

# Weak *even* in embedded polar questions

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# 1 Introduction

Many expressions are described as negative polarity items (NPIs) because they display distribution restrictions like the italicized items in (1)-(2)<sup>1</sup>.

- (1) a. \*Bill read *any* articles on the reading list  
b. Bill didn't read *any* articles on the reading list
- (2) a. \*Bill read *even ONE* article on the reading list  
b. Bill didn't read *even ONE* article on the reading list

Here, I discuss the NPI-hood of what I call “weak *even*” following Lahiri 1998 and Crnič 2011. This refers to an occurrence of *even* whose focus-associate is the low endpoint of a logical scale, such as *one* in (2a-b). I observe that certain question embedding verbs or constructions like *wonder* and *want-to-know* license weak *even* in their embedded polar question complement (3a-b), while other question embedding verbs like *know* and *tell* do not (4a-b) (at least in neutral contexts).

## ***Wonder* and *want-to-know* license weak *even* in an embedded polar question**

- (3) a. Sue *wondered* whether Bill read *even ONE* article from the reading list  
b. Sue *wanted to know* whether Bill read *even ONE* article from the reading list

## ***Know* and *tell* do not license weak *even* in an embedded polar question**

- (4) a. #Sue *knew* whether Bill read *even ONE* article from the reading list  
b. #Mary *told* Sue whether Bill read *even ONE* article from the reading list

The main contribution of this work is to show that the two existing theories for the licensing of weak *even* in main-clause polar questions (Guerzoni 2003, 2004; Abels 2003) do not predict the contrast between (3)-(4) when extended to embedded polar questions. They predict (4a-b) to be acceptable in the same way that (3a-b) are. While I do not provide my own analysis here, I draw a connection between the distributional patterns exhibited by weak *even* in embedded polar questions and those exhibited by NPIs in the scope of non-monotone quantifiers (Crnič 2011, 2014 on weak *even*; Linebarger 1987 on *any* and *ever*).

## 1.1 Meaning-based approaches to NPIhood

Many works have attempted to explain the distribution of NPIs in terms of the meaning of the NPIs themselves (on *any*: Kadmon & Landman 1993, Krifka 1995, Chierchia 2013, and Crnič 2014 a.o.; on *even one*: Heim 1984, Krifka 1995, Lahiri 1998, and Crnič 2014 a.o.). Meaning-based analyses of NPIhood make specific proposals for the meaning of NPIs, explain how that meaning leads to pathology in particular environments, hypothesize about the mechanisms by which licensing takes place, and predict which sentences or constructions will license the NPI's meaning.

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<sup>1</sup>Uppercase is used to mark the constituent that, by hypothesis, is focused. *Even* is said to “associate with focus,” meaning we draw different inferences from *even* according to which constituent in the sentence that it's in is focused.

There is a purely meaning-based explanation for weak *even*'s distributional restrictions, which says that it is the satisfiability of *even*'s presupposition that determines its acceptability in a sentence. Before presenting in greater depth the distributional patterns of weak *even* in embedded polar questions that I attempt to extend the existing theory to, I will describe how the theory explains the contrast in (5a-b); following the literature, I will call the meaning-based account the “scope theory” of *even* (Karttunen & Peters 1979; Wilkinson 1996; Lahiri 1998; Schwarz 2000; Guerzoni 2004; Crnič 2011, a.o.).

- (5) a. \*Bill read *even ONE* article on the reading list  
 b. Bill didn't read *even ONE* article on the reading list

According to many works, *even* contributes a presupposition that its propositional argument (its “prejacent”) is less likely than all contextually-determined alternatives, which differ in terms of the denotation of the focused constituent<sup>2</sup>. For instance, from the second sentence in (6), we can infer that it's less likely (more surprising) for Bill to show up than for Sue to show up.

- (6) Sue showed up to class today. In fact, *even BILL* showed up to class.

(6) is felicitous in a context where it's established that it is less likely for Bill to show up than for Sue (e.g. if Bill's history of attendance is known to be worse than Sue's). In contrast, if it's established that Bill shows up to class as often or more often than Sue, then (6) is judged odd because the presupposition introduced by *even* is not satisfied in such a context.

The reason that (5a) is judged unacceptable is that no context satisfies its presupposition. The alternatives to *even*'s prejacent are propositions in a contextually-restricted subset of {“that Bill read  $n$  articles” :  $n \in \mathbb{N}_{>0}$ }, all of which entail the prejacent; reading a greater number of articles involves reading at least one article as well. As emphasized by Lahiri 1998, if proposition  $q$  entails proposition  $p$ ,  $p$  cannot be less likely than  $q$ . For example, the proposition “that it will rain hard” entails the proposition “that it will rain”. A conceivable weather forecast is that there is a 50% chance of rain and a 30% chance of hard rain. In contrast, a weather forecast reporting on a 30% chance of rain and a 50% chance of hard rain is illogical; the chance of rain in general has to be at least as great as the chance of hard rain. *Even*'s prejacent is entailed by all alternatives in (5a), so the sentence suffers from a built-in presupposition failure that no contextual manipulation can fix. This explains its unacceptability.

According to the scope theory, (5b) is acceptable because one possible LF for the sentence has *even* scoping over negation, thereby contributing a satisfiable presupposition—specifically, the presupposition that the negated prejacent “that Bill didn't read one article” is less likely than all members in the set of negated alternatives {“that Bill didn't read  $n$  articles” :  $n \in \mathbb{N}_{>0}$ } (i.e. at the very least, one would have expected him to read one). This matches intuitions about what *even* conveys in this sentence. *Even*'s negated prejacent entails all of the alternatives, making it logically stronger and therefore less likely than all of them. For that reason, *even*'s presupposition is satisfiable. The statement does not have a built-in presupposition failure, so weak *even* is licensed.

A note on minimizer NPIs before proceeding: many works discuss weak *even* together with minimizer

<sup>2</sup>This is just one of many views on what *even*'s presupposition is. Other views differ with respect to (i) what scale is used to compare the prejacent to alternatives (e.g. noteworthiness, informativity, some contextually-supplied gradable property); (ii) whether prejacent has to occupy a more extreme position on the scale than some, most, or all of its alternatives; and (iii) whether *even* also comes with an additive presupposition. I adopt this view of the presupposition without independent motivation because I believe that it can explain the distributional patterns that I discuss and that the account could be reproduced with a different view on *even*'s meaning. For summaries of some of the different views, see Rullmann 1997, Crnič 2011, Greenberg 2015.

NPIs like *give a damn*, which have been analyzed as denoting the low endpoint of a logical scale, associated with an implicit *even* (Heim 1984). I refrain from making this assumption, given distributional contrasts like (7a-b). I leave the precise characterization of the relation between minimizer NPIs and weak *even* for future work.

- (7) a. Samsung has finally started to *give a damn* about how good its phones look and feel<sup>3</sup>  
b. \*Samsung has finally started to care *even the SLIGHTEST BIT* about how good its phones look and feel

## 1.2 New data: weak *even* in embedded questions

Ideally, the scope theory could be extended to explain the distributional patterns of weak *even* in embedded polar questions that I observe here; in this work, all I show is that existing approaches within the scope theory do not provide a ready explanation for the distributional contrasts that I now present. Some question-embedding verbs readily license weak *even* in their polar-question complement while others do not. An interesting pattern of amelioration obtains with the non-licensors, however. (8) show that weak *even* and minimizer NPIs can appear in the *whether*-complements of *wonder*, *ask*, and *investigate*. These are “rogative verbs” in Lahiri’s (2002: 287) categorization of question-embedders, which I adopt here.

### Rogative verbs can embed weak *even*

- (8) Evidently, people around here have a very low opinion of Bill. . .  
a. Sue *wondered* whether he read *even ONE* article  
b. Sue *asked* whether he read *even ONE* article  
c. Sue *investigated* whether he read *even ONE* article

In contrast, (9) shows that weak *even* cannot appear in the *whether*-complement of *know*, *tell*, and *establish*, which belong to Lahiri’s “responsive class.”

### Responsive verbs cannot embed weak *even* directly

- (9) Evidently, people around here have a very low opinion of Bill. . .  
a. #Sue *knew* whether he read *even ONE* article  
b. #Sue *told* Mary whether he read *even ONE* article  
c. ?Sue and Mary *established* whether he read *even ONE* article

According to Lahiri (also Spector & Egré 2015), the basis for the responsive/rogative distinction is that when an individual bears to some question the relation denoted by a responsive verb, then that individual bears that relation to some answer to the question. In contrast, rogative verbs relate their subject to the embedded question “irreducibly.” To illustrate, *Mary knew whether it was raining* can be paraphrased as *Mary knew that it was raining or that it was not raining, whichever was true*, but no such paraphrase is possible with *Sue wondered whether it was raining*.

(10) shows that changing the context-providing sentence does not ameliorate the embedding of weak *even*. This context-providing sentence naturally precedes statements containing the declarative variants of the responsive

<sup>3</sup><https://recombu.com/mobile/article/samsung-galaxy-note-5-launch-official-specs-uk-release-date-price>

verbs, with *even* conveying that the proposition denoted by the entire sentence is less likely than alternatives, differing in terms of the denotation of the embedded focused constituent.

### Changing the context doesn't help

- (10) Evidently, people around here are deeply interested in Bill's reading habits. . .
- a. #Sue *knew* whether he read *even ONE* article
  - b. #Sue *told* Mary whether he read *even ONE* article
  - c. ?Sue and Mary *established* whether he read *even ONE* article
  
  - d. Sue *even* knows that he read his CEREAL-BOX LABEL
  - e. Sue *even* told Mary that he read his CEREAL-BOX LABEL
  - f. Sue and Mary *even* established that he read his CEREAL-BOX LABEL

I identify three ways to improve the embedding of weak *even* under responsive verbs. The first is to embed the responsive verb itself under *want*, as in (11).

### Responsive verbs under *want* can embed weak *even*

- (11) Evidently, people around here have a very low opinion of Bill. . .
- a. Sue *wanted to know* whether he read *even ONE* article
  - b. Mary *wanted* Sue to *tell* her whether he read *even ONE* article
  - c. Sue and Mary *wanted to establish* whether he read *even ONE* article

The second and third are to interpret the responsive verb habitually, as in (12), or in future tense, as in (13).

### Habitual responsive verbs can embed weak *even*

- (12) Evidently, people around here are deeply interested in Bill's reading habits. . .
- a. Sue *always knows* whether he has read *even ONE* article
  - b. Sue *always tells* Mary whether he has read *even ONE* article
  - c. Sue and Mary *always establish* whether he has read *even ONE* article

### Future responsive verbs can embed weak *even*

- (13) People around here will monitor Bill's reading habits very closely. . .
- a. Sue *will know* whether he has read *even ONE* article
  - b. Sue *will tell* Mary whether he has read *even ONE* article
  - c. Sue and Mary *will establish* whether he has read *even ONE* article

The distribution of weak *even* in embedded questions is different from that of so-called "weak NPIs" like *any* and *ever*. As observed by Guerzoni & Sharvit 2007, 2014 *any* and *ever* are sensitive to whether the embedded question they appear in is interpreted in a weakly or strongly exhaustive way, a distinction that arises only in the

interpretation of constituent questions. As such, it is sufficient for the licensing of weak NPIs that they appear in an embedded polar question. I don't take a position on what licenses weak NPIs in embedded questions, and my discussion here does not extend to them.

### **Weak NPIs are uniformly licensed in embedded polar questions**

- (14) a. Sue is wondering whether Bill read *any* articles
- b. Sue is asking whether Bill read *any* articles
- c. Sue is investigating whether Bill read *any* articles
- d. Sue knows whether Bill read *any* articles
- e. Sue is telling Mary whether Bill read *any* articles
- f. Sue and Mary are establishing whether Bill read *any* articles
  
- (15) a. Sue is wondering whether Bill *ever* read the article
- b. Sue is asking whether Bill *ever* read the article
- c. Sue is investigating whether Bill *ever* read the article
- d. Sue knows whether Bill *ever* read the article
- e. Sue is telling Mary whether Bill *ever* read the article
- f. Sue and Mary are establishing whether Bill *ever* read the article

### **1.3 Summary of the paper**

After providing background on the mechanics of the scope theory, I illustrate that the two existing accounts of the licensing of weak *even* in matrix polar questions, due to Guerzoni 2003, 2004 and to Abels 2003, do not predict the distributional patterns observed in embedded polar questions. The reason is that the existing accounts provide a mechanism by which weak *even*'s presupposition is satisfied in every polar question; as such, the distribution of weak *even* in embedded polar questions is implicitly predicted to be uniform, despite the contrasts just observed.

