High negation questions and epistemic bias[1]

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Abstract. High negation questions—questions like "Isn't it nice out?"—necessarily convey that the speaker is epistemically biased, i.e., the speaker has a prior belief about the correct answer to the question. In particular, the speaker necessarily expresses bias toward the proposition embedded under the high negation. Low negation questions, on the other hand, do not necessarily convey this bias. Romero and Han (2004) demonstrate that this asymmetry holds in several languages, some unrelated. This remarkable crosslinguistic fact merits explanation. In particular, what role does the structural height of negation play in triggering this epistemic bias? In this paper, I present novel evidence demonstrating that high negation questions lack propositional negation. This evidence is taken to support Ladd's (1981) suggestion that high negation is somehow outside of the proposition, and is used to motivate an analysis in which high negation scopes above an epistemic operator. I argue that this analysis of high negation enables a novel account of epistemic bias that predicts its context insensitivity.

Keywords: polar questions, negation, biased questions.

1. Introduction

Classic theories of question semantics treat polar questions such as (1a) as a set of propositions representing the positive and negative answers, as in (2) (e.g., Hamblin, 1973; Karttunen, 1977; Groenendijk and Stokhof, 1984). Assuming that double negation of a proposition is equivalent to the proposition itself (i.e., $\neg\neg p = p$), a puzzle for such a view is that the addition of negation to a polar question, as in (1b) and (1c), is predicted to result in the same set of propositions, despite that the meanings of such questions are clearly different in some sense (e.g., Büring and Gunlogson, 2000).

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

(2) $\{$*that Moira is home, that Moira is not home*$\}$

In this paper, I will demonstrate empirical differences between the different kinds of polar questions in (1) (section 2). In particular, I will focus on high negation questions—questions in which negation is preposed with the auxiliary like (1b)—which necessarily convey that the speaker is epistemically biased, i.e., the speaker has a prior bias toward the proposition embedded under the high negation, *that Moira is home*. Verum/polarity focus questions like (1d) convey a similar bias—but toward the negative answer *that Moira is not home*—though I will argue that this is for distinct reasons. Low negation questions like (1c) lack epistemic bias.

Romero and Han (2004) demonstrate that the asymmetry between high and low negation questions holds in several languages, some unrelated. This is a remarkable crosslinguistic fact that merits a deep explanation. Why would a high structural position for negation in a polar ques-

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tion give rise to a strong inference that the speaker is biased toward the propositional core of the question?

I present novel evidence demonstrating that high negation questions lack propositional negation (section 3). This evidence is taken to support Ladd's suggestion that high negation is somehow outside of the proposition (Ladd, 1981). I argue that this is due to negation scoping over an epistemic operator O. This structure denotes an unbalanced partition $\{Op, \neg Op\}$, consistent with previous proposals (section 4; e.g. Romero and Han, 2004; Repp, 2013; Krifka, 2017).

The remaining question is why does such a denotation result in the inference that the speaker is biased for the proposition embedded under the high negation? I develop a novel pragmatic account of this inference, arguing that it follows from the way in which the partition is unbalanced, and general pragmatic principles governing the asking of questions (section 5). The resulting account provides an explanation for the crosslinguistic link between structural height, negation, and speaker bias.

Another way to see the present work is that I am building on—but substantially revising—the approach of Romero and Han (2004). The key insight preserved from Romero and Han's theory is that high negation questions contain an epistemic or doxastic operator that composes with the rest of the structure to yield an unbalanced partition. The revisions I argue for result from two sets of novel empirical evidence. The first is that there are empirical asymmetries between high negation and verum/polarity focus, which lead me to conclude that a unified account of the two phenomena is untenable (section 2.2). The second is that high negation questions are not ambiguous between inner and outer negation readings (section 3), but instead only have the outer negation structure and interpretation (section 4). I will show that these revisions yield a happy result: the bias associated with high negation questions can be given a novel derivation that flows from the way in which the partition is unbalanced (section 5). Without these revisions, such a derivation could not be given.

2. Empirical facts distinguishing types of polar questions

2.1. High vs. low negation questions

(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. #Isn't Moira home?
   c. #Is Moira not 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. We might call this a "neutral context" in the sense that A has no prior expectations about the answer to the polar question, and there is no current contextual evidence supporting one answer or another. Clearly negative questions 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, she does find B in the last room that she checks, so she says to B:
   a. Isn't Moira home?
   b. Is Moira not home?

