

On Certain Epistemic Implicatures in Yes/No Questions  
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## 1 Introduction

Inverted or preposed negation in *yes/no* (*yn*-)questions contributes the implicature that the speaker expects the answer to be in the affirmative (Ladd (1981), Han (1998), Gunlogson and Büring (2000)). For instance, the intuition is that (1) asks whether John drinks and implies that the speaker believes or at least expects that John drinks. Note also that *yn*-questions with non-preposed negation do not necessarily have this implicature. (2) can be another way of seeking information on whether John is a teetotaler (cf., Han (1999)). We will call this type of implicature *epistemic implicature*.

- (1) Doesn't John drink?  
 Positive epistemic implicature: The speaker has the previous belief or expectation that John drinks.
- (2) Does John not drink?  
 No epistemic implicature necessary.

The goal of this paper is to provide (tentative) answers to the following questions:

1. What property correlated with the existence of an implicature distinguishes preposed negation from non-preposed negation?
2. How does this property of preposed negation enforce an epistemic implicature?
3. Why is the implicature raised by preposed negation a *positive* epistemic implicature? That is, why are the polarity in the question and the polarity in the implicature opposite?

## 2 A first hypothesis

A first explanation of the contrast between (1) and (2) would maintain that: (i) preposed negation in *yn*-questions is sentential negation, whereas non-preposed negation is VP constituent negation; and (ii) sentential negation, when combined with the semantics of *yn*-questions, is responsible for the epistemic implicature.

**Sentential vs. constituent negation will not do it.** In (3a), negation is not just negating the event contributed by the VP and is more like a sentential negation negating the entire modal proposition. Still, (3a) does not give rise to a necessary epistemic implicature, in contrast with its preposed negation version in (3b):

- (3) a. Does John not have to go to the meeting? ( $\neg\Box$ )  
 b. Doesn't John have to go to the meeting? ( $\neg\Box$ )

If we say that negation in (3a) is still constituent negation –negating a bigger constituent than VP–, the distinction between constituent and sentential negation becomes murky.

**The semantics of *yn*-questions (Hamblin (1973))** According to Hamblin (1973), the denotation of a question is the set of its possible answers. A question operator -overt *whether* or the silent *Q*-morpheme- is in charge of taking the proposition expressed by the IP and turn it into the appropriate question denotation, as shown in (4).

- (4) a. LF: [<sub>CP</sub> Whether/Q [ it is raining ] ]  
 b.  $[[it\ is\ raining]] = \lambda w. it\ is\ raining\ in\ w$   
 c.  $[[whether]] = [[Q]] = \lambda p_{\langle s,t \rangle} \lambda w_s \lambda q_{\langle s,t \rangle} [q = p \vee q = \neg p]$   
 d.  $[[whether/Q\ it\ is\ raining]](w_o)$   
 $= \lambda q [q = \lambda w. it\ is\ raining\ in\ w \vee q = \lambda w. \neg(it\ is\ raining\ in\ w)]$   
 $= \{“that\ it\ is\ raining”, “that\ it\ is\ not\ raining”\}$

If we apply these semantics to *yn*-questions containing a (sentential) negation operator, we obtain exactly the same question meaning for (5a) as we did for (4a). No epistemic implicature follows from this semantic computation.

- (5) a. LF: [<sub>CP</sub> Whether / Q [ not [ it is raining ] ] ]  
 b.  $[[\textit{whether/Q it is not raining}]](w_o)$   
 $= \lambda q [q = \lambda w. \neg(\textit{it is raining in } w) \vee q = \lambda w. \neg\neg(\textit{it is raining in } w)]$   
 $= \{ \text{“that it is not raining”, “that it is raining”} \}$

### 3 Focus is relevant

Interestingly, parallel effects to the ones associated with preposed negation can be reproduced in affirmative questions if we place Focus stress on the auxiliary (and on nothing else): (6) can be used to convey the negative implicature that the speaker believes that John does not drink. The non-stressed auxiliary version (7) is not biased in this way.

- (6) DOES John drink?  
 Negative epistemic implicature: The speaker expects that John does not drink.  
 (7) Does John drink?  
 No epistemic implicature.

