Bias in high negation questions as a quantity implicature in commitment space semantics

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Preposed negation triggers speaker bias

(1) In the early afternoon, S hears that Mo ate an enormous lunch at the pub. Then, 20 minutes later, A reports that Mo is hungry.
S: Didn't Mo eat?
$\rightsquigarrow$ S is biased for the proposition *that Mo ate*

(slides available at danielgoodhue.com/s/ac.pdf)

Preposed negation triggers speaker bias

(2) A and A's child Mo are visiting S. S wants to be a good host by offering something for Mo to eat, but S has **no idea** whether Mo has eaten or not.

(3) S: # Didn't Mo eat?
$\rightsquigarrow$ S is biased for the proposition *that Mo ate*

(4) S: Did Mo eat?
no bias necessary

Preposed negation triggers speaker bias

(5) *High Negation Question (HNQ)*
S: Didn't Mo eat?
$\rightsquigarrow$ S is biased for the proposition *that Mo ate*

(6) *Positive Polar Question (PPQ)*
S: Did Mo eat?
no bias necessary

A crosslinguistic phenomenon: Spanish, Bulgarian, Korean, German, Hungarian, Greek, and Turkish Sign Language

(Romero & Han, 2004; Hartung, 2009; Gyuris, 2017; Gökgöz & Wilbur, 2017)

Why do HNQs give rise to this speaker bias?
(What is preposed negation doing?)

Tests for negation: Presupposition projection

Several tests suggest the prejacents of HNQs are not negated (Goodhue, 2022)

E.g.: *Again* presupposes that the proposition denoted by its complement has happened before

(7) Did Mo eat again? (PPQ)
presupposes: Mo ate before

(8) Did Mo not eat again? (Low Negation Question (LNQ))
can presuppose: Mo did not eat before

(9) Didn't Mo eat again? (HNQ)
presupposes: Mo ate before
cannot presuppose: Mo did not eat before

Tests for negation: Negation sensitivity ✗

Until- and *for*-adverbials combine with durative but not punctual aspect.

(10) Punctual aspect in PPQs:

a. #Did Mo discover the thief until 9?
b. #Did the ball hit the ground for two minutes?

Negating punctual aspect creates durative aspect:

(11) Durative aspect in LNQs:

a. Did Mo not discover the thief until 9?
b. Did the ball not hit the ground for two minutes.

But HNQs do not license *until*- and *for*-adverbials:

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

Preposed negation is **not** negating the prejacent of the HNQ

Two disiderata driving my account

1. A location for high negation in HNQs that explains the absence of negation in their prejacents.

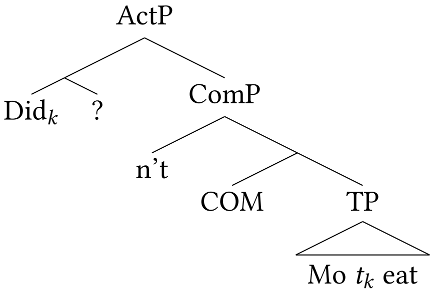
2. A semantics for HNQs that makes them weaker than their PPQ alternatives, which will be crucial for the derivation of speaker bias.

Where is high negation?

Over a commitment operator COM in the left periphery (building on Ladd 1981; Romero & Han 2004; Krifka 2017, and especially Krifka 2021)

LFs include distinct syntactic layers representing aspects of speech act structure

(13) Didn't Mo eat?



(14) $[_{\text{ActP}}$ Did$_k$ **?** $[_{\text{ComP}}$ COM $[_{\text{TP}}$ Mo t_k eat (ϕ)]]]

First disideratum resolved

1. ✓A location for high negation in HNQs that explains the absence of negation in their prejacents.

Commitment Space Semantics (building on Krifka 2021)

A *commitment state* is a context set, a set of worlds compatible with all the mutually shared commitments in the common ground à la Stalnaker 1978.

Commitment spaces are sets of commitment states that model future developments of the current commitment state. Since new commitments shrink commitment states, smaller commitment states are possible continuations, as in (15).

(15) If commitment states c, c' are in commitment space C, and $c' \subset c$, then c' is a possible continuation of c in C.

Commitment spaces are rooted in a set of their largest commitment states, as in (16).