While my own analysis is not developed in full, I sketch some ideas on how to explain the variable licensing of weak *even* as conditioned by the properties of the question embedding matrix clause. I interpret the effect on acceptability of changing or embedding the matrix verb as a clue that the meaning of the matrix clause factors into the calculation of *even*'s presupposition, something that the scope theory can accommodate. I propose that when *even* appears in an embedded polar question in the surface syntax, one possible LF has *even* scoping in the matrix clause. This position is not DE with respect to the focus-associate, but rather non-monotonic. As shown by Crnič 2011, 2014, the acceptability of the presupposition contributed by weak *even* from a position that is non-monotonic with respect to its associate is subject to considerations of plausibility. While I don't say anything concrete or predictive about which polar-question embedders license weak *even* and which don't, I submit that considerations of plausibility explain the variable licensing and the amelioration of weak *even* in embedded polar questions.

## **2 Background**

In this section, I spell out my assumptions on the meaning of *even* and make the preliminary prediction that *even* can associate with a weak element only if that element is in a DE environment. In this section and throughout, I

assume the following rules of semantic composition from Heim & Kratzer 1998 (some notational modifications).

(16) *Function Application (FA)*

If  $\alpha$  is a branching node and  $\{\beta, \gamma\}$  is the set of its daughters, then for any assignment  $g$  and world  $w$ ,  $\llbracket \alpha \rrbracket^{g,w}$  is defined if  $\llbracket \beta \rrbracket^{g,w}$  and  $\llbracket \gamma \rrbracket^{g,w}$  are defined and  $\llbracket \beta \rrbracket^{g,w}$  is a function whose domain contains  $\llbracket \gamma \rrbracket^{g,w}$ . If defined,  $\llbracket \alpha \rrbracket^{g,w} = \llbracket \beta \rrbracket^{g,w}(\llbracket \gamma \rrbracket^{g,w})$ .

(17) *Predicate Abstraction (PA)*

If  $\alpha$  is a branching node whose daughters are  $\gamma$  and index  $\langle i, \sigma \rangle$  (a number-type pair), then for any assignment  $g$  and world  $w$ ,  $\llbracket \alpha \rrbracket^{g,w} = \lambda x: x \in D_\sigma \ \& \ \llbracket \gamma \rrbracket^{g[i \rightarrow x],w}$  is defined.  $\llbracket \gamma \rrbracket^{g[i \rightarrow x],w}$

(18) *Intensional Function Application (IFA)*

If  $\alpha$  is a branching node and  $\{\beta, \gamma\}$  is the set of its daughters, then for any possible world  $w$  and assignment function  $g$ ,  $\llbracket \alpha \rrbracket^{g,w}$  is defined if  $\llbracket \beta \rrbracket^{g,w}$  is defined and  $\llbracket \beta \rrbracket^{g,w}$  is function whose domain contains  $[\lambda w'_s: \llbracket \gamma \rrbracket^{g,w'} \text{ is defined.} \llbracket \gamma \rrbracket^{g,w'}]$ . In this case,  $\llbracket \alpha \rrbracket^{g,w} = \llbracket \beta \rrbracket^{g,w}([\lambda w'_s: \llbracket \gamma \rrbracket^{g,w'} \text{ is defined.} \llbracket \gamma \rrbracket^{g,w'}])$ .

(19) *Pro-forms and traces rule (P&T)*

If  $\alpha$  is a pro-form or trace,  $i$  an index of type  $\langle n, \sigma \rangle$ , and  $g$  an assignment function of type  $\langle \langle n, \sigma \rangle, \sigma \rangle$  whose domain includes index  $i$ , then for any possible world  $w$  and assignment function  $g$ ,  $\llbracket \alpha_i \rrbracket^{g,w} = g(i)$

I mark abstraction indices at LF with a number (with the accompanying type marked on the pro-form or trace). I also use a meta-language shorthand for propositions: “that Bill read one article” abbreviates the function  $[\lambda w. \text{Bill read one article in } w]$ .

## 2.1 Mechanics of the scope theory

I assume that *even* introduces a presupposition that its prejacent proposition is less likely than all distinct alternative propositions, which are derived by substituting the denotation of the focused constituent with denotations of the same type. Two examples are given in (20)-(21).

(20) Even BILL showed up

Presupposition from *even*: it’s less likely for Bill to have shown up than for any other relevant individual to have shown up

(21) Bill didn’t read even ONE article on the reading list

Presupposition from *even*: it’s less likely for Bill not to have read one article than for Bill not to have read any greater number of articles

These presuppositions are derivable with the lexical entry in (22), which treats *even* as a sentential operator. I assume, following Rooth (1992, 1996), that focus-sensitive operators like *even* necessarily occur with a variable over sets of propositions ( $C_{\langle \langle st,t \rangle, 7 \rangle}$ , in (22)), and given the way that focus is interpreted, this variable is assigned to be a contextually-restricted subset of the focus-semantic value of *even*’s sister, containing both the prejacent and at least one distinct alternative. *Even*’s domain contains only those propositions which are less likely than their

distinct focus-evoked alternatives in the world of evaluation.

- (22)  $\llbracket \text{even-C}_{\langle\langle\text{st},\text{t}\rangle,7\rangle} \rrbracket^{\text{g},\text{w}} = \lambda p_{\text{st}} : \forall q \in \text{g}(7) [q \neq p \rightarrow p \triangleleft_{\text{w}} q]. p(\text{w}) = 1$   
 where “ $p \triangleleft_{\text{w}} q$ ” abbreviates “proposition  $p$  is less likely than proposition  $q$  in world  $w$ ”

Under this view of the meaning of *even*, *even Bill showed up* is assigned the LF and interpretation in (23).  $\text{Even}_n$  is an object-language abbreviation of  $\text{even-C}_{\langle\langle\text{st},\text{t}\rangle,n\rangle}$  throughout.

- (23) Even BILL showed up
- LF:  $[\text{even}_7 [\text{BILL showed up}]]$
  - $\llbracket (23a) \rrbracket^{\text{g},\text{w}}$  is defined only if  $\forall q \in \text{g}(7) [q \neq \text{“that Bill showed up”} \rightarrow \text{“that Bill showed up”} \triangleleft_{\text{w}} q]$ , where  $\text{g}(7) \subseteq \{\text{“that } x \text{ showed up”} : x \in D_e\}$ . If defined,  $\llbracket (23a) \rrbracket^{\text{g},\text{w}} = 1$  iff Bill showed up in  $w$
  - Presupposition (in prose): It’s less likely for Bill to show up than for any of the other relevant people to show up

Under the scope theory, any constituent containing *even* in the surface syntax and with a denotation of propositional type  $\langle\text{st}\rangle$  is an eligible scope site for *even* at LF. This means that two LFs can underlie a negated sentence like *Bill didn’t read even ONE article*: one where *even* scopes above negation, contributing a satisfiable presupposition, and one where *even* scopes below negation, contributing an unsatisfiable presupposition, given the way presuppositions project from under negation<sup>4</sup>.

- (24) Bill didn’t read even ONE article
- $\checkmark \text{LF}_1$ :  $[\text{even}_7 [\text{not} [\text{Bill read ONE article}]]]$
  - $\llbracket (24a) \rrbracket^{\text{g},\text{w}}$  is defined only if  $\forall q \in \text{g}(7) [q \neq \text{“that Bill didn’t read one article”} \rightarrow \text{“that Bill didn’t read one article”} \triangleleft_{\text{w}} q]$ , where  $\text{g}(7) \subseteq \{\text{“that Bill didn’t read } n \text{ articles”} : n \in \mathbb{N}_{>0}\}$ . If defined,  $\llbracket (24a) \rrbracket^{\text{g},\text{w}} = 1$  iff Bill didn’t read one article in  $w$
  - Presupposition (in prose): It’s less likely for Bill not to read one article than for Bill not to read any greater number of articles

- (25) Bill didn’t read even ONE article
- $*\text{LF}_2$ :  $[\text{not} [\text{even}_7 [\text{Bill read ONE article}]]]$
  - $\llbracket (25c) \rrbracket^{\text{g},\text{w}}$  is defined only if  $\forall q \in \text{g}(7) [q \neq \text{“that Bill read one article”} \rightarrow \text{“that Bill read one article”} \triangleleft_{\text{w}} q]$ , where  $\text{g}(7) \subseteq \{\text{“that Bill read } n \text{ articles”} : n \in \mathbb{N}_{>0}\}$  (unsatisfiable). If defined,  $\llbracket (25a) \rrbracket^{\text{g},\text{w}} = 1$  iff Bill didn’t read one article in  $w$
  - Presupposition (in prose): It’s less likely for Bill to read one article than to read any greater number of articles (unsatisfiable)

In support of the assumption that *even*’s scope is variable, Karttunen & Peters 1979 note that either the low endpoint or the high endpoint of a scale of difficulty can substitute  $X$  in a sentence like *I find it hard to believe Bill even understood X*.

- (26) I find it hard to believe Bill even understood MOTHER GOOSE

<sup>4</sup> $\llbracket \text{not} \rrbracket^{\text{g},\text{w}} = \lambda p_{\text{st}} : w \in \text{dom}(p). p(\text{w}) = 0$

- (27) (Bill is very clever, but did he really understand *Syntactic Structures*?...)  
I find it hard to believe Bill even understood SYNTACTIC STRUCTURES

When X is the low endpoint of a scale of difficulty (i.e. an easy book like *Mother Goose*), *even* conveys that it is *more* likely for X to be understood than other books. When X is the high endpoint of a scale of difficulty (i.e. a hard book like *Syntactic Structures*), *even* conveys that it is *less* likely for X to be understood than other books. The less-likely presupposition is derived by scoping *even* in the embedded clause, and the most-likely presupposition is derived by scoping *even* in the matrix clause above *I-find-it-hard-to-believe*, a likelihood reversing function. The more likely something is to be the case, the less likely I will find it hard to believe that it is the case. The favored LFs for (26)-(27) are below.

- (28) I find it hard to believe Bill even understood MOTHER GOOSE
- LF: [even<sub>7</sub> [I find it hard to believe Bill understood MOTHER GOOSE]]
  - Presupposition from *even*: Of all the relevant books, the one that is least likely for me to find it hard to believe that Bill understood is *Mother Goose*
- (29) I find it hard to believe Bill even understood SYNTACTIC STRUCTURES
- LF: [I find it hard to believe [even<sub>7</sub> [Bill understood SYNTACTIC STRUCTURES]]]
  - Presupposition from *even*: (I believe that) of all the relevant books, the one that is least likely for Bill to have understood is *Syntactic Structures*

## 2.2 A licensing condition for weak *even* (first version)

(30) is unacceptable because weak *even*'s prejacent is entailed<sup>5</sup> by all alternatives, making it the weakest and most likely among them, in conflict with the presupposition contributed by *even*. There is no position that *even* can move to where its prejacent won't be entailed by all alternatives.

- (30) \*Bill read even ONE article from the reading list

More generally, weak *even* will not be licensed in a sentence if, in every eligible scope site, *even*'s sister is UE<sup>6</sup> with respect to the position of the focus. The reason is that the presupposition contributed by *even* in such a position is in violation of the strength-likelihood constraint in (31). The constraint states that if proposition p entails proposition q, no index of evaluation (or context) assigns a lower likelihood to p than to q.

<sup>5</sup>I assume the following definitions of entailment:

- Generalized Entailment*,  $\Rightarrow$  (von Stechow 1999: 99)  
For p, q of type t:  $p \Rightarrow q$  iff  $p = 0 \vee q = 1$ ;  
For f, g of type  $\langle \sigma, \tau \rangle$ :  $f \Rightarrow g$  iff for all x of type  $\sigma$ :  $f(x) \Rightarrow g(x)$

<sup>6</sup>I assume the following definitions of DEness. UENess can be defined inversely to i. and ii.

- Strawson DE function* (von Stechow 1999: 104)  
A function f of type  $\langle \sigma, \tau \rangle$  is Strawson DE iff for all x,y of type  $\sigma$  such that  $x \Rightarrow y$  and f(x) is defined:  $f(y) \Rightarrow f(x)$
- Strawson DE environment* (Gajewski 2005: 33; Homer 2011)  
A constituent A is DE with respect to the position of  $\beta$  (where  $\llbracket \beta \rrbracket$  is of type  $\sigma$ ) iff  $\lambda x. \llbracket A[\beta/t_{\sigma,7}] \rrbracket \llbracket \sigma[7 \rightarrow x] \rrbracket$  is Strawson DE.  $A[\beta/t]$  is the result of replacing  $\beta$  with t in A.

- (31) *The strength-likelihood constraint* (cf. Lahiri 1998; Crnič 2011)  
 If  $p \Rightarrow q$ , then  $\{w : q \triangleleft_w p\} = \emptyset$

In contrast, weak *even*'s presupposition is guaranteed to be satisfied if its sister is DE with respect to the position of the focus; because of the entailment-reversal effected by DE environments, weak *even*'s prejacent entails all alternatives, making it less likely than all distinct alternatives. (32) is a prediction about weak *even*'s distributional patterns in the form of a licensing condition.

- (32) *Weak even licensing condition (version 1)*  
 Weak *even* is licensed in sentence S only if there is a constituent A of S containing the associate of *even* such that  $\llbracket A \rrbracket \in D_{st}$  and A is DE with respect to the position of *even*'s associate

This licensing condition predicts the acceptability of weak *even* in sentences (33a) and (34a), given that these sentences have a node dominating the associate of *even* which is DE with respect to its position.