Now, both (4a) and (4b) are acceptable. In fact, many contexts that render high negation questions acceptable also render low negation questions acceptable, and vice versa. However, it turns out that their acceptability depends crucially of different features of the context. In particular, high negation questions necessarily require the speaker to have a prior expectation that the proposition embedded under negation is true, so-called *epistemic bias*. Low negation questions do not have this requirement. To see this, consider the following:

(5) A has no idea 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, she does find B in the last room that she checks, so she says to B:
   a. #Isn't Moira home?
   b. Is Moira not home?

In this context, the low negation question (5b) is perfectly acceptable, however the high negation question (5a) is not. Here is another example demonstrating the asymmetry:

(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?
      $\not\rightsquigarrow$ The speaker believes that it's nice out
   b. #Isn't it nice out?
      $\rightsquigarrow$ The speaker believes that it's nice out

Crucially, high negation questions necessarily convey the speaker's epistemic bias toward the proposition embedded under negation. Thus, if the context establishes that the speaker lacks such a bias, the high negation question will be infelicitous in that context. Note that if we altered (6) slightly so that A has just checked the weather online and has seen that it is supposed to be nice out, now (6b) is a perfectly acceptable response to B's behavior. Low negation questions on the other hand—questions in which the negation is not preposed—are completely acceptable in contexts that lack this epistemic bias.

Such observations are well established in the literature (e.g., Romero and Han, 2004; Sudo, 2013; AnderBois, 2019).[2] Romero and Han further demonstrate that this is not just a quirky fact of English; preposed negation in polar questions correlates with epistemic bias in Modern Greek, Spanish, German, Bulgarian, and Korean, while non-preposed negation does not. The

[2]It is also well established that low negation questions also have distinct licensing requirements, in particular they seem to require immediate contextual evidence in favor of the negative answer, or at least asker interest in the negative answer (Büring and Gunlogson, 2000; Romero and Han, 2004; Sudo, 2013; Trinh, 2014). However this is a distinct phenomenon that is beyond the scope of this paper. See Goodhue (2018b: 85ff) for an argument that high negation questions lack any kind of contextual evidence condition whatsoever, *pace* Büring and Gunlogson (2000); Sudo (2013); Northrup (2014); Trinh (2014).

generalization is also found in Japanese (Ito and Oshima, 2014; Shimoyama et al., 2019), and in Hungarian (Gyuris, 2017).

The crosslinguistic stability of the phenomenon gives rise to the question that motivates this work: Why is there a correlation between negation, preposing, and epistemic 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 epistemic bias from preposed negation, rather than stipulating it.

2.2. High negation vs. verum/polarity focus

Romero and Han (2004) note that both high negation questions and questions with verum/polarity focus convey epistemic bias on the part of the speaker.

(7) a. Isn't Moira home?
   ⇝ The speaker believes that Moira is home
   b. IS Moira home?
   ⇝ The speaker believes that Moira is not home

This common meaning leads Romero and Han to propose that high negation is related to verum focus (Höhle, 1992). In particular, they suggest that both high negation as in (7a) and prominence on the auxiliary as in (7b) introduce a VERUM operator to the syntax, which in turn plays a crucial role in the bias derivation. However, they are the first to acknowledge that the link between high negation and VERUM remains an unexplained assumption of their account. And I add that since the account stipulates that high negation introduces VERUM, the crosslinguistic link between high negation and epistemic bias remains unexplained.

An even greater challenge is that a closer examination of high negation and verum/polarity focus in questions reveals two empirical asymmetries that speak against a unified account. First, verum/polarity focus requires the sort of antecedent needed to license prosodic prominence shifts more generally, while high negation does not.

(8) B: Ok, now that Stephan has come, we are all here. Let's go!
   A: Wait, Jane's coming too.
   B: IS Jane coming?

In (8), B's use of verum/polarity focus is licensed by A's utterance, which provides the required antecedent for the prominence shift. Consider (9), in which the antecedent is missing from the context:

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

In this context, verum/polarity focus in (9a) is infelicitous. However, the same question without this prominence shift in (9b) is felicitous. Moreover, note that the high negation question in (9c) is felicitous in this context, despite that the antecedent required for verum/polarity fo-

cus is missing. Finally, if we try to shift prominence to the auxiliary as in (9d), the result is infelicitous.