(16) $\sqrt{C}$, the root of C, is defined as $\{c \in C \mid \neg\exists c' \in C\ [c \subset c']\}$

(Krifka, 2021, p. 68)

Interpretation: COM

In proceedings, COM is '⊢', and it is treated as an attitude predicate

(17) $[\![\text{COM}]\!]^{i,d,g} = \lambda p.\lambda w.\ \forall w'[w\mathcal{R}_j w' \rightarrow p(w') = 1]$

(18) $[\![\text{COM}]\!]^{i,d,g} = \lambda p.\lambda w.\ \text{COM}_{j,w}\ p$

j commits to p → The judge j claims publicly that p is true, and j would provide arguments supporting p if p were challenged. (Brandom, 1983; MacFarlane, 2011)

The judge variable j is a variable in the assignment function g set by a speech act operator to one of the interlocutors i:

- An assert operator in ActP sets j to the speaker S
- The question operator '?' sets j to the addressee A

Interpretation: ?

Krifka (2021): Polar questions restrict the commitment space to just those developments in which *A* makes the commmitment in the ComP

My account: **?** takes an input $[\![[_{\text{ComP}}\ \alpha]]\!]$, and it projects two opposing future continuations of the conversation:

- Continuation 1: A makes the commitment $[\![[_{\text{ComP}}\ \alpha]]\!]$
- Continuation 2: A makes a commitment to an alternative $[\![[_{\text{ComP}}\ \alpha']]\!]$ that would be incompatible with $[\![[_{\text{ComP}}\ \alpha]]\!]$
  I.e. $[\![[_{\text{ComP}}\ \alpha]]\!] \cap [\![[_{\text{ComP}}\ \alpha']]\!] = \varnothing$

Interpretation: ?

Giving a compositional semantics for **?** that produces the right opposing alternative $[\![[_{\text{ComP}}\ \alpha']]\!]$ for both PPQs and HNQs is nontrivial

Can't simply negate $[\![[_{\text{ComP}}\ \alpha]]\!]$: then PPQ and HNQ would be identical

? needs access to the TP proposition ϕ

Then, depending on $[_{\text{ComP}}\ \alpha]$, **?** produces $[\![[_{\text{ComP}}\ \alpha']]\!]$ as follows:

1. If $[_{\text{ComP}}\ \alpha]$ contains high negation, then $[\![[_{\text{ComP}}\ \alpha']]\!] \approx$ COM + ϕ
2. If $[_{\text{ComP}}\ \alpha]$ doesn't, then $[\![[_{\text{ComP}}\ \alpha']]\!] \approx$ COM + $\neg\phi$

? needs access to the TP proposition ϕ

TPs produce propositional discourse referents $\textsc{dr}_\phi$

(Krifka, 2013; Roelofsen & Farkas, 2015)

$\textsc{dr}_\phi$ is recorded in the parameter d, and is accessed by the question operator **?**

Interpretation: ?

Informal semantics for ?

? is a function from an input commitment space C to an output C' restricted to those elements c in C that are subsets of either $[\![[_{\text{ComP}}\ \alpha]]\!]$ or $[\![[_{\text{ComP}}\ \alpha']]\!]$

We can think of **?** as a conditional function as in (19):

(19) *Semantics for* **?**

$$[\![\ \textbf{?}\ [_{\text{ComP}}\ \alpha]]\!]^{i,d,g} = \lambda C.\ \{c \in C \mid c \subseteq [\![[_{\text{ComP}}\ \alpha]]\!]^{i,d,g[j\to A]} \vee \ldots$$

a. $c \subseteq [\![\text{COM}]\!]^{i,d,g[j\to A]}(\text{DR}_\phi)\},$

$$\text{if } [\![[_{\text{ComP}}\ \alpha]]\!]^{i,d,g[j\to A]} \cap [\![\text{COM}]\!]^{i,d,g[j\to A]}(\text{DR}_\phi) = \varnothing$$

b. $c \subseteq [\![\text{COM}]\!]^{i,d,g[j\to A]}(\neg\text{DR}_\phi)\},$

$$\text{if } [\![[_{\text{ComP}}\ \alpha]]\!]^{i,d,g[j\to A]} \cap [\![\text{COM}]\!]^{i,d,g[j\to A]}(\neg\text{DR}_\phi) = \varnothing$$

(19a) is used when $[\![[_{\text{ComP}}\ \alpha]]\!]$ contains high negation

(19b) is used when $[\![[_{\text{ComP}}\ \alpha]]\!]$ does not contain high negation

Interpretations for PPQs and HNQs

(20) $[\![\text{Did Mo eat?}]\!]^{i,\,d,\,g} =$
$\{c \in C \mid c \subseteq \lambda w.\ \text{COM}_{A,w}\,\phi \;\vee\; c \subseteq \lambda w.\ \text{COM}_{A,w}\neg\phi\}$

(21) $[\![\text{Didn't Mo eat?}]\!]^{i,\,d,\,g} =$
$\{c \in C \mid c \subseteq \lambda w.\ \neg\text{COM}_{A,w}\,\phi \;\vee\; c \subseteq \lambda w.\ \text{COM}_{A,w}\,\phi\}$

2. ✓A semantics for HNQs that makes them weaker than their PPQ alternatives, which will be crucial for the derivation of speaker bias.