- (33) I'm deeply disappointed in my students. . .  
 a. Few of them read even ONE article on the reading list  
 b. LF: [even<sub>7</sub> [few of them [1 [t<sub>1</sub> read ONE article on the reading list]]]]
- (34) People here have a low opinion of Bill. . .  
 a. Sue doubts that he read even ONE article on the reading list  
 b. LF: [even<sub>7</sub> [Sue doubts [that he read ONE article on the reading list]]]

Regarding *Bill didn't read even ONE article on the reading list*, every possible world satisfies the presupposition contributed by *even*: no matter what the expectations are in the context, the logical entailment relation between *even*'s prejacent and its alternatives ensures the satisfaction of *even*'s presupposition. To preface some of the discussion below, the disjunction of this universally satisfied presupposition with an unsatisfiable one is still true in every possible world.

### 3 The distribution of weak *even* in questions

It's well-known that weak *even* can appear in polar interrogative clauses, as in (35), where it introduces a "negative bias" in addition to a scalar presupposition; as an informal characterization of the negative bias, weak *even* conveys that the asker expects or suspects that the negative answer is true (Borkin 1971, Ladusaw 1979 on minimizer NPIs; Karttunen & Karttunen 1977 on *even*; Guerzoni 2003, 2004 on both; etc.)

- (35) Did Bill read even ONE article from the reading list?  
 a. Likelihood inference (roughly): For Bill to read one article would have been highly expected  
 b. Bias inference: Asker suspects/expects that Bill didn't read one article

Two questions are discussed in connection to such examples: (i) how is weak *even* licensed in polar questions? and (ii) why does weak *even* induce a negative bias in polar questions? The first question is pressing in light of the way I expressed the licensing condition for weak *even*: polar questions are not DE in the various ways that question-

entailment has been defined (e.g. Groenendijk & Stokhof 1989, Guerzoni & Sharvit 2007). Groenendijk & Stokhof 1989 suggest that  $Q_1$  entails  $Q_2$  iff every true and complete answer to  $Q_1$  determines a true and complete answer to  $Q_2$ . I formalize this idea in (36); following Karttunen 1977, I take question intensions to be functions from possible worlds to sets of true propositions, and following Heim 1994, I assume that both weakly- and strongly-exhaustive question interpretations exist. Following Guerzoni & Sharvit 2014 rather than Heim 1994, however, I assume that question strength is encoded in the LF of the question rather than in the lexical entry of verbs or other objects that embed questions. As such,  $Q_1$  may be the denotation of a string like *who left*, but whether it entails  $Q_2$  (e.g. the denotation of *whether Bill left*) depends on whether it has a strongly- or weakly-exhaustive LF.

(36) *Question entailment*

$Q_1$  entails  $Q_2$  iff  $\forall w \in W, \bigcap Q_1(w) \Rightarrow \bigcap Q_2(w)$

On this view of question-entailment, it's clear that (37a) does not entail (37b).

(37) a.  $\llbracket$ Did Bill read ONE article from the reading list? $\rrbracket$

↯

b.  $\llbracket$ Did Bill read TWO articles from the reading list? $\rrbracket$

There are worlds where the complete answer to (37a) is that Bill read one article and the complete answer to (37b) is that Bill didn't read two article. The former does not entail the latter. For this reason, polar questions are not DE with respect to the position of the focused constituents I am interested in.

In the following section, I discuss how two accounts have approached the licensing of weak *even* in matrix polar questions and demonstrate their shortcomings in explaining the distributional restrictions on weak *even* in embedded polar questions. The first account I discuss is due to Guerzoni 2003, 2004 (revised in Guerzoni & Sharvit 2014). According to this analysis, the licensing of weak *even* is due to there being a subconstituent of the polar question that is an eligible scope site for *even* and that is DE with respect to *ONE*. Additionally, weak *even* introduces different presuppositions into each answer to a polar question from this eligible scope site. Specifically, it introduces the unsatisfiable presupposition into the positive answer—that it's less likely for Bill to read one article than for Bill to read two, in violation of the strength-likelihood constraint—and the universally satisfied presupposition into the negative answer—that it's less likely for Bill *not* to read one article than for Bill *not* to read two. The fact that the positive answer has a false presupposition explains the bias towards the negative answer: the speaker asks the addressee to commit to an element of the answer set, but in fact, the answer set effectively contains only the negative answer.

The second analysis I present is due to Abels 2003, and it does not assume that *even* can trigger different presuppositions in each answer. Rather, the main proposal is that under pressure of having *even* trigger the same unsatisfiable presupposition in both answers, interlocutors may accommodate there being an alternative in *even*'s alternative set that does not entail the prejacent. Specifically, they may accommodate an alternative that is the negation of the disjunction of all the other alternatives. Concretely, for the question *Did Bill read even ONE article?*, speakers are forced to understand *even* as conveying a likelihood comparison between the propositions “that Bill read one article” and “that Bill didn't read one or more articles”, neither of which entails the other. In combination with the assumption that *even* contributes an additive presupposition (cf. Karttunen & Peters 1979), the question as a whole ends up presupposing (i) that it's less likely for Bill to read one article than for Bill not to

read one or more articles (the scalar presupposition; satisfiable) and (ii) Bill did not read one or more articles (the additive presupposition). The latter presupposition explains the negative bias; the asker is already presupposing that Bill didn't read one article, despite asking the addressee to commit to an answer to whether Bill read an article.

While both existing accounts explain what licenses weak *even* in matrix polar questions and why it induces a bias, they do not explain why there might be distributional restrictions on weak *even* in embedded polar questions, conditioned by the properties of the question-embedding verb. The reason is that the existing accounts make available a mechanism by which weak *even* can trigger a satisfiable presupposition in every polar question. Additionally, I identify independent problems for both analyses. For Guerzoni's, I provide some evidence that in general, elements of a two-membered question extension can't have incompatible presuppositions, a necessary ingredient of her analysis. For Abels', I provide some evidence that matrix polar questions with weak *even* do not involve a likelihood comparison between the weak prejacent and the negation of the disjunction of all of the prejacent's focus-alternatives. First, I repeat and expand on the empirical generalizations presented earlier before showing how the existing accounts fail to predict them.

### 3.1 Weak *even* in embedded polar questions

Focusing on the embedding of weak *even* under *wonder* and *know*, I expand on the generalizations presented in the introduction. Specifically, in addition to discussing the acceptability of weak *even* under different question-embedding constructions, I indicate whether particular examples come with a negative bias inference (the inference that an individual expects that the negative answer to a question is the case). Negative bias inferences do not arise in all instances that weak *even* is acceptable under a question-embedder: while negative bias arises when weak *even* is embedded under *wonder* and *want-to-know*, it does not arise with other question embedders that license weak *even*. I also present a context which improves the embedding of weak *even* directly under a responsive verb and tentatively suggest what property of the context allows weak *even* to be acceptable.

*know* and other responsive verbs normally cannot embed weak *even* directly when interpreted episodically, as in (38a) or in (39a). Two context-providing sentences are given.

#### ***Know* (neutral context): ✗weak *even***

- (38) Evidently, people around here have a very low opinion of Bill. . .  
a. #This morning, Sue knew whether he had read even ONE article on the reading list
- (39) Evidently, people around here are deeply interested in Bill's reading habits. . .  
a. #This morning, Sue knew whether he had read even ONE article on the reading list

In contrast, *wonder* and other rogative verbs can embed weak *even* directly, as in (40a). (40a) seems negatively biased in the same way that matrix polar questions with weak *even* are. It conveys that Sue expected that Bill hadn't read one article.

#### ***Wonder*: ✓weak *even*, ✓negative bias**

- (40) People around here have a very low opinion of Bill. . .  
a. This morning, Sue wondered whether he had read even ONE article on the list

Similarly, weak *even* can appear under *know* when *know* is itself embedded under *want*, in which case, whether a bias is perceived depends on the nature of the clause embedded under *want*. In a control construction like (41a), a negative bias on the part of Sue is perceived. In an ECM construction like (42a), no bias is perceived, neither on the part of the subject of *want* nor of the subject of *know*.

***Want to know*: ✓ weak even, ✓ negative bias**

- (41) People around here have a very low opinion of Bill...  
a. This morning, Sue wanted to know whether he had read even ONE article from the reading list

***Want X to know*: ✓ weak even, ✗negative bias**

- (42) Mary has asked Sue to monitor Bill's reading habits very closely...  
a. She wants Sue to know whether Bill has read even ONE article

Weak *even* can also appear under *know* interpreted habitually or in future tense, in which case no negative bias is perceived. (43a) does not convey that Sue or the speaker always expects that Bill didn't read one article, and (44a) does not convey that Sue or the speaker will expect that Bill didn't read one article.

***Always know, will know*: ✓ weak even, ✗negative bias**

- (43) Evidently, people around here are deeply interested in Bill's reading habits...  
a. Sue *always knows* whether he has read even ONE article  
(44) People around here will monitor Bill's reading habits very closely...  
a. Sue *will know* whether he has read even ONE article

Finally, (45) sets up a context that some speakers judged to improve the embedding of weak *even* under responsive verbs directly<sup>7</sup>.

***Know (correlated expectation)*: ✓ weak even, ✗negative bias**

- (45) Every time Mary sees Bill, she finds out whether he's read the number of articles corresponding to the number of days since they last met up. Mary and Bill usually meet up once a year, so Mary usually knows whether Bill has read 365 articles. Recently, however, they've been meeting up more frequently, which is surprising. Last time I talked to Mary, she knew whether Bill had read 7 articles, and this morning...  
a. Mary knew whether Bill had read even ONE article

The context establishes an expectation for the frequency of Mary and Bill's meetings, and what *even* conveys in (45a) is that is surprising for Mary to have met up with Bill two days in a row (which is inferable from the fact that she knew whether he had read one article). In this context, for any number n, the likelihood assigned to the proposition *that Mary knows whether Bill read n articles* is correlated with the likelihood assigned to the

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<sup>7</sup>I thank Alon Adar for this example.

proposition *that Mary met up with Bill n days ago*. I will call this context the *correlated-expectation context*. (45a) does not come with a negative bias i.e. it does not convey that Mary or the speaker expect Bill to not have read one article.

The table in (46) summarizes the generalizations presented above. It indicates for different polar-question embedders whether weak *even* is acceptable in their question-complement and whether weak *even* induces a negative bias; it seems that only *wonder* and *want-to-know* license the negative bias inference when embedding weak *even*.

(46)

Embedding construction	Acceptability	Bias
<i>know</i> (neutral context)	*	N/A
<i>wonder</i>	✓	Yes
<i>want to know</i>	✓	Yes
<i>want X to know</i>	✓	No
<i>always know</i>	✓	No
<i>will know</i>	✓	No
<i>know</i> (correlated-expectation)	✓	No

## 4 Why the distributional patterns are not predicted

In this section, I present two views on how weak *even* is licensed in matrix polar questions in greater detail, showing that neither predicts the distributional patterns summarized in the table in (46). Both accounts overgenerate; they allow weak *even* to trigger a satisfiable presupposition from a position internal to the question, implicitly predicting that all embedded questions should license weak *even*. This includes questions embedded under *know*, interpreted episodically against an ordinary context.

### 4.1 Guerzoni 2003, 2004

I present a version of Guerzoni’s (2003, 2004) analysis of weak *even* in matrix questions that is based on the modification in Guerzoni & Sharvit 2014. In order to test the applicability of her analysis to embedded question, I modify her proposal so as to allow presuppositions to project from embedded questions; I adopt Guerzoni’s (2003) “question-based approach” to presupposition projection in questions, according to which question-intensions are partial functions. Following Karttunen 1977, Guerzoni and Sharvit assume that the extension of a question in a world  $w$  is the set of answers to the question that are true in  $w$ ; for polar questions, this is derived from a disjunctive LF as in (47a), which may be realized as *did Bill read one article?* after undergoing ellipsis.

(47) Did Bill read one article?

- a. LF: [whether [4 [? [[Bill read one article] [or<sub>4</sub> [not [Bill read one article]]]]]]]
- b.  $[(47a)]^{g,w} = \{p : [p = \text{“that Bill read one article”} \vee p = \text{“that Bill didn’t read one article”}] \& p(w) = 1\}$

The meaning of the polar question is derived as follows. Its nucleus, *Bill read one article or<sub>4</sub> not Bill read one article* denotes an assignment-dependent disjunctive proposition, derived with the meaning for *or<sub>4</sub>* below (Rooth

& Partee 1982; rendered here for simplicity as propositional rather than cross-categorial disjunction)<sup>8</sup>.

$$(48) \quad \llbracket \text{or}_4 \rrbracket^{\mathfrak{g},w} = \lambda p_{st}. \lambda q_{st} : w \in \text{dom}(p) \vee w \in \text{dom}(q). [g(4) = p \vee g(4) = q] \ \& \ g(4)(w) = 1$$

This disjunctive proposition is then taken as the argument of the function denoted by the set-creating morpheme,  $\text{?}$ , whose meaning is given in (49) (Karttunen 1977).

$$(49) \quad \llbracket \text{?} \rrbracket^{\mathfrak{g},w} = \lambda p_{st}. \lambda q_{st} : w \in \text{dom}(q). q = p$$

PA occurs above the set-creating morpheme, binding  $\text{or}_4$ . This results in a function from propositions to a function from propositions to truth values (i.e. a relation between propositions). Roughly speaking, it maps to 1 the pairs of propositions  $\langle$ “that Bill read one article”, “that Bill read one article” $\rangle$  and  $\langle$ “that Bill didn’t read one article”, “that Bill didn’t read one article” $\rangle$  and maps to 0 any other pairs of propositions.