If we thought that high negation was verum focus, then we should expect high negation questions to have the same licensing requirements, but this isn't what we have found, since high negation is acceptable even when verum/polarity focus is not ((9a) vs. (9c)). Minimally, a unified VERUM theory of the two phenomena needs 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. I think a more straightforward explanation of the facts is to treat verum/polarity focus and high negation as two distinct phenomena requiring distinct accounts.

The second asymmetry between high negation questions and verum/polarity focus questions is that the epistemic bias arising from the former is context insensitive, while that associated with the latter is context sensitive.

(10) B wants to know whether Jill will be at a meeting for members of a club. 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?
$\not\rightsquigarrow$ B believes she isn't a member
b. B: # ISN'T she a member?
$\rightsquigarrow$ B believes she is a member

The context of (10) stipulates that B lacks an epistemic bias about whether Jill is a member. Nevertheless, the verum/polarity focus question in (10a) is perfectly felicitous, despite this lack of bias. The high negation question in (10b) 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, the high negation question would be perfectly felicitous. If both of these question types introduce a VERUM operator that triggers epistemic bias, as Romero and Han (2004) claim, then this asymmetry is unexpected.

I believe that it is one of the central empirical facts about high negation questions that they always convey a bias, as argued convincingly by Romero and Han. It is an equally central fact about verum/polarity focus questions that the bias they convey is context sensitive. I develop an account of this context sensitive bias in Goodhue (2018a, b). An account of bias in high negation questions will be offered below (based on Goodhue, 2018b).

Due to these empirical asymmetries, I take it that high negation and verum/polarity focus are distinct phenomena deserving distinct theoretical accounts. This frees us up to pursue an account of high negation questions that offers an explanation for the crosslinguistic correspondence between structural height, negation, and bias.

3. Evidence that high negation questions lack propositional negation

We want to know what negation is doing in high negation questions such that it gives rise to epistemic bias. In assertions of declaratives, the effect of negation is straightforward to observe, it reverses truth values. Since polar questions do not have truth values, it is less

straightforward to determine the effect of negation. Does the negative morpheme *not/n't* make its usual contribution to the larger composed meaning? Or does it do something else?

Ladd (1981) suggests that high negation questions are ambiguous between an inside negation reading (in which propositional, sentential negation is present), and an outside negation reading, in which negation "is somehow outside the proposition…" If the latter is true, then the interesting question to ask is, where is it? But before we get there, we'd like some empirical evidence of the presence or absence of propositional negation in negative polar questions.

Ladd uses the negative polarity item *either* and the positive polarity item *too* to bring out the two readings.

(11) a. Isn't Jane coming too? outside negation
b. Isn't Jane coming either? inside negation

Ladd claims that (11a) questions p, while (11b) questions $\neg p$. However many speakers of American English find (11b) to be infelicitous or at least degraded (cf. AnderBois, 2019), a fact that has been demonstrated experimentally (Hartung, 2006; Sailor, 2013). To make matters worse, it is not completely clear how *either* is licensed (Rullmann, 2003; Ahn, 2015).

The upshot is that we need to look beyond *either* to determine whether high negation questions have a reading with propositional negation. I will do this by considering three phenomena that are sensitive to negation: projecting content, sensitivity to aspect, and polarity particle responses.

3.1. 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:

(12) Did Danielle come to class again?
presupposes: Danielle has come to class before

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

(13) 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 (13).[3]

Now consider *again* in a high negation question:

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

Interestingly, the high negation question in (14) does not presuppose the negative proposition that (13) can presuppose. Instead it patterns with (12), presupposing *that Danielle has come to*

[3](13) 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.

class before. This pattern replicates with other presupposition triggers.

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 (15) could either include or exclude negation (Potts, 2002).

(15) Kim did not lie, as Ann claimed.
can implicate: Ann claimed that Kim did not lie
or
can implicate: Ann claimed that Kim lied

As above, we can check to see what content projects out of low negation questions and high negation questions:

(16) Did Zoe not win, as Joy predicted?
can implicate: Joy predicted that Zoe did not win
or
can implicate: Joy predicted that Zoe won

(17) 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 low negation question, but not a high negation question. These facts suggest that *again* and *as*-parentheticals cannot scope over high negation.