PPQs entail HNQs

(20) $[\![\text{Did Mo eat?}]\!]^{i,\,d,\,g} =$
$\{c \in C \mid c \subseteq \lambda w.\, \mathrm{COM}_{A,w}\, \phi \;\vee\; c \subseteq \lambda w.\, \mathrm{COM}_{A,w} \neg\phi\}$

(21) $[\![\text{Didn't Mo eat?}]\!]^{i,\,d,\,g} =$
$\{c \in C \mid c \subseteq \lambda w.\, \neg\mathrm{COM}_{A,w}\, \phi \;\vee\; c \subseteq \lambda w.\, \mathrm{COM}_{A,w}\, \phi\}$

(22) $[\![\text{Did Mo eat?}]\!]^{i,\,d,\,g} = \{\mathrm{COM}_A\, \phi, \mathrm{COM}_A\, \neg\phi\}$

(23) $[\![\text{Didn't Mo eat?}]\!]^{i,\,d,\,g} = \{\mathrm{COM}_A\, \phi, \neg\mathrm{COM}_A\, \phi\}$

Speaker bias derivation

Goal: To have bias fall out from the unique structure and interpretation of HNQs, along with general pragmatic principles

In a nutshell (✗?):
1. S asks the HNQ “Didn’t Mo eat?”
2. If S were ignorant of whether or not Mo ate, the PPQ “Did Mo eat?” would have been better at resolving S’s ignorance (because ‘stronger’).
3a. Since S chose HNQ over PPQ, S must not be ignorant of whether or not Mo ate.
3b. That is, S is biased: Either S thinks that Mo ate, or S thinks that Mo did not eat.
4. The way the HNQ is unbalanced tells us the direction of bias:
that S thinks that Mo ate.

Some assumptions

“Did Mo eat?” is an alternative to “Didn’t Mo eat?” because they have the same prejacent.

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

(25) Let ‘$\mathcal{B}$’ stand for ‘*bias*’
‘S is biased for p’: $\mathcal{B}_S\ p$
If $\mathcal{B}_S\ p$, then $P(p|S\text{'s beliefs}) > \theta > .5$

(26) *Ignorance*
S is ignorant of whether p or $\neg p \Leftrightarrow \neg\mathcal{B}_S\ p \wedge \neg\mathcal{B}_S\ \neg p$

Quantity implicature

(27) a. If S believes **all** (and other assumptions are met), then **all** is more useful than **some**.

b. *S believes* **all** $\rightarrow$ **all** $\succ$ **some**

(28) a. If S is ignorant of whether p or $\neg p$, then the PPQ with prejacent p is more useful than the HNQ with prejacent p.

b. $\neg \mathcal{B}_S\, p \wedge \neg \mathcal{B}_S\, \neg p \rightarrow$ PPQ-$p \succ$ HNQ-p

Why S should use PPQ instead of HNQ when ignorant:

1. S is ignorant of whether p or $\neg p$.
2. Assumption: The goal of ignorant S is to gain info about whether p or $\neg p$.
3. PPQ is better than HNQ at providing info about whether p or $\neg p$ because it is stronger.
4. So, S should use PPQ, not HNQ.

Deriving non-directional speaker bias

(28) a. If S is ignorant of whether p or $\neg p$, then the PPQ with prejacent p is more useful than the HNQ with prejacent p.

b. $\neg \mathcal{B}_S\, p \wedge \neg \mathcal{B}_S\, \neg p \rightarrow \text{PPQ-}p \succ \text{HNQ-}p$

If S uses HNQ instead of PPQ:

Then PPQ must not be more useful in this case (consequent of (28) is false)

So antecedent is false, S is not ignorant of whether p or $\neg p$

That is, S is biased for either p or for $\neg p$

But: HNQs always convey positive bias! (bias for their propositional content)

Why?

Explaining the positive bias

This can be read off of the structure of the answer set in (23).