Furthermore, if we take a *yn*-question with non-preposed negation and place focus stress on *not*, the epistemic implicature arises again:

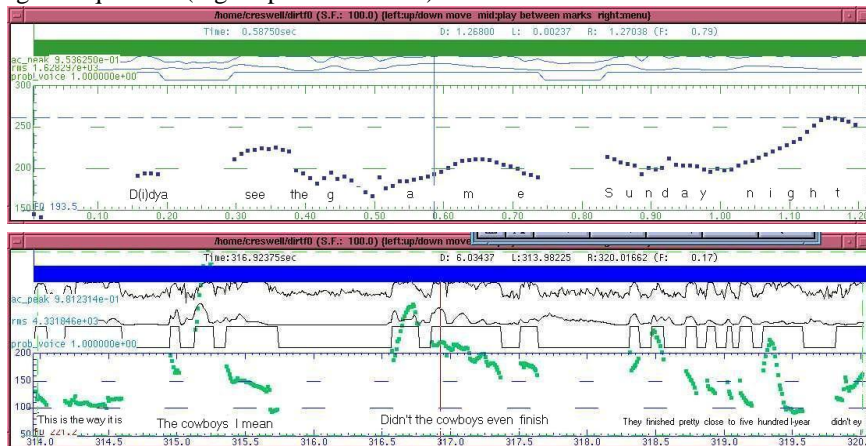
- (8) Does John NOT drink?  
 Positive epistemic implicature: The speaker expects that John drinks.

Note that the polarity of a question carrying an implicature and the polarity of the implicature itself are opposite: i.e., *negative yn*-questions with preposed negation give rise to a *positive* epistemic implicature, and *positive yn*-questions with focus on the auxiliary give rise to a *negative* implicature. This crossed pattern of implicatures is the same as the distributional pattern of tag questions, which clearly bear focus stress on the auxiliary:

- (9) a. John drinks, DOESN'T he?      b. John doesn't drink, DOES he?

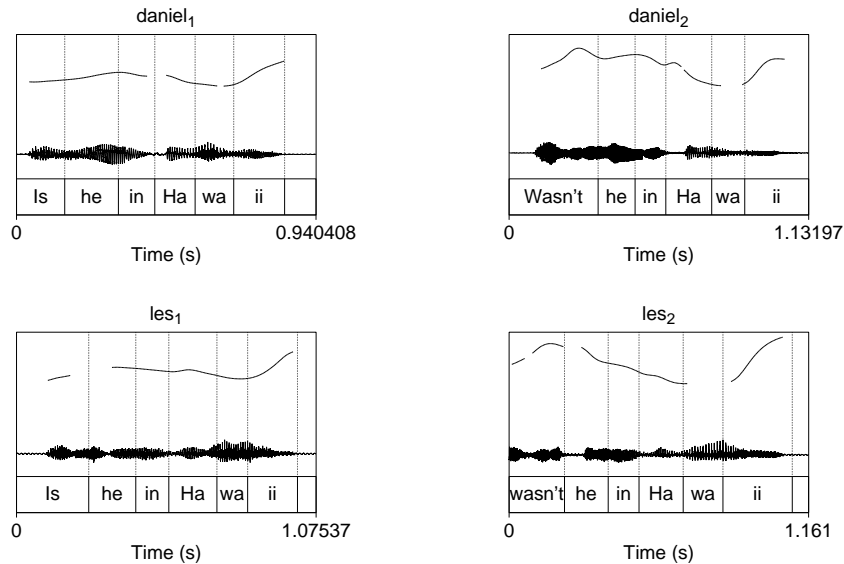
All this raises the question of whether the existence of epistemic implicatures and the crossed pattern of their polarities is related to focus. If so, we would expect our original sentences with preposed negation to involve focus-marking as well.

Preliminary evidence from naturally occurring data suggests that preposed negation does involve a special pitch curve different from non-focused auxiliaries. Compare the pitch track of the regular affirmative question (low pitch for *did*) with that of the preposed negation question (higher pitch for *didn't*) below:



We have also conducted a small experiment that elicits an (unfocused) affirmative *yn*-question and a negative *yn*-question with preposed negation in appropriate contexts. The

results show that the negated auxiliary verb has relatively higher pitch than the auxiliary verb in affirmative questions.