3.2. Negation sensitivity

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

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

Negating a verb with punctual aspect creates durative aspect:

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

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

(20) a. Did Liv not discover the thief until 9?
b. Did the ball not hit the ground for two minutes?

However, high negation questions do not:

(21) 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 *until*- and *for*-adverbials cannot scope above high negation.

3.3. Inversion is not enough

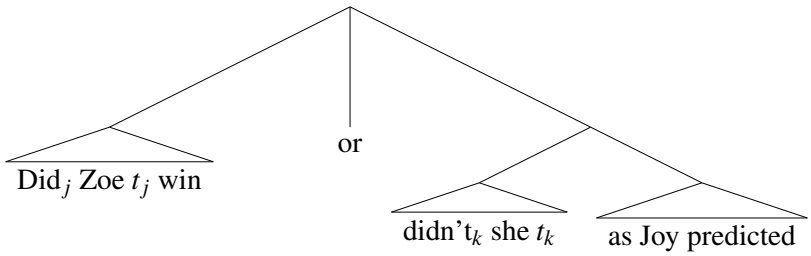
The empirical facts examined so far can be summarized as follows: The relevant operators—*again*, *as*-parentheticals, *until*- and *for*-adverbials—cannot scope above negation in high negation questions. Ultimately, I will claim that this is because high negation does not modify the prejacent of the 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 *again* and the other operators to reach, and no speech act operator is needed to explain the facts about high negation questions.

To test this idea, we can look at other examples of inversion of *aux-n't* to see whether they behave like high negation questions. Here is an example with an *as*-parenthetical:

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

Unlike in high negation questions, the *as*-parenthetical scopes over negation in (22), suggesting a structure like (23):

(23)

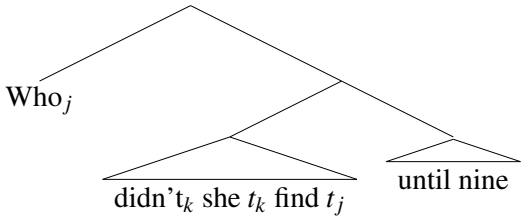


Here is an example with *until*:

(24) *A game of hide-and-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 high negation questions, the *until*-phrase scopes over negation in (24), suggesting a structure like (25):

(25)



I take these results to demonstrate that we are safe in assuming that the high negation question data considered so far are not simply due to the inversion of *aux-n't* in high negation questions. Something different seems to be going on in high negation questions than in other sentences in which *aux-n't* is inverted.

3.4. Responses to negative sentences

As has been explored in recent work (Kramer and Rawlins, 2009; Krifka, 2013; Roelofsen and Farkas, 2015; Holmberg, 2016; Goodhue and Wagner, 2018), negative polar questions have a noteworthy effect on English polar particle responses. While *yes*/*no* responses to positive polar questions as in (26) convey unambiguous, clear answers, they are interchangeable in response to low negation questions, as in (27).

(26) 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

(27) 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 that are explored in detail in Goodhue and Wagner (2018). However, while the accounts may differ, all researchers agree that a crucial component of the explanation for the contrast between (26) and (27) is that the sentence that B responds to in (27) is negative, i.e., it contains propositional negation, while that in (26) is not.

Krifka (2017) points out that responses to high negation questions pattern with (26) rather than (27):

(28) 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 high negation question patterns with the positive polar question rather than the low negation question. Whatever the negative morpheme in the high negation question is doing, it clearly is not contributing the propositional negation necessary to condition the interchangeable behavior of *yes* and *no* seen in (27).