(23) $[\![\text{Didn't Mo eat?}]\!]^{i,d,g} = \{\text{COM}_A\ \phi, \neg\text{COM}_A\ \phi\}$

Suppose S were biased for $\neg\phi$: $\mathcal{B}_S$ ¬*that Mo ate*

With the positive answer "COM_A *that Mo ate*", A would disconfirm S's bias.

The negative answer "$\neg\text{COM}_A$ *that Mo ate*" is consistent with two states of affairs that conflict w/r/t to S's bias:

1. Commitment to $\neg\phi$: COM_A ¬*that Mo ate* (A confirms S's bias)
2. Lack of commitment either way: $\neg\text{COM}_A$ *that Mo ate* ∧ $\neg\text{COM}_A$ ¬*that Mo ate* (A doesn't confirm it)

Explaining the positive bias

Recall the way that HNQs are unbalanced:

(23) $[\![\text{Didn't Mo eat?}]\!]^{i,\,d,\,g} = \{\text{COM}_A\ \phi, \neg\text{COM}_A\ \phi\}$

Now suppose S were biased for ϕ: $\mathcal{B}_S$ *that Mo ate*

With the positive answer "COM_A *that Mo ate*", A would confirm S's bias.

The negative answer "$\neg\text{COM}_A$ *that Mo ate*" would mean that A doesn't confirm S's bias.

Explaining the positive bias

(23) $[\![\text{Didn't Mo eat?}]\!]^{i,d,g} = \{\text{COM}_A\ \phi, \neg\text{COM}_A\ \phi\}$

(23) is structured in just the right way to help S figure out if A can confirm S's bias for *p*.

If S were biased for $\neg p$, the $\neg\text{COM}_A\ \phi$ answer wouldn't clearly settle whether A can confirm S's bias or not.

An HNQ with prejacent *p* is used by speakers to try to get confirmation of their bias for *p*

Conclusion

High negation is structurally high, above a commitment operator.

This unique syntax/semantics for HNQs explains these facts while retaining a negation interpretation for high negation, explaining the crosslinguistic link.

The commitment space structure that HNQs give rise to are only felicitous if the speaker is biased.

High negation triggers speaker bias in multiple languages because the negation scopes into the speech act structure, which produces an commitment space that implicates that the speaker is not ignorant of whether p or $\neg p$. The commitment space structure leads to p bias.

Comparison to other accounts

The present account improves on Goodhue 2022 by providing a unified syntax/semantics for the left-periphery

- The role of high negation is clear and consequential: remove it and you have a PPQ; move it lower and you have an LNQ
- The proposed semantics relates PPQs and HNQs directly via entailment

The version just presented also spells out how the bias derivation can deliver a bias weaker than full belief

Krifka's (2021): distinct denotations for PPQs, LNQs, and negative alternative questions ("Did Mo eat or not?")

My account collapses them into a single denotation. This may be a feature rather than a bug, if alternative explanations for asymmetries between these can be given

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Interpretation: ? (other version in proceedings)

? is a function from an input commitment space C to an output C' restricted to those elements c in C that are subsets of either $[\![[_{\text{ComP}}\ \alpha]]\!]$ or $[\![[_{\text{ComP}}\ \alpha']]\!]$

The polarity operator variable 'y' is **?**'s means of either negating the TP DR_ϕ or not, depending on what $[\![[_{\text{ComP}}\ \alpha]]\!]$ is (the polarity operator variable 'y' is based on an idea proposed by Schlöder & Lascarides (2020))

(29) $[\![\ \mathbf{?}\ [_{\text{ComP}}\ \alpha]]\!]^{i,\,d,\,g} = \lambda C.\ \{c \in C \mid c \subseteq [\![[_{\text{ComP}}\ \alpha]]\!]^{i,\,d,\,g[j \to A]} \vee c \subseteq [\![\text{COM}]\!]^{i,\,d,\,g[j \to A]}(y(\text{DR}_\phi))\}$,
where y is a variable ranging over polarity operators—i.e. $y \in \{\lambda p.p, \neg\}$—set to whichever operator produces an alternative commitment incompatible with $[\![[_{\text{ComP}}\ \alpha]]\!]^{i,\,d,\,g[j \to A]}$
I.e.: $[\![[_{\text{ComP}}\ \alpha]]\!]^{i,\,d,\,g[j \to A]} \cap [\![\text{COM}]\!]^{i,\,d,\,g[j \to A]}(y(\text{DR}_\phi)) = \varnothing$