This function is the input to the function denoted by *whether*, given in (50) (proposed by Guerzoni & Sharvit 2014, inspired by Larson 1985).

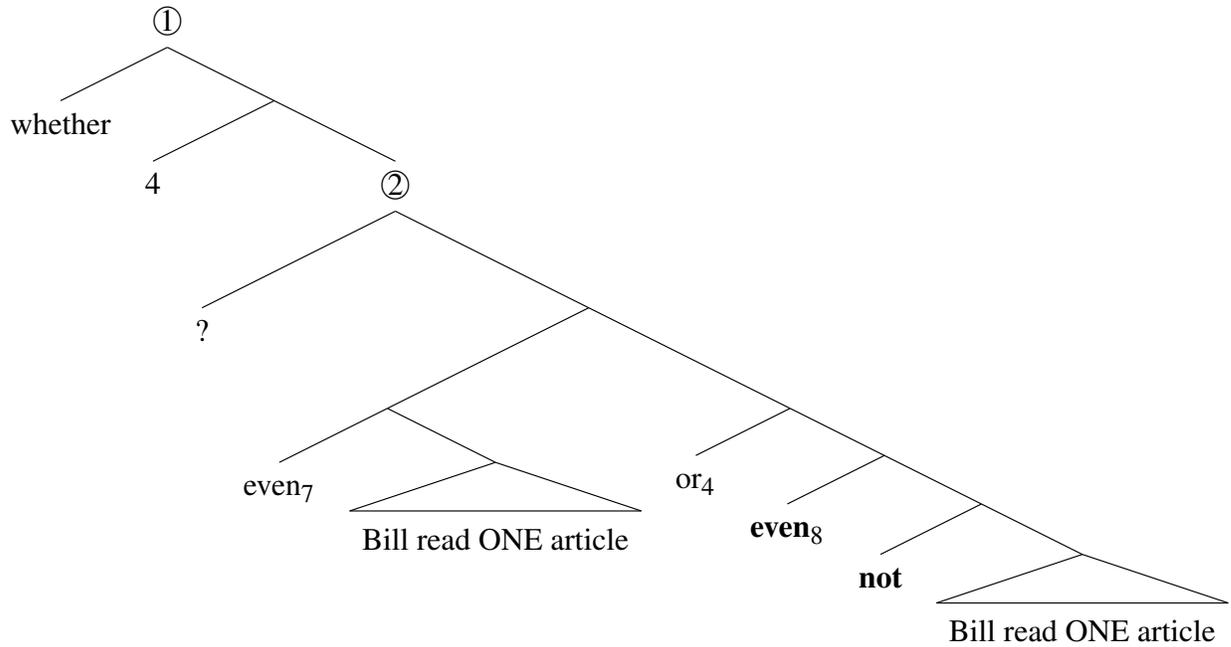
$$(50) \quad \llbracket \text{whether} \rrbracket^{\mathfrak{g},w} = \lambda Q_{\langle st, \langle st, t \rangle \rangle}. \lambda q_{st}. \text{there is an } r_{st} \text{ such that } Q(r)(q) = 1 \ \& \ q(w) = 1$$

*Whether* denotes a function from relations between propositions to functions from propositions to truth values. Roughly speaking, after combining with the relation between propositions denoted by the abstracted predicate, it maps to 1 those propositions which (i) stand in the relation denoted by the abstracted predicate to some proposition and (ii) are true in the world of evaluation. In other words, it maps to 1 whichever is true of “that Bill read one article” and “that Bill didn’t read one article”.

Guerzoni proposes that at least two different LFs can underlie matrix polar questions with *even*. It follows from the scope theory that *even* may scope above or below negation in the negated disjunct. The two possible LFs for *did Bill read even ONE article?* are shown in (51)-(52), and as I will discuss, the topmost node ① has different presuppositions in these LFs.

<sup>8</sup>Disjunctive propositions derived with this denotation for *or* have an implausibly weak domain restriction; a statement like *Mary tasted the cake or the stew* presupposes that either there is exactly one cake or exactly one stew, despite the intuition that the use of this statement requires there to be exactly one cake *and* exactly one stew. This weak domain restriction is necessary for recasting the original account found in Guerzoni 2003, 2004; the original proposal assumes a different, somewhat more complex composition for questions, but it does not involve this stipulation. However, I choose to use Guerzoni & Sharvit 2014’s disjunctive representation of questions for its transparency.

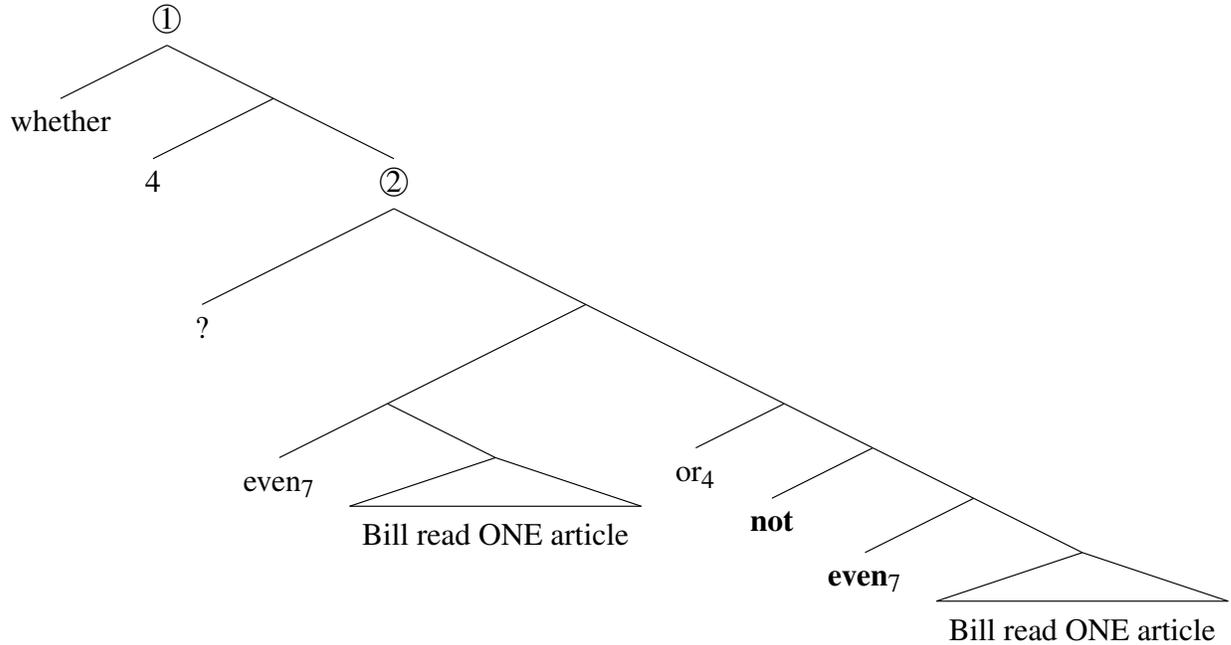
(51)  $\checkmark LF_1, even > not$



$[[\textcircled{1}]]^{g,w}$  is defined only if  $\forall q \in g(7) [q \neq \text{"that Bill read one article"} \rightarrow \text{"that Bill read one article"} \triangleleft_w q]$ , where  $g(7) \subseteq \{\text{"that Bill read } n \text{ articles"} : n \in \mathbb{N}_{>0}\} \vee \forall q' \in g(8) [q' \neq \text{"that Bill didn't read one article"} \rightarrow \text{"that Bill didn't read one article"} \triangleleft_w q']$ , where  $g(8) \subseteq \{\text{"that Bill didn't read } n \text{ articles"} : n \in \mathbb{N}_{>0}\}$

Presupposition (in prose): Either it's less likely for Bill to read one article than for Bill to read two or more (unsatisfiable), or it's less likely for Bill not to read one article than for Bill not to read two or more (true)

(52) \*LF<sub>2</sub>, not > even



$\llbracket \textcircled{1} \rrbracket^{g,w}$  is defined only if  $\forall q \in g(7) [q \neq \text{“that Bill read one article”} \rightarrow \text{“that Bill read one article”} \triangleleft_w q]$ , where  $g(7) \subseteq \{\text{“that Bill read } n \text{ articles”} : n \in \mathbb{N}_{>0}\}$

Presupposition (in prose): It’s less likely for Bill to read one article than for Bill to read more (unsatisfiable)

Different question-intensions are derived from these two LFs. From LF<sub>2</sub> is derived a question-intension with a domain restricted to worlds that satisfy the presuppositions of either the positive or the negative answer. However, both of these answers have the unsatisfiable presupposition, namely that it’s less likely for Bill to read one article than for him to read more, in violation of the strength-likelihood constraint. LF<sub>2</sub> derives a question-intension with no worlds in its domain; it has a built-in presupposition failure.

In contrast, from LF<sub>1</sub> is derived a question-intension with a satisfiable presupposition. Again, its domain is restricted to worlds that satisfy the presuppositions of either the positive or the negative answer, but this LF derives answers with different presuppositions. The positive answer has the same unsatisfiable presupposition as the answers derived from LF<sub>2</sub>, while the negative answer has the universally satisfied presupposition derived by applying the meaning of *even* to the negated prejacent, “that Bill didn’t read ONE article”. The disjunctive nature of the question’s presupposition allows for a usable question-intension to be derived from LF<sub>1</sub>. Additionally, the question’s extension in every world in its domain is effectively a one-membered set, since no world is in the domain of the positive answer. Thus, LF<sub>1</sub> derives the singleton set containing “that Bill didn’t read one article”, explaining the bias: for any context that satisfies the presuppositions of the polar question, the positive answer is undefined. The conversational move of posing such a question can be thought of as the asker offering the addressee a set of responses which has two membership conditions but effectively only one member.

This theory can also explain the negative bias of questions where *even* associates with the low endpoint of a contextual, rather than logical, scale, as in *Did Bill even answer the EASIEST question?* The alternatives to the prejacent are logically independent (answering a harder question does not entail answering the easiest question),

so the presuppositions of both answers, derived in the analog of LF<sub>1</sub>, are in principle satisfiable. However, the two answers have contradictory presuppositions. The positive answer presupposes that it's less likely for Bill to answer the easiest question vs. harder questions, and the negative answer presupposes that it's less likely for Bill *not* to answer the easiest questions vs. not answering harder questions. If it's already established in the context that the negative answer's (in this case, more plausible) presupposition is true and the positive answer's presupposition is false, then a negative bias arises.

Summing up, Guerzoni's theory makes available two different LFs for matrix polar questions containing weak *even* only one LF has a satisfiable presupposition, and for any world in the domain of its denotation, a one-membered question extension is derived.

#### 4.1.1 Problems

While the account is successful for matrix polar questions, it implicitly predicts uniformity in the distribution of weak *even* in embedded questions, contra the observations in the last section; the availability of question-LFs like LF<sub>1</sub> above, where *even* scopes above negation in the negated disjunct, allows *even* to trigger easily satisfiable disjunctive presuppositions. Additionally, because the existing account takes polar question LFs containing weak *even* to denote one-membered question-extensions, unattested readings for embedded polar questions are made available.