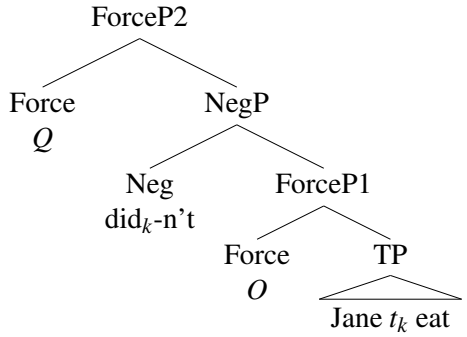
4. Epistemic operators and unbalanced partitions

The facts presented in section 3 suggest that high negation is indeed outside of the proposition. But where? One likely candidate, the one I will pursue here, is that high negation is

located above an operator *O* that, broadly speaking, contributes some epistemic, doxastic, or commitment-based meaning to the interpretation. The advantage of this approach is that it provides a ready made explanation for the facts from the previous section if the relevant phrases naturally cannot scope above *O*. Moreover, I will argue it has a second advantage in that it provides a necessary piece of the puzzle for explaining the crosslinguistic correlation between negation, structural height, and bias.

The idea that high negation scopes above an epistemic, conversational operator is suggested already by Romero and Han (2004) in the form of their 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. I will explore here the idea that negation scopes above a doxastic speech act operator. Such operators have been proposed for independent reasons in the prior literature (Kratzer and Shimoyama, 2002; Chierchia, 2006; Alonso-Ovalle and Menéndez-Benito, 2010; Meyer, 2013). Here is the structure I assume for a high negation question like "Didn't Jane eat?" (cf. Krifka 2017, who proposes a similar structure):

(29)



Besides having the advantage of explaining the facts from section 3, the account also puts flesh on the bones of Ladd's suggestion that high negation is outside of the proposition. Moreover, negation is still negation, so if this idea can be shown to play a key role in the derivation of bias, then we would have an explanation for the persistent crosslinguistic link between negation, structural height, and bias. In the next section, I will argue that it does indeed play just such a key role in the bias derivation.

First however, an interpretation for the structure in (29) is needed. I will assume that *O* has the denotation of a doxastic necessity operator, as in (30).

(30) $[\![O]\!] = \lambda p_{\langle s,t\rangle}.\lambda w_s.\forall w' \in Dox_x(w)[p(w') = 1]$

$Dox_x(w)$ is the set of worlds compatible with x's beliefs in w. x is a free variable for individuals whose value is contextually determined. When *O* appears in (falling) declaratives, x is the speaker, but in high negation questions, x is the addressee. In the following, I will frequently abbreviate doxastic necessity with "□" for ease of exposition.[4]

Following Romero and Han (2004), and Dayal (2016), I assume the denotation for *Q* in (31), which provides Hamblin (1973)/Karttunen (1977) denotations for polar questions.[5]

[4]So, if $[\![\phi]\!] = p$ (where p is a proposition), then $[\![O\phi]\!] = \Box p$, and $[\![[not[O\phi]]]\!] = \neg\Box p$.

[5]I assume that the auxiliary *did* is vacuous, and that *not/n't* is defined for propositions: $[\![$not/n't$]\!]$ =

(31) $[\![Q]\!] = \lambda p_{\langle s,t\rangle}.\lambda q_{\langle s,t\rangle}.[q = p \vee q = [\![not]\!](p)]$

The interpretation for the LF in (29) is worked out in (32).

(32) a. $[\![\text{TP}]\!] = \lambda w_s.\ \text{eat}(j)(w)$

b. $[\![\text{ForceP1}]\!] = [\![O]\!](\lambda w_s.\ \text{eat}(j)(w)) =$
$\lambda p_{\langle s,t\rangle}.\lambda w_s.\forall w' \in Dox_x(w)[p(w') = 1](\lambda w_s.\ \text{eat}(j)(w)) =$
$\lambda w_s.\forall w' \in Dox_x(w)[\text{eat}(j)(w') = 1]$

c. $[\![\text{NegP}]\!] = [\![\text{did}_k\text{-n't}]\!](\lambda w_s.\forall w' \in Dox_x(w)[\text{eat}(j)(w') = 1]) =$
$\lambda p_{\langle s,t\rangle}.\lambda w_s.\neg p(w)(\lambda w_s.\forall w' \in Dox_x(w)[\text{eat}(j)(w') = 1]) =$
$\lambda w_s.\neg\forall w' \in Dox_x(w)[\text{eat}(j)(w') = 1]$