In view of these data, we will assume that preposed negation bears Focus too, and it does so necessarily, whereas non-preposed negation, instead, can –but does not need to– be focused.<sup>1</sup> We will pursue a unified focus-based account of the positive and negative implicatures above: in all the examples with a necessary epistemic implicature, the negative/positive polarity inside the question is focus-marked (Verum Focus as in Höhle (1992)), lending (10a)-(11a) roughly equivalent to (10b)-(11b) respectively.

- (10) a. Doesn't John drink?                      b. Is it FALSE that John drinks?  
 (11) a. DOES John drink?                         b. Is it TRUE that John drinks?

#### 4 How polarity focus generates an epistemic implicature

##### 4.1 A second hypothesis

Theories of Focus converge on the idea that non-focused material must be old, whereas focused material must be new (Rooth (1992), Schwarzschild (1999)). Applying that to (12a) (and obliterating the contribution of the question operator *Q*), it follows that the proposition in (12b) -with the positive polarity *POS* instead of *not*- must be old in the discourse.

- (12) a. Wasn't<sub>F</sub> he in Hawaii?  
 b. The proposition  $\lambda w. John\ was\ in\ Hawaii\ in\ w$  must be old.

One could argue that, since the proposition in (12b) is old but has not been explicitly expressed in the previous discourse, we infer that it is old in the *epistemic state* of the speaker. But, then, the proposition in (12b) certainly should count as old if explicitly expressed too, e.g. if the speaker A asserted it. This wrongly predicts (13) should be fine.

- (13) A: John was in Hawaii last week.      B: # Wasn't he (in Hawaii last week)?

In fact, the appropriate epistemically biased question to follow A's utterance does not contain a focused negative polarity, but a focused *positive* polarity, as in (14).

- (14) A: John was in Hawaii last week.      B: WAS he (in Hawaii last week)?

<sup>1</sup>It may be that preposed negation sometimes associates with other focused element instead of signaling focus-marking on itself. The present analysis can be extended to cover that case.

The generalizations we draw from this set of facts are: (i) B’s question with focus on polarity  $\alpha$  correlates with B’s epistemic implicature of polarity  $\beta$ ; and (ii) B’s question with focus on polarity  $\alpha$  correlates with A’s utterance(/implication) of polarity  $\alpha$ . The hypothesis presented in this subsection cannot explain these generalizations.

#### 4.2 Our proposal

We assume that focus on polarity is evaluated with respect to a probabilistic epistemic model, where each proposition in the speaker’s epistemic state is mapped to a probability value ranging from 1 ((TRUE-FOR-SURE, i.e.,  $\llbracket POS \rrbracket$ ) to 0 (FALSE-FOR-SURE, i.e.,  $\llbracket not \rrbracket$ ) (cf. Bayesian models in Gaerdenfors 1988). Other probability measures can be expressed by simple or complex expressions: e.g., *probably* (.9), *most likely* (.8), *likely* (.7), *possibly* (.5), etc. Each of these probability measures is an alternative to all the others. Focusing one of the expressions makes all the probability measures relevant in a way that will be important for the type of *yn*-questions at issue. (But see Höhle (1992)’s section 6.3.)

We further note that in a coherent discourse, we often find a hierarchy of superquestions and subquestions (Roberts (1996)). E.g., if we are searching for the answer to “Who is married to Bertha?”, we may proceed by asking the subquestions “Is John married to Bertha?”, “Is Paul married to Bertha?”, etc. We propose that Focus can be used to mark this relation explicitly: focus in (15) presupposes that (15) is just a subquestion and that its superquestion “Who is married to Bertha?” is relevant and salient in the discourse.

- (15) Is JOHN married to Bertha?  
 →It presupposes relevant superquestion: “Who is married to Bertha?”

Now, let us take the mini-discourse (16).

- (16) A: I saw John at the movies last night (in Philadelphia).  
 B: Wasn’t he in Hawaii? / Is it FALSE that he was in Hawaii?