To illustrate, I adopt the lexical entries for *know* and *want-to-know/wonder* in (53)-(54). Roughly, *x* knows a question when *x*'s beliefs align with the true alternative(s) specified by the question, and *x* wonders a question when *x* wants for his or her beliefs to align with the true alternative(s) specified by the question.

$$(53) \quad \llbracket \text{know} \rrbracket^{\mathbf{g}, \mathbf{w}} = \lambda Q_{\langle s, \langle st, t \rangle \rangle} . \lambda x_e . \text{ACC}_{\text{dox}}(x, w) \subseteq \bigcap Q(w)$$

where  $\text{ACC}_{\text{dox}}(x, w)$  is the set of possible worlds that are compatible with *x*'s beliefs in *w*

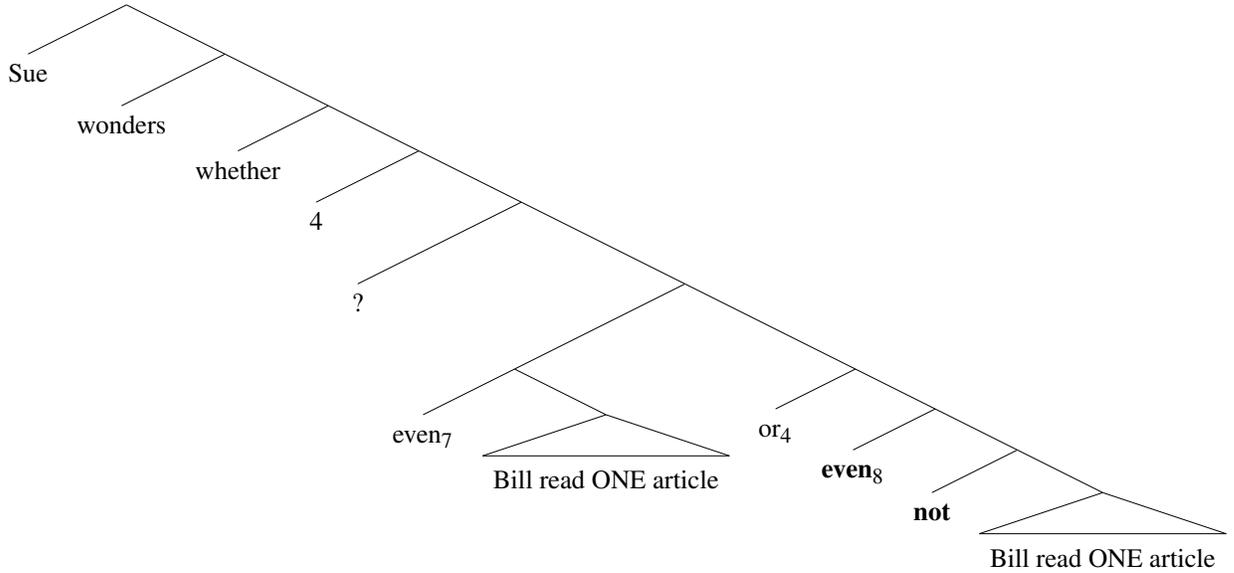
$$(54) \quad \llbracket \text{want-to-know/wonder} \rrbracket^{\mathbf{g}, \mathbf{w}} = \lambda Q_{\langle s, \langle st, t \rangle \rangle} . \lambda x_e . \text{ACC}_{\text{des}}(x, w) \subseteq \{w' : \text{ACC}_{\text{dox}}(x, w') \subseteq \bigcap Q(w')\}$$

where  $\text{ACC}_{\text{des}}(x, w)$  is the set of possible worlds that are compatible with *x*'s beliefs in *w* and that realize no fewer of *x*'s desires in *w* than any other world compatible with *x*'s beliefs in *w* (cf. Heim 1992, von Stechow 1999 on *want*)

As observed earlier, *Sue wonders whether Bill has read even ONE book from the reading list* is well-formed and attributes to Sue a negative bias. In contrast, *#Sue knows whether Bill read has even ONE book from the reading list* is judged odd (unless in a correlated-expectation context). Although Guerzoni's approach seems to make good predictions for polar questions embedded under *wonder/want-to-know*, it predicts an unattested reading for polar questions containing weak *even* under *know*.

Attempting to extend Guerzoni's theory to embedded polar questions, we might attribute an LF as in (55) to the sentence *Sue wonders whether Bill read even ONE article from the reading list*. Here, *even* scopes above negation in the negated disjunct of the embedded question. The intension of the embedded question is a partial function, and it follows from the definition of desire-attributions (i.e. the definition of the selection function  $\text{ACC}_{\text{des}}$ ) that all of Sue's belief worlds must be in the embedded question's domain in order for the presuppositions of the statement as a whole to be satisfied. In order for the presuppositions of *Sue wants-to-know/wonders whether Bill read even ONE article from the reading list* to be satisfied, Sue has to believe the presuppositions of the embedded question.

(55)



$\llbracket(55)\rrbracket^{g,w}$  is defined only if  $\text{ACC}_{\text{dox}}(\text{Sue}, w) \subseteq \{w' : \forall q \in g(7) [q \neq \text{"that Bill read one article"} \rightarrow \text{"that Bill read one article"} \triangleleft_{w'} q], \text{ where } g(7) \subseteq \{\text{"that Bill read } n \text{ articles"} : n \in \mathbb{N}_{>0}\} \vee \forall q' \in g(8) [q' \neq \text{"that Bill didn't read one article"} \rightarrow \text{"that Bill didn't read one article"} \triangleleft_{w'} q']\}$ , where  $g(8) \subseteq \{\text{"that Bill didn't read } n \text{ articles"} : n \in \mathbb{N}_{>0}\}$

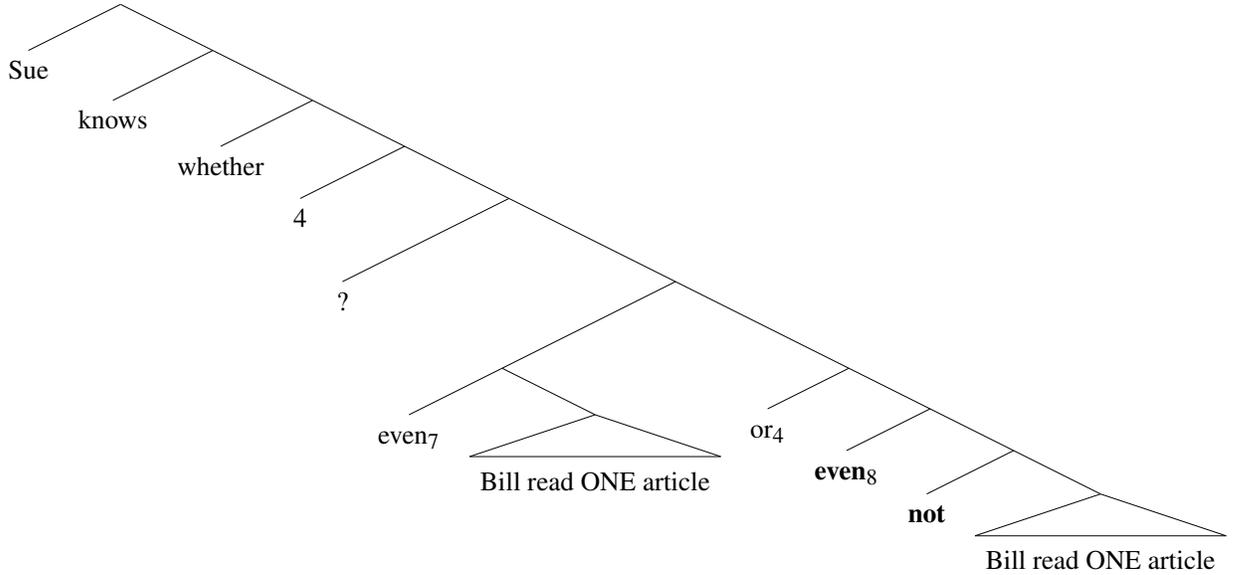
Presupposition (in prose): Sue believes that that it's less likely for Bill to read one article vs. more (unsatisfiable) or that it's less likely for Bill not to read one article vs. more (true)

If defined,  $\llbracket(55)\rrbracket^{g,w}=1$  iff  $\text{ACC}_{\text{des}}(\text{Sue}, w) \subseteq \{w' : \text{ACC}_{\text{dox}}(\text{Sue}, w') \subseteq \bigcap \{p : [p = [\lambda w''. \llbracket\text{even}_7[\text{Bill read ONE article}]\rrbracket^{g,w''}]] \vee p = [\lambda w''. \llbracket\text{even}_8[\text{not}[\text{Bill read ONE article}]\rrbracket^{g,w''}]] \ \& \ p(w') = 1\}\}$

Sue cannot fail to believe the presupposition contributed by *even* in the negated disjunct of the question and therefore the presupposition contributed by *even* to the embedded question as a whole; every possible world, including all of Sue's belief worlds, assign a smaller likelihood to the proposition "that Bill didn't read ONE article" than to the proposition "that Bill didn't read TWO articles" (as a consequence of the entailment relation between *even*'s prejacent and its alternatives). Thus, weak *even*'s presupposition is satisfied. Additionally, the unsatisfiability of the presupposition of the positive answer means that it is undefined for every world, including all of Sue's belief worlds. As a consequence, the positive answer is not true in any of her belief worlds. Therefore, the proposition expressed by (55) is that in all of Sue's desire worlds, she either believes that Bill didn't read one article (the negative answer), or she believes something which cannot be believed (the positive answer). Effectively, this means that in all of Sue's desire worlds, she believes that Bill didn't read one article i.e. "that Sue wants to know that Bill didn't read an article". Arguably, this interpretation explains why the statement seems to attribute to Sue a bias towards the negative answer; it is tantamount to an attribution of a desire to know the negative answer.

A problem arises because the unacceptable #*Sue knows whether Bill read even ONE article from the reading list* can be given an analogous LF, which allows *even* to trigger an easily satisfiable presupposition, contra to the acceptability judgement. This is shown in (56). This time, by the denotation assumed for *know*, the actual world has to be in the domain of the question-intension in order for the presupposition contributed by *even* to be satisfied.

(56)



$\llbracket (56) \rrbracket^{g,w}$  is defined only if  $\forall q \in g(7) [q \neq \text{“that Bill read one article”} \rightarrow \text{“that Bill read one article”} \triangleleft_w q]$ , where  $g(7) \subseteq \{\text{“that Bill read } n \text{ articles”} : n \in \mathbb{N}_{>0}\} \vee \forall q' \in g(8) [q' \neq \text{“that Bill didn’t read one article”} \rightarrow \text{“that Bill didn’t read one article”} \triangleleft_w q']$ , where  $g(8) \subseteq \{\text{“that Bill didn’t read } n \text{ articles”} : n \in \mathbb{N}_{>0}\}$

Presupposition (in prose): either it’s less likely for Bill to read one article vs. more (unsatisfiable) or it’s less likely for Bill not to read one article vs. more (true)

If defined,  $\llbracket (56) \rrbracket^{g,w} = 1$  iff  $\text{ACC}_{\text{dox}}(\text{Sue}, w) \subseteq \bigcap \{p : [p = [\lambda w'. \llbracket \text{even}_7[\text{Bill read ONE article}] \rrbracket^{g,w'}] \vee p = [\lambda w'. \llbracket \text{even}_8[\text{not}[\text{Bill read ONE article}]] \rrbracket^{g,w'}]] \& p(w) = 1\}$

Once again, the presupposition contributed by *even* in (56) is trivially satisfied because of the entailment relation between *even*’s prejacent and its alternatives. As before, because of the unsatisfiability of the presupposition of the positive answer, the proposition expressed by (56) is that Sue either believes that Bill didn’t read one article (the negative answer), or she believes something which cannot be believed (the positive answer). The statement is tantamount to an attribution of knowledge of the negative answer i.e. “that Sue knows that Bill didn’t read one article”. This is not an attested interpretation of the statement #*Sue knows whether Bill read even ONE article*.

Summing up, Guerzoni’s approach makes good predictions for matrix polar questions containing weak *even* and embedded polar questions under *wonder*, but unattested readings for embedded polar questions like #*Sue knows whether Bill read even ONE article* are also derived; the unacceptability of the statement is not predicted.

As a final note, there is evidence that introducing different, incompatible presuppositions into the answers of two-membered question extensions in general results not in a bias towards the defined answer but rather unacceptability. For instance, Guerzoni & Sharvit 2014 take the extension of alternative questions like (57) to be two-membered sets.

(57) Did BILL or SUE show up to class?

a. LF: [whether [4 [ ? [[Bill showed up] [or<sub>4</sub> [Sue showed up]]]]]]

b.  $\llbracket (57a) \rrbracket^{g,w} = \{p : [p = \text{“that Bill showed up”} \vee p = \text{“that Sue showed up”}] \& p(w) = 1\}$

In (58), the two occurrences of *even* introduce distinct, incompatible presuppositions in the two members of the alternative question, which results in ungrammaticality<sup>9</sup>; on analogy with Guerzoni’s treatment of weak *even* in polar questions, however, (58) can be given an LF as in (58a), which derives a presupposition as in (58b).

- (58) \*Did even BILL or even SUE show up to class?
- a. LF: [whether [4 [? [[even<sub>7</sub> BILL showed up] [or<sub>4</sub> [even<sub>8</sub> SUE showed up]]]]]]
  - b.  $\llbracket(58a)\rrbracket^{g,w}$  is defined only if  $\forall q \in g(7)$  [ $q \neq$  “that Bill showed up”  $\rightarrow$  that Bill showed up  $\langle_{\text{w}}$   $q$ ], where  $g(7) \subseteq \{ \text{“that } x \text{ showed up”} : x \in D_e \} \vee \forall q' \in g(8)$  [ $q' \neq$  “that Sue showed up”  $\rightarrow$  “that Sue showed up”  $\langle_{\text{w}}$   $q'$ ], where  $g(8) \subseteq \{ \text{“that } x \text{ showed up”} : x \in D_e \}$
  - c. Presupposition (in prose): either Bill is the least likely person to show up or Sue is the least likely person to show up

The presupposition of (58) is a disjunction of two mutually incompatible propositions. In a context where the presupposition that Sue is the least likely person to show up is true and the presupposition that Bill is the least likely person to show up is false, (58) is still unacceptable and does not receive a biased interpretation (the predicted interpretation being that the asker suspects that Sue showed up to class and that Bill didn’t show up to class). (58) calls into question the hypothesis that the propositions in two-membered question extensions can have incompatible presuppositions.