d. $[\![\text{ForceP2}]\!] = [\![Q]\!](\lambda w_s.\neg\forall w' \in Dox_x(w)[\text{eat}(j)(w') = 1]) =$
$\lambda p_{\langle s,t\rangle}.\lambda q_{\langle s,t\rangle}.[q = p \vee q = [\![not]\!](p)](\lambda w_s.\neg\forall w' \in Dox_x(w)[\text{eat}(j)(w') = 1]) =$
$\lambda q_{\langle s,t\rangle}.\ [q = \lambda w_s.\neg\forall w' \in Dox_x(w)[\text{eat}(j)(w') = 1]$
$\vee\ q = \lambda w_s.\neg\neg\forall w' \in Dox_x(w)[\text{eat}(j)(w') = 1] =$
$\lambda q_{\langle s,t\rangle}.\ [q = \lambda w_s.\neg\forall w' \in Dox_x(w)[\text{eat}(j)(w') = 1]$
$\vee\ q = \lambda w_s.\forall w' \in Dox_x(w)[\text{eat}(j)(w') = 1] =$
$\{\neg\Box$ *that Jane ate*, $\Box$ *that Jane ate*$\}$

The denotation for high negation questions produced in (32) is similar to that proposed by Romero and Han, except with VERUM replaced by doxastic necessity, and the assumption based on data from section 3 that a high negation question like "Didn't Jane eat?" only corresponds to the LF in (29), and is not ambiguous between (29) and another structure in which negation scopes below O. That is, high negation questions only have the structure $[Q[NEG[O[\phi]]]]$, not $[Q[O[NEG[\phi]]]]$.

As Romero and Han note, if we think of the resulting set of propositions as a partition in Groenendijk and Stokhof's (1984) sense, then the partition is unbalanced. Whereas a positive polar question presents a balanced partition between p and $\neg p$, a high negation question presents an unbalanced partition in which the addressee is presented with the choice between doxastic necessity for p, or a lack of doxastic necessity for p. Krifka (2017) refers to the latter option as one in which the addressee refrains from committing to p. Romero and Han say that it covers any other degree of belief in p besides belief in p itself. I will ultimately argue that the bias of high negation questions follows from the way in which the possibility space is unbalanced, with the speaker expressing bias for the more precise, more narrowly defined cell, $\Box p$. Despite that both Romero and Han, and Krifka posit such unbalanced partitions, neither derives the bias associated with high negation questions from the way in which the partition is unbalanced.

As Meyer (2013) points out, $\neg\Box p$ would be a weak claim, since it includes a wide range of situations, which can be partitioned into two sorts.

1. Lack of belief either way: the addressee neither believes p, nor $\neg p$ $(\neg\Box p \wedge \neg\Box\neg p)$
2. The addressee believes $\neg p$ $(\Box\neg p)$

As I will show in section 5, the direction in which the partition is unbalanced plays a key role in the kind of bias a high negation question conveys.

$\lambda p_{\langle s,t\rangle}.\lambda w_s.\neg p(w)$. Set-theoretically, negation returns the complement of the set of worlds representing the input proposition p, $W \setminus p$.

5. Deriving epistemic bias

In a nutshell, the bias derivation proceeds as follows: First, I will assume that questions are felicitous only if they are useful. Second, I will argue that high negations questions are useful only if the speaker is biased toward the prejacent of the question. Equivalently, I will argue that if the speaker is not biased toward the prejacent, then some other question will be more useful. This argument depends on the way in which high negation question partitions are unbalanced. When the speaker is not biased for p, the problem will be that the less specific cell of the partition ($\neg\Box p$) 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 high negation question partition is only useful when the speaker is biased.

To begin, let's recast the goal of the derivation as a felicity condition on the use of high negation questions. "HNQ-p" is shorthand for a high negation question with propositional content p. The propositional content is the denotation of the TP, so for example, the propositional content of "Didn't Jane eat?" is the proposition *that Jane ate*.

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

The goal then is to derive (33) from the unbalanced partition of high negation questions and general pragmatic principles.

The derivation will depend in part on the relative utility of different questions given the speaker's goals (cf. Van Rooy and Šafářová, 2003). I assume the following condition on the felicitous use of questions:

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

Obviously, much depends on how the phrase "at least as useful as" in (34) is understood. The guiding idea: the utility of one question can be compared to that of another by considering the partitions denoted by the questions, and asking which partition's cells would increase the speaker's information more, given the speaker's goals. Crucially, the speaker's goals may be different in different contexts, which will affect how cells impact the speaker's information. In the following, we will need to consider carefully just two sorts of contexts: contexts in which the speaker wants to gain information about p from the addressee, and contexts in which the speaker wants to determine agreement over p with the addressee.