As in (15), (16B) presupposes that there is a relevant, salient superquestion (SQ) “What is the probability assignment to the proposition “John was in Hawaii?””. In (16) (out of the blue), the only trigger for SQ is A’s utterance. But A’s utterance is not that question. How can it trigger or raise SQ? A’s utterance triggers SQ if the acceptance of A’s proposition into the epistemic state induces a revision of it. To see this, let us take an initial epistemic state  $S_1$ , where the proposition P “John was in Hawaii” has probability 0.9 or 1. Then we get A’s utterance, which implies that the proposition P “John was in Hawaii” is mapped to 0. This raises the question of what is the probability measure of P, after all. That is, this raises our SQ. In sum, the effect of Focus on the polarity –no matter whether it’s on TRUE or on FALSE– is to presuppose the SQ and, from that, to imply that we had pre-existent beliefs about the answer to SQ and that they have been contradicted in the last update.

#### 5 The crossed polarity pattern for epistemic implicatures

We now need to address the issue of why the focused polarity in the question and the polarity in the implicature are opposite. We will use the paradigm in (17) for illustration.

- (17) Previous belief of B: The speaker B believed John was in Hawaii.  
 A: I saw John at the movies last night (in Philadelphia).  
 B: Wasn’t he in Hawaii?      B: Is it FALSE that he was in Hawaii?  
 B: # WAS he is Hawaii?      B: # Is it TRUE that he was in Hawaii?

Let us first examine B’s good response. We saw earlier that the  $Q$  morpheme in *yn*-questions takes the proposition  $P$  expressed by its sister node and makes a two-member set containing  $P$  and its negation  $\neg P$ . The resulting denotation is a set of propositions that divides the probability measure space for  $P$  in two *balanced* cells (cf. Groenendijk and Stokhof (1985)’s partition over the background set of possible worlds).

- (18) 

$\lambda w. it\ is\ raining\ in\ w \rightarrow 1$
---

$\lambda w. it\ is\ raining\ in\ w \rightarrow 0$
---

Adding focus and the semantics of *yn*-questions, the denotation of a question with focus on epistemic polarity FALSE-FOR-SURE is as in (21).

(19) a. B: Wasn't he in Hawaii? b. B: Is it FALSE that he was in Hawaii?

(20) LF: [<sub>CP</sub> Q [ FALSE-FOR-SURE<sub>F</sub> [ he was in Hawaii ] ] ]

(21) { *false – for – sure*( $\lambda w. he\ was\ in\ Hawaii\ in\ w$ ),  
 $\neg$ *false – for – sure*( $\lambda w. he\ was\ in\ Hawaii\ in\ w$ ) }

Assuming that a focused epistemic polarity makes all the gradient alternative probability measures salient, we obtain a partition of the probability continuum in two *unbalanced* cells:

(22) 

$\lambda w. he\ was\ in\ Hawaii\ in\ w \rightarrow 0$
---

$\lambda w. he\ was\ in\ Hawaii\ in\ w \rightarrow n$ , where $0 < n \leq 1$
--

Note that, given that accepting the proposition  $\lambda w. you\ saw\ John\ at\ movies\ in\ Ph\ in\ w$  entails rejecting the proposition  $\lambda w. he\ was\ in\ Hawaii\ in\ w$ , the same partition would obtain if B had responded *DID you (see him at the movies last night)?*. That is, given the entailment between the two propositions, (22) can be further spelled out as in (23):

(23) 

$\lambda w. he\ was\ in\ Hawaii\ in\ w \rightarrow 0$
$\lambda w. A\ saw\ John\ atm\ in\ w \rightarrow 1$

$\lambda w. he\ was\ in\ Hawaii\ in\ w \rightarrow n$ , where $0 < n \leq 1$
$\lambda w. A\ saw\ John\ atm\ in\ w \rightarrow n$ , where $0 \leq n < 1$

Let us now turn to B's bad response. The denotation of (24) is given in (26). In the resulting partition (27), the cells are unbalanced on the opposite extreme:

(24) a. B: # WAS he in Hawaii? b. B: # Is it TRUE that he was in Hawaii?