## 4.2 Abels 2003

Now, I present Abels’s (2003) take on how weak *even* is licensed in matrix polar questions. The analysis hinges on two assumptions. The first is that *even* contributes an additive presupposition that all alternatives to the prejacent are true, meaning that a statement like *even BILL showed up* presupposes that all other relevant individuals showed up as well. The second is that under pressure to accommodate *even*’s scalar presupposition, interlocutors may construct a set of alternatives that allows for weak *even*’s presupposition in an upward entailing environment not to be pathological. Specifically, in addition to propositions in the focus alternative set of the prejacent, the set of alternatives can also contain the negation of the disjunction of all alternatives (which I call “NOD,” following Abels). For a weak prejacent like “that Bill read ONE article”, the corresponding NOD is the proposition “that Bill didn’t read one or two or three... articles”. The lexical entry for *even* adopted by Abels is given in (59), where  $g(7)$  is a contextually restricted set of propositions that is a subset of the focus-semantic value of *even*’s sister that may also contain the NOD. I will indicate Abels’ *even* as  $^{Ab}even$ . It requires that the alternative set not be empty, that all alternatives be true, and that the prejacent be least likely among the alternatives.

$$(59) \quad \llbracket^{Ab}even_7\rrbracket^{g,w} = \lambda_{pst} : g(7) \neq \emptyset \ \& \ \forall q \in g(7) [q(w) = 1 \ \& \ [q \neq p \rightarrow p \langle_{\text{w}} q]]. \ p(w) = 1$$

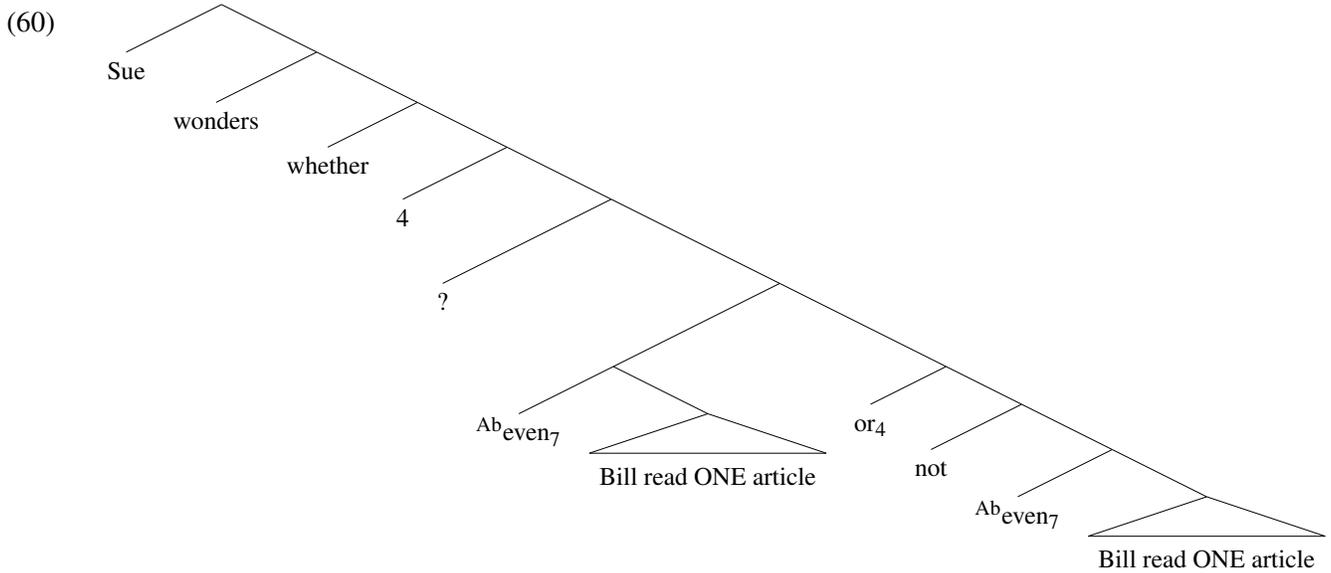
Pressure to have a satisfiable scalar presupposition can introduce NOD into *even*’s set of alternatives, and *even*’s additive presupposition requires NOD to be true. According to Abels, this is precisely what happens in the question *Did Bill read even ONE article?* *Even*’s prejacent, “that Bill read ONE article”, cannot have its likelihood compared to its focus-alternatives  $\{ \text{“that Bill read } n \text{ articles”} : n \in \mathbb{N}_{>0} \}$ , or else an unsatisfiable scalar presupposition arises. For that reason, *even*’s set of alternatives comes to contain the proposition “that Bill didn’t read one or more articles”. The prejacent proposition “that Bill read one article” is potentially less likely than NOD because they

<sup>9</sup>I thank Yael Sharvit for this example and this point.

are not related by logical entailment, giving rise to a satisfiable scalar presupposition. Importantly, the additivity of *even* makes the question presuppose the truth of NOD. *Even*'s additive presupposition is what leads to negative bias: the asker is requesting that the addressee commit to the answer to whether Bill read one article, but the asker's question presupposes that Bill didn't read one article or more articles (see Abels 2003 for discussion of why allowing NOD to be an element of the prejacent's alternative-set does not overgenerate and predict declaratives like *\*Bill read even ONE article* to be well-formed).

#### 4.2.1 Problems

Once again, a problem arises when the analysis is extended to weak *even* in embedded polar questions. Allowing NOD to be one of the alternatives predicts uniformity in the licensing of weak *even* in embedded questions, contrary to fact. Specifically, introducing NOD into weak *even*'s alternatives allows for a satisfiable presupposition to be triggered under *know* as well as under *want-to-know/wonder*<sup>10</sup>. An LF for *Sue wonders whether Bill read even ONE article* is shown in (60).



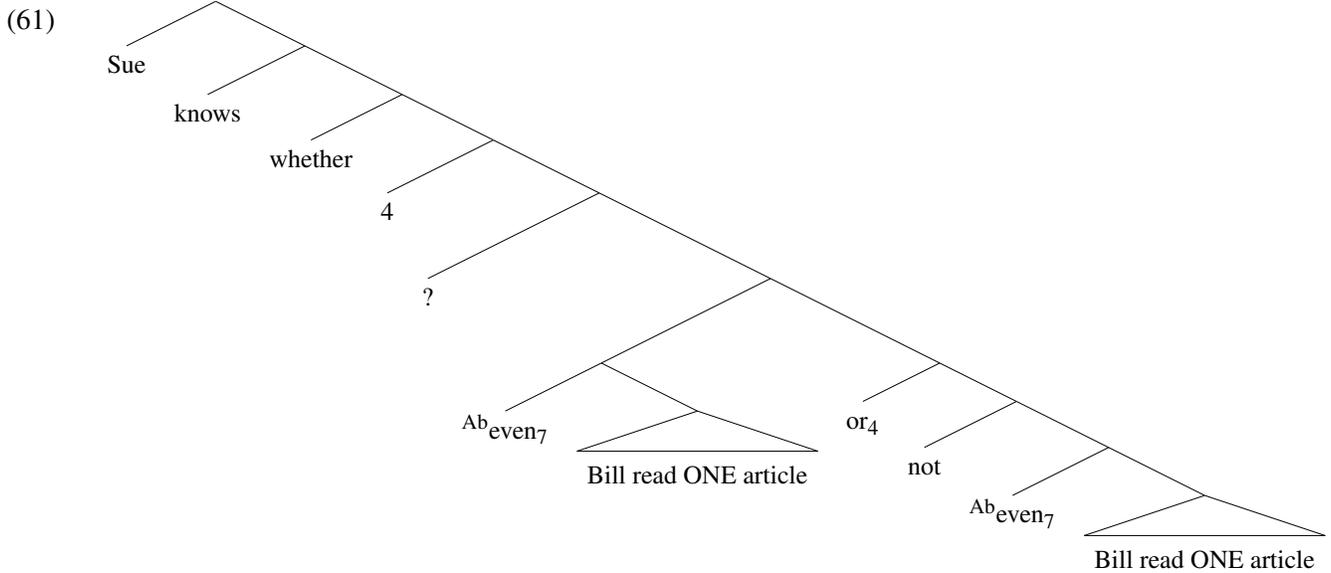
$\llbracket(60)\rrbracket^{g,w}$  is defined only if  $g(7) \neq \emptyset$  &  $\text{ACC}_{\text{dox}}(\text{Sue}, w) \subseteq \{w' : \forall q \in g(7) [q(w') = 1 \ \& \ [q \neq \text{“that Bill read one article”} \rightarrow \text{“that Bill read one article”} \prec_{w'} q]]\}$ , where  $g(7) = \{\text{“that Bill didn’t read one or more articles”}\}$  (i.e. NOD)

Presupposition (in prose): Sue believes that it's less likely for Bill to read one article than for Bill not to read one or more articles (scalar presupposition) and Sue believes that Bill didn't read one or more articles (additive presupposition)

If defined,  $\llbracket(60)\rrbracket^{g,w} = 1$  iff  $\text{ACC}_{\text{des}}(\text{Sue}, w) \subseteq \{w' : \text{ACC}_{\text{dox}}(\text{Sue}, w') \subseteq \bigcap \{p : [p = [\lambda w'' . \llbracket \text{Abeven}_7[\text{Bill read ONE article}] \rrbracket^{g,w''}] \vee p = [\lambda w'' . \llbracket \text{not}[\text{Abeven}_7[\text{Bill read ONE article}]] \rrbracket^{g,w''}] \ \& \ p(w') = 1\}\}$

<sup>10</sup>On Abels' view, *even* need not scope above negation in the negative disjunct of the polar question in order to trigger a satisfiable presupposition. Pairing Guerzoni's approach of having *even* introduce incompatible presuppositions into each answer with Abels' approach of introducing NOD into the set of alternatives won't fix the overgeneration problem faced by either account. This is because, as emphasized by Guerzoni, both high- and low-scope LFs are derivable. So long as a low-scope LF where NOD is among the set of alternatives is derivable, there will be no explanation for why weak *even* in a polar question under *know* is bad to begin with, as I will show.

Allowing NOD to be in *even*'s alternative set and treating *even* as additive makes (60) presuppose that Sue believes that Bill didn't read one or more articles and assert that Sue wants to know whether Bill read one article. This seems to be a good result in explaining the bias that the statement attributes to Sue; the statement asserts that Sue is wondering about a question that she already believes the negative answer to. Once again, however, a problem arises for polar questions containing weak *even* embedded under *know*, as in (61). Allowing NOD to be in *even*'s alternative set predicts weak *even* to be able to trigger a plausible presupposition, contrary to fact.



$\llbracket(61)\rrbracket^{g,w}$  is defined only if  $g(7) \neq \emptyset$  &  $\forall q \in g(7) [q(w) = 1 \text{ \& } [q \neq \text{“that Bill read one article”} \rightarrow \text{“that Bill read one article”} \triangleleft_w q]]$ , where  $g(7) = \{\text{“that Bill didn’t read one or more articles”}\}$  (i.e. NOD)

Presupposition (in prose): It’s less likely for Bill to read one article than for Bill not to read one or more articles (scalar presupposition) and Bill didn’t read one or more articles (additive presupposition)

If defined,  $\llbracket(61)\rrbracket^{g,w} = 1$  iff  $\text{ACC}_{\text{dox}}(\text{Sue}, w) \subseteq \bigcap \{p : [p = [\lambda w'. \llbracket \text{Ab even}_7 [\text{Bill read ONE article}] \rrbracket^{g,w'}] \vee p = [\lambda w'. \llbracket \text{not} [\text{Ab even}_7 [\text{Bill read ONE article}]] \rrbracket^{g,w'}] \text{ \& } p(w) = 1]\}$

Again, the problem is that a satisfiable presupposition and a well-formed assertion are derived, despite the intuition that #*Sue knows whether Bill read even ONE article* is odd. This time, by the additivity of *even*, the statement presupposes that Bill didn't read one or more articles and asserts that Mary believes the true alternative of whether Bill read one article (i.e. she knows that he didn't read one). This is not an available interpretation of the sentence. Therefore, I take Abels' analysis to overgenerate as well by wrongly predicting the well-formedness of polar questions containing weak *even* embedded under *know*.

As a more general problem with Abels' account, it's not clear that matrix questions containing weak *even*, such as *Did Bill read even ONE article?*, license an inference about the relative likelihood of the propositions *that Bill read one article* and *that Bill didn't read one or more articles*, the NOD. To illustrate, if (62a) came with the scalar presupposition predicted by Abels' account, it is predicted not to cohere with the context-providing sentence,

contrary to fact.