To see why these two sorts of contexts matter, we need to consider the second main step of the bias derivation, which for lack of a better term, I simply refer to as *the lemma*:

(35) *The lemma*:
HNQ-p is at least as useful as other Qs only if S is biased for p.

The lemma in (35) is phrased as is because it provides a crucial intermediate step from (34) to (33), the goal of the bias derivation. Together (35) and (34) entail (33):

(36) (34) *Q Utility*: A question Q is felicitous only if Q is at least as useful as other Qs.
(35) *The lemma*: HNQ-p is at least as useful as other Qs only if S is biased for p.
$\therefore$ (33) *HNQ bias*: HNQ-p is felicitous only if S is biased for p.

To see that (35) holds, it is helpful to restate it in the form of its contrapositive:

(37) *Contrapositive of (35)*:
If S is not biased for p, then some other Q is more useful than HNQ-p.

To show that (37) holds, we need to say what it means for S to be biased for p. I take bias to be identical to the doxastic necessity operator introduced in (30). S is biased for p if and only if S believes p, i.e., p holds throughout the worlds compatible with her beliefs.[6] Therefore, in order to show that (37) holds, we need to consider situations in which it's not the case that S believes p ($\neg\Box p$), and demonstrate that some other Q is more useful than HNQ-p in each of those situations.

As I said above, $\neg\Box p$ situations can be partitioned into two subkinds of situations:

1. Lack of belief either way: the speaker neither believes p, nor $\neg p$ $(\neg\Box p \wedge \neg\Box\neg p)$
2. The speaker believes $\neg p$ $(\Box\neg p)$

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. Nevertheless, this variation is irrelevant to our purposes. Situation 2 is much more narrow, covering only cases in which S is certain that $\neg p$. The goal now is to show that in each of these kinds of situations, some other Q would be more useful than HNQ-p.

5.1. Situation 1: lack of belief either way ($\neg\Box p \wedge \neg\Box\neg p$)

If S lacks belief about p either way (and p is relevant at this point), then her goal will be to gain information about p from her addressee.

(38) *Gain info strategy*:
Q_1 is more useful than Q_2 iff the cells of the partition representing Q_1 produce epistemic states that are more informed relative to p than the cells of Q_2 do.

Given the strategy for comparing the utility of questions in (38), consider the positive polar question in (39):

(39) $[\![$Did Jane eat$]\!]$ = {*that Jane ate, that Jane did not eat*}

Clearly, either of the cells in the partition in (39) would increase S's information, given that she began with a lack of belief either way about p.

Now consider the high negation question in (40):

(40) $[\![$Didn't Jane eat$]\!]$ = {$\Box$ *that Jane ate*, $\neg\Box$ *that Jane ate*}

The first cell of the partition would certainly increase S's information, since it conveys A's certainty that p. The second cell, however, is not ideal: since $\neg\Box p$ is compatible with A's lack

[6] This claim is discussed further in Goodhue (2018b: 130ff).

of belief about p ($\neg\Box p \wedge \neg\Box\neg p$), S doesn't yet learn much about p from this cell. S learns that it's not the case that A believes p, but since this could be because A lacks a belief either way, S doesn't yet learn whether or not p holds.

Therefore, by (38), the positive polar question in (39) is more useful than HNQ-p in (40) when S lacks a belief either way about p.

5.2. Situation 2: certainty that $\neg p$

If S is biased toward $\neg p$ (and $\neg p$ is relevant at this point), then S's goal will be to determine whether or not she and her addressee agree about $\neg p$.

(41) *Determine agreement strategy*:
Q_1 is more useful than Q_2 iff the cells of the partition representing Q_1 make it easier to determine whether A agrees with S about p than the cells of Q_2 do.

Given the strategy for comparing the utility of questions in (41), consider the high negation question with an added low negation in (42):

(42) $[\![$Didn't Jane not eat$]\!]$ = {$\Box$ *that Jane did not eat*, $\neg\Box$ *that Jane did not eat*}

Either one of the cells in (42) would enable S to learn whether or not A agrees with her bias for $\neg p$. The first cell ($\Box\neg p$) would clearly indicate agreement. The second cell ($\neg\Box\neg p$) would indicate disagreement since it would mean that A does not hold the same belief as S.