(25) LF: [<sub>CP</sub> Q [ TRUE-FOR-SURE<sub>F</sub> [ he was in Hawaii ] ] ]

(26) { *true – for – sure*( $\lambda w. he\ was\ in\ Hawaii\ in\ w$ ),  
 $\neg$ *true – for – sure*( $\lambda w. he\ was\ in\ Hawaii\ in\ w$ ) }

(27) 

$\lambda w. he\ was\ in\ Hawaii\ in\ w \rightarrow 1$
---

$\lambda w. he\ was\ in\ Hawaii\ in\ w \rightarrow n$ , where $0 \leq n < 1$
--

The same partition would obtain if B responded *Didn't you (see him at the movies last night)?*, since accepting the proposition  $\lambda w. he\ was\ in\ Hawaii\ in\ w$  entails rejecting the proposition  $\lambda w. you\ saw\ John\ at\ movies\ in\ Ph\ in\ w$ . That gives us the bad partition in (28):

(28) 

$\lambda w. he\ was\ in\ Hawaii\ in\ w \rightarrow 1$
$\lambda w. A\ saw\ John\ atm\ in\ w \rightarrow 0$

$\lambda w. he\ was\ in\ Hawaii\ in\ w \rightarrow n$ , where $0 \leq n < 1$
$\lambda w. A\ saw\ John\ atm\ in\ w \rightarrow n$ , where $0 < n \leq 1$

The question is: what makes (23) acceptable and (28) unacceptable in the context illustrated in (17)? We propose that the contrast ultimately stems from whether or not the question is informative (Grice (1975)). We also assume, in the spirit of Gaerfenfors informational economy (p. 49), that a speaker wants to retain as much as possible from her old beliefs and that, hence, she only executes a revision of her previous epistemic state for a proposition P' if there is enough certainty about P'. In the examples at issue, A's utterance asserted or entailed any of the propositions P' in (29). Given the Gricean cooperation principles, this implies that A assigns P' a very high probability measure (.9 or 1). But, since accepting P' would suppose a revision of B's epistemic state, B will only execute such revision if P' is certain. That is, informational economy makes highly relevant a question that would distinguish between the measures .9 and 1 for P'.

- (29)  $P' = \lambda w. A \text{ saw John atm in } w$ , or  
 $P' = \lambda w. \neg(\text{he was in Hawaii in } w)$ , or  
 $P' = \lambda w. (A \text{ saw John atm in } w) \wedge \neg(\text{he was in Hawaii in } w)$

Let us see how these considerations impact our unbalanced partitions. The good partition carves the spectrum of probability measures so that the values .9 and 1 for the conflicting proposition  $P'$  are in two different cells. B asks A to choose one of the cells in (23). In this way, B is asking A to distinguish between a high probability belief for  $P'$  (.9) and certainty about  $P'$  (1). That is, B asks his question in a way coherent with the Gricean maxims and useful to the pursuit of informational economy. However, the bad partition draws the line between the probability measures 0 and .1 for the conflicting proposition  $P'$ . B asks A to choose the cell [0] or the cell [.1, .2, ..., .9, 1]. But, since A just asserted  $P'$ , A must map  $P'$  to a very high probability measure, .9 or 1. But this means that the question B is asking with this partition has already been answered by the fact that A uttered  $P'$ . Hence, the partition induced by this question is bogus.

## 6 Conclusions and further issues

Preposed negation carries focus-marking on the negative polarity (Verum Focus in Höhle (1992)), and it does so necessarily. Non-preposed negation may or may not be focus-marked.

The felicity conditions of Polarity Focus in a question require that the corresponding superquestion (Roberts (1996)) be presupposed or salient in the previous discourse. Typically, a non-uttered question is salient if new information contradicts one speaker's previous beliefs, leading to a contradictory epistemic state that raises the superquestion.

Unfocused  $y/n$ -questions induce a balanced partition ( $[P']$ ,  $[\neg P']$ ), whereas questions with Polarity Focus induce an unbalanced partition on the space of probability measures for  $P'$ . Only when the focused polarity in the question is opposite to that in the epistemic implicature (i.e., only when it is equal to that in A's utterance or its implication) is the unbalanced partition informative and, hence, felicitous.

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