- (62) Everyone knows that it's more expected for Bill to read one article than to not read one article, but...
- a. Did Bill even read ONE article?
  - b. Presupposition of <sup>Ab</sup>*even* (in prose): it's less likely for Bill to read one article than for Bill not to read one or more articles (scalar presupposition) and Bill didn't read one or more articles (additive presupposition)

### 4.3 Conclusion

Both existing analyses of the licensing and bias of weak *even* in matrix polar questions fail to explain the distributional patterns that weak *even* exhibits in embedded polar questions. Focusing on *wonder/want-to-know* vs. *know*, I showed that the analyses provide good results for polar questions under *wonder* but predict licensing and unattested interpretations for polar questions under *know*. The generalization stated originally was that polar questions embedded under responsive verbs do not license weak *even*. I believe that similar arguments could be made on the basis of other responsive verbs like *tell*, assuming a lexical entry as in (63)<sup>11</sup>. Again, both analyses predict unattested readings for polar questions with weak *even* embedded under such verbs, so long as scoping *even* over negation (for Guerzoni) or introducing NOD into the alternative set (for Abels) is taken to be possible.

- (63)  $[[\text{tell}]]^{g,w} = \lambda Q_{\langle s, \langle st, t \rangle \rangle} . \lambda x_e . \lambda y_e . \text{ACC}_{\text{tell}}(x, y, w) \subseteq \bigcap Q(w)$   
 where  $\text{ACC}_{\text{tell}}(x, y, w)$  is the set of possible worlds that are compatible with what *y* conveyed to *x* through (an act of) telling in *w*

Under Guerzoni's approach, the odd statement #*Sue told Mary whether Bill read even ONE article* could be assigned the presuppositions in (64a) and truth conditions in (64b), derived with an embedded question LF where *even* scopes above negation. The interpretation is tantamount to Sue telling Mary that Bill didn't read an article, an unattested reading for (64).

<sup>11</sup>This lexical entry treats *tell* as veridical, expressing a relation to the true answer to the embedded question. That *tell* and other verbs of communication are veridical has been questioned recently by Spector & Egré 2015. We could also give *tell* a non-veridical denotation, as in *i.*, which means that Sue told Mary some answer to the question, not necessarily the true answer. However, it wouldn't help to explain why weak *even* can't appear in an embedded polar question under *tell*.

- i.*  $[[\text{tell}]]^{g,w} = \lambda Q_{\langle s, \langle st, t \rangle \rangle} . \lambda x_e . \lambda y_e . \exists w' [\text{ACC}_{\text{tell}}(x, y, w) \subseteq \bigcap Q(w')]$

The point about overgeneration applies equally, though the particular presuppositions and assertions ultimately derived are different.

### **Tell under Guerzoni's approach**

- (64) #Sue told Mary whether Bill read even ONE article
- a. Guerzoni's presupposition (in prose): either it's less likely for Bill to read one article vs. more articles (unsatisfiable), or it's less likely for Bill not to read one article vs. more articles (true)
  - b. Assertion: Sue told Mary that Bill didn't read one article or that something with a built-in presupposition failure is the case (i.e. the positive answer)

Under Abels' approach, <sup>Ab</sup>*even* could scope low and compare its weak prejacent to its corresponding NOD. This would derive the presupposition in (65a) and truth conditions in (65b). In a somewhat different way, this statement is also ends up being tantamount to Sue telling Mary that Bill didn't read an article.

### **Tell under Abels' approach**

- (65) #Sue told Mary whether Bill read even ONE article
- a. Abels' presupposition (in prose): it's less likely for Bill to read one article than for Bill not to read one or more articles (scalar presupposition), and Bill didn't read one or more articles (additive presupposition)
  - b. Assertion: Sue told Mary that Bill read one article or that Bill didn't read one article

On top of the undesirable results for polar questions embedded under responsive verbs, I pointed out some independent problems for both accounts. For Guerzoni's, I observed that elements of a two-membered question can't otherwise have incompatible presuppositions, a necessary ingredient of her analysis. The example provided to illustrate this point is the alternative question in (66).

- (66) \*Did even BILL or even SUE show up to class?

For Abels' account, I observed that matrix polar questions where weak *even* is licensed do not necessarily convey something about the relative likelihood of the weak prejacent and that of the NOD. (67) was given in support of this conclusion.

- (67) Everyone knows that it's more expected for Bill to read one article than to not read one article, but...
- a. Did Bill even read ONE article?
  - b. Presupposition of <sup>Ab</sup>*even* (in prose; not perceived): it's less likely for Bill to read one article than for Bill not to read one or more articles (scalar presupposition) and Bill didn't read one or more articles (additive presupposition)

In light of these conclusions, I think it is worthwhile not just to look for an explanation of the distributional patterns of weak *even* in embedded polar questions but also to reconsider what explains the licensing of weak *even* in matrix polar questions. I briefly outline some ideas in the final section. In the following discussion, I assume that *even* cannot scope in such a way that it introduces different presuppositions into the answers of a question, contra Guerzoni 2003, 2004. I also assume that the introduction of NOD into a weak prejacent's alternative-set is not possible, contra Abels 2003.

## 5 Towards an analysis

(68)-(71) repeat some of the contrasts displayed by responsive verbs. Changes to the meaning of the matrix clause that embeds the polar question containing weak *even* affect the acceptability of the sentence overall.

### Responsive verbs cannot embed weak *even* directly

- (68) Evidently, people around here have a very low opinion of Bill. . .
- #Sue *knew* whether he read *even ONE* article
  - #Sue *told* Mary whether he read *even ONE* article
  - ?Sue and Mary *established* whether he read *even ONE* article

### Responsive verbs under *want* can embed weak *even*

- (69) Evidently, people around here have a very low opinion of Bill. . .
- Sue *wanted to know* whether he read *even ONE* article
  - Mary *wanted* Sue to *tell* her whether he read *even ONE* article
  - Sue and Mary *wanted to establish* whether he read *even ONE* article

### Habitual responsive verbs can embed weak *even*

- (70) Evidently, people around here are deeply interested in Bill's reading habits. . .
- Sue *always knows* whether he has read *even ONE* article
  - Sue *always tells* Mary whether he has read *even ONE* article
  - Sue and Mary *always establish* whether he has read *even ONE* article

### Future responsive verbs can embed weak *even*

- (71) People around here will monitor Bill's reading habits very closely. . .
- Sue *will know* whether he has read *even ONE* article
  - Sue *will tell* Mary whether he has read *even ONE* article
  - Sue and Mary *will establish* whether he has read *even ONE* article

The effect on acceptability of changing the matrix clause suggests that the meaning of the matrix clause factors into the calculation of *even*'s presupposition. Previous accounts focused on matrix polar questions, where it's not clear that questions are embedded under anything, and as such, previous analyses proposed different ways for *even* to trigger a presupposition internal to the question that is not in violation of the strength-likelihood constraint. The contrasts in (68)-(71), however, suggest that *even* conveys something about the relative likelihood of the proposition denoted by the entire sentence compared to alternatives. This is an analytical option under the scope theory. Indeed, some of the initial evidence given in favor of the scope theory involves examples like *I find it hard to believe that Bill even understood MOTHER GOOSE*, where, according to the scope theory, the perceived contribution of *even* (i.e. that *Mother Goose* is an easy book to be understood) must be derived by scoping *even* in the matrix clause.

I propose that all the examples in (68)-(71) can have multiple LFs, at least one of which involves *even* scoping in the matrix clause, taking as its prejacent the proposition denoted by the maximal constituent of the sentence. From this matrix position, *even*'s sister is non-monotonic with respect to the position of the focus in the embedded question. As shown by Crnič 2011, 2014, non-UEness, which includes both DEness and non-monotonicity, is what weak *even* requires in order to trigger a satisfiable presupposition; I show that once weak *even*'s licensing condition integrates non-monotonicity, all polar question–embedding constructions meet weak *even*'s licensing condition. In this section, I present Crnič 2011, 2014's evidence for a revised view on weak *even*'s licensing and sketch some ideas I intend to explore in future work for explaining the distributional contrasts conditioned by the properties of the question embedding construction.

## 5.1 Weak *even* and non-monotonicity

The licensing condition for weak *even* adopted earlier in this work and repeated in (72) predicts that weak *even* must appear in a sentence that contains a constituent which is DE with respect to *even*'s associate. By reversing the direction of entailment, constituents that are DE with respect to weak *even*'s associate provide *even* with a prejacent that is logically stronger than all alternatives and guarantee that *even*'s scalar presupposition is satisfied.

(72) *Weak even licensing condition (version 1)*

Weak *even* is licensed in sentence S only if there is a constituent A of S containing the associate of *even* such that  $\llbracket A \rrbracket \in D_{st}$  and A is DE with respect to the position of *even*'s associate

Crnič 2011, 2014 emphasizes that eligible scope sites that are DE guarantee the acceptability of weak *even*'s presupposition, but eligible scope sites that are simply non-UE make weak *even*'s presupposition potentially acceptable as well. All DE environments are non-UE, but non-UEness also includes *non-monotonic* environments<sup>12</sup>, which do not license inferences from subsets to supersets in their scope, nor from supersets to subsets. Weak *even* cannot appear in sentences where every eligible scope site is UE because *even*'s scalar presupposition is pathological if its prejacent is weakest among the relevant set of alternatives. Although sentences with eligible scope sites that are DE with respect to weak *even*'s focus-associate guarantee that weak *even* is able to trigger a true presupposition, sentences with eligible scope sites that are merely non-monotonic also make it possible for *even* to trigger a satisfiable presupposition. This is because scope sites that are non-monotonic with respect to a weak focus-associate provide *even* with a prejacent that is logically independent of its alternatives, not entailed by all of them, which is the real constraint on the distribution of weak *even*. If *even*'s prejacent and alternatives are not related by logical entailment, in principle, they can stand in whatever likelihood relation context or real-world knowledge imposes. This is similar to the presupposition contributed by *even* in sentences like *even BILL showed up*, where *even*'s prejacent has no logical relation to its alternatives. The satisfaction of this presupposition in

<sup>12</sup>I assume the following definition of non-monotonic functions and environments:

- i. *Strawson non-monotonic function* (Crnič 2011: 30)  
A function  $f$  of type  $\langle \sigma, \tau \rangle$  is Strawson non-monotonic iff (i) there are  $x, y$  of type  $\sigma$  such that  $x \Rightarrow y$ ,  $f(x)$  is defined, and  $f(y) \not\Rightarrow f(x)$  and (ii) there are  $x, y$  of type  $\sigma$  s.t.  $x \Rightarrow y$ ,  $f(y)$  is defined, and  $f(x) \not\Rightarrow f(y)$
- ii. *Strawson non-monotonic environment*  
A constituent A is non-monotonic with respect to the position of  $\beta$  (where  $\llbracket \beta \rrbracket$  is of type  $\sigma$ ) iff  $\lambda x. \llbracket A[\beta/t, \sigma, \tau] \rrbracket \mathfrak{g}[7 \rightarrow x]$  is Strawson non-monotonic.  $A[\beta/t]$  is the result of replacing  $\beta$  with  $t$  in A.

any given context depends on factors other than the non-existent logical relations between the prejacent and its alternatives.

The empirical support that Crnič 2011, 2014 provides for this take on the licensing condition of weak *even* comes from the distribution of weak *even* in statements containing non-monotonic quantifiers, as in *exactly n NP VP* (though the fact that non-monotonic quantifiers license NPIs was first observed by Linebarger 1987). The maximal constituent of such statements is non-monotonic with respect to positions in the VP, as illustrated in (73a-b).

- (73) a. [[Exactly one student read one article from the reading list]]  
 $\cancel{\text{X}}$   $\cancel{\text{X}}$   
 b. [[Exactly one student read two articles from the reading list]]

(73a) does not entail (73b) because it's possible that exactly one student read one article but many students (rather than exactly one student) read two articles. (73b) does not entail (73a) because it's possible that exactly one student read two articles but many students (rather than exactly one student) read one article. Crnič 2011, 2014 observes that the distribution of weak *even* in the scope of non-monotonic quantifiers is subject to constraints of plausibility, as illustrated by the acceptability contrast between (74a) and (74b) (modified example and discussion based on Crnič 2014: 182-185). What's interesting is that *even*'s focus-associate is in an environment that has the same logical property in both (74a) and (74b); both *exactly one NP VP* and *exactly 11 NP VP* are non-monotonic with respect to positions in the VP.