Now consider the high negation question in (43):

(43) $[\![$Didn't Jane eat$]\!]$ = {$\Box$ *that Jane ate*, $\neg\Box$ *that Jane ate*}

The first cell ($\Box p$) could be used to convey that A definitely disagrees with S, since it's the opposite belief about p. The second cell ($\neg\Box p$), however, would leave S uncertain as to whether they agree, since it is consistent with both $\Box\neg p$, which would mean A and S agree, and lack of belief ($\neg\Box p \wedge \neg\Box\neg p$), which would indicate disagreement.

Therefore, by (41), the high negation question with an added low negation in (42) is more useful than HNQ-p in (43) when S is biased for $\neg p$.

5.3. Putting it together

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

(37) *Contrapositive of (35)*:
If S is not biased for p, then some other Q 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 ($\neg\Box p \wedge \neg\Box\neg p$), and bias for $\neg p$ ($\Box\neg p$). In section 5.1 and section 5.2, I argued that in each of these states of affairs some other question is more useful than HNQ-p. Therefore, (37) holds, which means the lemma itself in (35) holds.

The lemma together with question utility in (34) entails the bias condition on high negation questions in (33).

(36) (34) *Q Utility*: A question Q is felicitous only if Q is at least as useful as other Qs.
(35) *The lemma*: HNQ-p is at least as useful as other Qs only if S is biased for p.
$\therefore$ (33) *HNQ bias*: HNQ-p is felicitous only if S is biased for p.

The bias of high negation questions falls out from the fact that the unbalanced partition of HNQ-p is not useful when the speaker is not biased for p. Instead, other questions are more useful. We conclude that the only kind of context in which HNQ-p could be useful is one in which S is biased for p.

6. Conclusion

I have argued that the crosslinguistic correspondence between negation, preposing, and bias in polar questions observed by Romero and Han (2004) requires an explanation: why does preposing negation necessarily give rise to a bias inference? Given the crosslinguistic persistence of the signal, we should expect the meaning of negation to play a role.

In section 3, I demonstrated that high negation is not in the propositional core of the question. Therefore, we should also expect the structural height of negation to play a key role in the presence of bias. Given these facts, I argued that high negation is above a syntactically represented doxastic operator O, and showed how such a structure gives rise to an unbalanced partition for high negation questions (section 4).

Then in section 5, I argued that such unbalanced partitions require the speaker to be biased for the propositional prejacent of the high negation question. This is because if the speaker were not biased for p, other questions would be more useful.

The advantage of this account is that it explains the crosslinguistic connection between negation, height, and bias. The high position for negation gives the question a unique interpretation. That unique interpretation in turn is only useful if the speaker is biased in a certain way. As mentioned above, the idea that high negation questions involve a kind of assertion or epistemic/doxastic operator that negation can scope above is not novel. What is novel is some of the evidence that high negation does indeed scope above such an operator, the evidence that the operator is unlikely to be related to verum/polarity focus, and the argument that bias falls out of the interpretation of such structures. Since the semantics flows from the syntax, the arguments presented here provide an explanation for the crosslinguistic link between high negation and bias.

In the future, more work is needed on high negation is languages other than English, especially unrelated languages. Japanese provides one interesting avenue for further research (Ito and Oshima, 2014; Shimoyama et al., 2019).

I consider the precise characterization of the semantics of the operator O an open question. I treated it as doxastic necessity in section 4, however this is not necessary. If the goal is simply to explain the bias inference, then other epistemic, doxastic or conversational operators would do. For example, the bias derivation could be given using Krifka's (2017) commitment based semantics, as is done in Goodhue (2018b). It could also be given using Romero and Han's (2004) VERUM operator, so long as its syntax is constrained so that high negation may only scope above it. Moreover, the operator could be weakened by giving it a semantics similar to a weak epistemic *must* (e.g. Kratzer, 1991; Lassiter, 2016). If it were decided that the bias

associated with high negation questions is weaker than outright belief, such a weakening of *O*'s semantics would ensure that the bias derivation given in section 5 would still go through. I leave an adjudication between competing options for the precise characterization of *O*'s semantics to future work.

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