similar to that observed in matrix clauses? It's not obvious, since LNQs are also often acceptable in contexts with positive bias. We could try using embedded negative PQs in contexts from previous sections that allowed HNQs but blocked LNQs. For example "I wonder if The Moon and You aren't opening" in (9), or "I wonder if it isn't nice out" in (10). These utterances are clearly infelicitous in those contexts, however it's at least possible if not plausible that this is due to the inappropriateness of using an embedded question in these contexts.

To gain some traction, we will try to use one of the tests from section 5, *until*-phrases.

- (86)    a.    Let's see if we can't get this party started.  
           b.    ??Let's see if we can't get this party started until Lois arrives.  
           c.    Let's find out if we can't get this party started until Lois arrives.  
           d.    I wonder if we can't get this party started until Lois arrives.

(86a) is roughly equivalent to "Let's (try to) get this party started". (86b) is odd under this interpretation, roughly "Let's (try to) get this party started until Lois arrives".<sup>22</sup> (86c) on the other hand feels like a genuine question asking about the possibility that the party cannot be started until Lois has arrived, i.e. the prejacent of the embedded question seems to contain a low negation, licensing the *until*-phrase. Interestingly, a parallel interpretation in which negation is present in the prejacent seems to be unavailable for (86b). Perhaps the construction "Let's see if *DP AUX-n't*" only has a high negation interpretation available. (86d) is included just to demonstrate the same basic effect as (86c) without the "let's" construction. These examples suggest that there is indeed an ambiguity in embedded negative PQs.

Here is another set of examples:

- (87)    A and B are teammates in a soccer game, and they are losing.  
           A: I wonder if we can't win by using an offside trap.

In (87), A suggests a new strategy for winning by wondering if *it's possible to win* by using an

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<sup>22</sup>Unless one coerces a durative interpretation of "get X started".

offside trap. This corresponds to a high negation reading.

- (88) A and B are playing a new soccer video game that they just got, and it seems to require them to use multiple strategies to win before it moves on to the next level. They're having trouble getting passed the current level, though they have tried just about everything.  
A: I wonder if we can't win until we use an offside trap.

Here, A wonders if *it's not the case* that it's possible to win until the offside trap has been used.

The *until*-phrase seems to require the negation to be in the prejacent of the embedded PQ.

Taking these examples to demonstrate an ambiguity between high and low negation in embedded contexts, they show that whatever the ultimate account of the difference between HNQs and LNQs in matrix contexts is, it must be replicable in embedded contexts. For the account I gave above, that means that embedded high negation must be scoping over an embedded speech act operator. This may seem unexpected at first glance, however Krifka (2014) has argued that speech act operators are embeddable on independent grounds, and has argued that the verb *wonder* in particular may embed speech acts. If so, then the existence of embedded HNQs combined with the analysis of HNQs given above may provide a novel argument for embedded speech act operators.

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