- (74) Sue is deeply disappointed in the 12 students in her seminar. She assigned five articles as summer reading. None of them read all five and...
- a. Exactly one of them read even ONE article from the list  
 LF: [even<sub>7</sub> [exactly one of them [1 [t<sub>1</sub> read ONE article from the list]]]]  
 Presupposition from *even*: it's less likely for exactly one student to have read one article than for exactly one student to have read any greater number of articles
- b. #Exactly 11 of them read even ONE articles from the reading  
 LF: [even<sub>7</sub> [exactly 11 of them [1 [t<sub>1</sub> read ONE article from the list]]]]  
 Presupposition from *even*: it's less likely for exactly 11 students to have read one article than for exactly 11 students to have read any greater number of articles

Why is a contrast perceived between these examples<sup>13</sup>, despite the fact that *even*'s focus-associate is in a non-monotonic environment in both? Suppose these sentences are evaluated relative to a context where the following ordinary expectations hold: in a seminar of 12 students where five articles have been assigned as summer reading, it's expected that all 12 students will read at least one article, that six students will read two articles, and that only two will read all five. In such a context, the presupposition contributed by *even* in (74a) is true while the presupposition contributed by *even* in (74b) is false.

<sup>13</sup>Speakers seem to have stronger intuitions about examples where the focus is on a contextual rather than logical scale with its alternatives. I discuss an example with numerals for perspicuity, but I believe that a more robust judgement is perceived with *exactly one student even GLANCED at the article* vs. *#exactly 11 students even GLANCED at the article*, with the alternatives being understood as {*glanced-at, read, understood*}. See Crnič 2014 for many more examples.

The reason that *even*'s presupposition in (74a) is true is that the disparity between the actual number of one-article readers (i.e. one) and the expected number of one-article readers (i.e. 12) is greater than the disparity between the the actual number of one-article readers (i.e. one) and the expected number of two-or-more-article readers (i.e. 6). Therefore, it is indeed more surprising for exactly one student to have read one article than for exactly one student to have read two articles, as conveyed by *even* in this example. The reason that *even*'s presupposition in (74b) is false is that the disparity between the actual number of one-article readers and the expected number of one-articles readers is *not* greater than the disparity between the actual number of one-article readers and the expected number of two-or-more-article readers (i.e. the difference between 12 and 11 is smaller, not greater, than the difference between 12 and 6 or between 12 and two); therefore, it's not more surprising for exactly 11 students to have read one article than for exactly 11 students to have read two or more articles, contrary to what *even* conveys in this example. Again, the contrast between (74a-b) exists in spite of the fact that *even*'s associate is in an environment with the same logical property i.e. non-monotonicity<sup>14</sup>; rather, the contrast is a result of expectations that hold in the context.

Crnič 2011, 2014 concludes that non-UEness, rather than DEness, is the necessary condition for the licensing of weak *even*. Context and independent expectations constrain the distribution of weak *even* in non-monotonic environments. Based on his findings, I assume the licensing condition in (75) for weak *even*.

(75) *Weak even licensing condition (final)*

Weak *even* is licensed in sentence S only if there is a constituent A of S containing the associate of *even* such that  $\llbracket A \rrbracket \in D_{st}$  and A is not UE with respect to the position of *even*'s associate

Returning to embedded polar questions, it turns out that all question embedding constructions provide a constituent that is an eligible scope site for *even* and that is non-monotonic with respect to positions inside the embedded question, namely, the maximal constituent of the sentence. Thus, all instances of weak *even* in an embedded polar question satisfy the licensing condition in (75). Consider the two possible LFs for the three sentences in (76)-(78), according to the scope theory (once we exclude the possibility of *even* scoping above negation in the negated disjunct of the embedded question; a disjunctive structure for the embedded question is assumed but not represented here).

(76) Sue wanted to know whether Bill read even ONE article

- a. LF<sub>1</sub>: [even<sub>7</sub> [Sue wanted to know whether Bill read ONE article]]
- b. \*LF<sub>2</sub>: [Sue [wanted to know [whether [even<sub>7</sub> [Bill read ONE article]]]]]]

(77) Sue wondered whether Bill read even ONE article

- a. LF<sub>1</sub>: [even<sub>7</sub> [Sue wondered whether Bill read ONE article]]
- b. \*LF<sub>2</sub>: [Sue [wondered [whether [even<sub>7</sub> [Bill read ONE article]]]]]]

<sup>14</sup>On how to construct a well-formed example with weak *even* in the scope of a non-monotonic quantifier:

“The scalar presupposition triggered by *even* that associates with a weak element in the scope of a non-monotone quantifier *exactly n NP* is satisfied only if the numeral in the non-monotone quantifier is (i) appropriately lower than the expected number of individuals that are both in the domain of the quantifier and in the denotation of the main predicate e.g., [the expected number one-article readers] and (ii) appropriately close to the expected number of individuals that are in the domain of the non-monotone quantifier and in the relevant stronger alternatives to the main predicate e.g., [the expected number two-or-more-article readers]” (Crnič 2014: 184).



- (81) Sue wanted to know whether Bill read even ONE article from the list
- a. LF: [even<sub>7</sub> [Sue wanted to know whether Bill read ONE article from the list]]
  - b. Presupposition of *even*: it's less likely for Sue to want to know whether Bill read one article than for Sue to want to know whether Bill read any greater number of articles
- (82) #Sue knew whether Bill read even ONE article from the list
- a. LF: [even<sub>7</sub> [Sue knew whether Bill read ONE article from the list]]
  - b. Presupposition of *even*: it's less likely for Sue to know whether Bill read one article than for Sue to know whether Bill read any greater number of articles

I take it to be desirable that both presuppositions are satisfiable; as I have shown, certain contexts, such as the correlated expectation context repeated in (83), license the use of statements like (82).

***Know (correlated expectation)***

- (83) Every time Mary sees Bill, she finds out whether he's read the number of articles corresponding to the number of days since they last met up. Mary and Bill usually meet up once a year, so Mary usually knows whether Bill has read 365 articles. Recently, however, they've been meeting up more frequently, which is surprising. Last time I talked to Mary, she knew whether Bill had read 7 articles, and this morning. . .
- a. Mary knew whether Bill had read even ONE article

In future work, I hope to explain the contrast in neutral contexts between polar questions with weak *even* under *want-to-know/wonder* vs. *know* in terms of how readily we can accept the likelihood comparisons in (81b) and (82b). Specifically, I would like to explore the possibility that in ordinary contexts, the presupposition triggered by *even* when the statement contains a rogative verb or an embedded responsive verb is more plausible than when it contains an unembedded responsive verb, interpreted episodically.

I would like to explore the idea that in ordinary contexts, the likelihood assigned to the the proposition denoted by the maximal constituent of a statement with an episodic responsive verb does not change from number to number. Consider the presupposition contributed by *even* to (84), a statement with *know* interpreted episodically; this time, the proposition expressed by the statement with the responsive verb is restated disjunctively<sup>15</sup>.

- (84) #Sue knew whether Bill read even ONE article from the list
- a. LF: [even<sub>7</sub> [Sue knew whether Bill read ONE article from the list]]
  - b.  $\llbracket(84a)\rrbracket^{g,w}$  is defined only if  $\forall n \in \mathbb{N}_{n>1}$  that are contextually relevant:  
 “that Bill read *n* articles and Sue knew that Bill read *n* articles or Bill didn't read *n* articles and Sue knew that Bill didn't read *n* articles”  
 $\triangleright_w$   
 “that Bill read one article and Sue knew that Bill read one article or Bill didn't read one article and Sue knew that Bill didn't read one article”

(84b) is a likelihood comparison of disjunctive propositions, where the two disjuncts are mutually incompatible.

<sup>15</sup>This restatement is justified with polar questions because of the way that responsive verbs compose with their question complements (see Spector & Egré 2015: 1752 for a meaning postulate that achieves this result systematically with any responsive verb).

There are no worlds where Sue both knows that Bill read one article and knows that Bill didn't read one article. Every alternative is also a disjunction of two mutually exclusive proposition. Interestingly, the disjunct in the prejacent "that Bill didn't read one article and Sue knows that Bill didn't read one article" is logically stronger than one of the disjuncts in every alternative, while the disjunct in the prejacent "that Bill read one article and Sue knows that Bill read one article" is logically weaker than a disjunct in every alternative. According to the basic axioms of probability theory (specifically Kolmogorov's third axiom), the probability assigned to a disjunction of two mutually exclusive propositions is simply the sum of their individual probabilities. The probability assigned to the weak disjunct in the prejacent is greater than its corresponding disjunct in any alternative, while the probability assigned to the strong disjunct in the prejacent is smaller than its corresponding disjunct in any alternative.

I hypothesize that in ordinary contexts, the disparity in likelihood between the weak disjunct and its correspondent in an alternative is the same as the disparity in likelihood between the strong disjunct and its correspondent. The idea is that in ordinary contexts, we expect likelihood to decrease for the positive disjuncts as the number gets higher by the same proportion that it increase for the negative disjuncts as the number gets lower. This is equivalent to saying that in ordinary contexts, the extent to which "that Bill read one article" is more likely than "that Bill read two articles" is the same as the extent to which "that Bill didn't read one article" is less likely than "that Bill didn't read two articles".

In contexts where these assumptions obtain, the presupposition of *even* is not satisfied. The prejacent is not less likely than all alternatives; rather, it is just as likely. In these contexts, Sue is just as likely to know whether Bill read one article as she is to know whether he read two. I hypothesize that when speakers are presented with statements like #*Sue knew whether Bill read even ONE article* in neutral contexts, this assumption about normality is the reason that *even*'s presupposition is difficult to accommodate.

In future work, I will attempt to explain why the likelihood comparison in (85), with *want-to-know*, is more readily accepted in ordinary contexts i.e. why in most contexts, it is less expected for an individual to want to know a polar question containing a minimal number compared to the relevant alternatives with higher numbers.

- (85) Sue wanted to know whether Bill read even ONE article from the list
- a. LF: [even<sub>7</sub> [Sue wanted to know whether Bill read ONE article from the list]]
  - b.  $[(85a)]^{g,w}$  is defined only if  $\forall n \in \mathbb{N}_{n>1}$  that are contextually relevant:  
 "that Sue wants it to be the case that Bill read *n* articles and she knows that Bill read *n* articles or that Bill didn't read *n* articles and Sue knows that Bill didn't read *n* article"  
 $\triangleright_w$   
 "that Sue wants it to be the case that Bill read one article and she knows that Bill read one article or that Bill didn't read one article and she knows that Bill didn't read one article"

While the ideas in this section have been speculative, I have shown that *even*'s presupposition is satisfiable in sentences where it associate with a weak element in an embedded polar question. This is because the maximal constituent of the sentence is non-monotonic with respect to the position of focus, allowing *even*'s presupposition to be satisfiable. I've speculated that considerations of plausibility explain why weak *even* is more readily accepted in polar questions under *want-to-know/wonder* vs. *know*. While my own proposal still has to be developed, I suspect that some explanation in terms of plausibility can eventually be given.

### 5.3 Open questions: bias and main clause questions

Matrix clause polar questions containing weak *even* come with a negative bias, conveying that the speaker expects or suspects that the negative answer is true, and polar questions embedded under *want-to-know/wonder* also come with a negative bias, conveying that the subject expects or suspects that the negative answer is true. All other polar questions that license weak *even* are not associated with negative bias, including the ECM construction *want X to know*. Regarding how weak *even* is licensed in matrix polar questions, I think it would be fruitful to explore an analysis where *even* scopes outside the question itself, above some kind of question-act operator that embeds the question. Such an analysis would be similar to the one proposed by Iatridou & Tatevosov 2014 for a different class of questions containing *even*. While positing such operators in the logical form of sentences is controversial (Lauer 2015), their utility has been shown by their application in the analysis of many different linguistic phenomena (e.g. Krifka 2001 on questions with quantifiers; Kaufmann 2012 on imperatives; Sauerland & Yatsushiro 2015 on speech act-modification readings of *again*, among many others).

Concretely, we might assume that matrix polar questions contain the ASK operator in (86) in their left-periphery, which provides weak *even* with an additional scope site whose sister is non-monotonic with respect to the position of the focus-associate. This operator is loosely based on the one proposed by Sauerland & Yatsushiro 2015, but simplified into a single head rather than decomposed into multiple left-peripheral functional heads.

$$(86) \quad \llbracket \text{ASK} \rrbracket^{g,c,w} = \lambda Q_{\langle s, \langle st, t \rangle \rangle} \cdot \text{ACC}_{\text{des}}(c_{\text{speaker}}, w) \subseteq \{w' : \text{ACC}_{\text{tell}}(c_{\text{addressee}}, c_{\text{speaker}}, w') \subseteq \bigcap Q(w')\}$$

The use of an ASK operator yields matrix-question LFs and presuppositions as in (87) for questions containing weak *even*.

- (87) Did Bill read even ONE article from the reading list?
- a. LF: [even<sub>7</sub> [ASK [whether Bill read ONE article from the list]]]
  - b.  $\llbracket (87a) \rrbracket^{g,w}$  is defined only if  $\forall n \in \mathbb{N}_{n>1}$  that are contextually relevant:  
 “that the speaker wants it to be the case that Bill read *n* articles and the addressee tells him/her that Bill read *n* articles or that Bill didn’t read *n* articles and the addressee tells him/her that Bill didn’t read *n* article”  
 $\triangleright_w$   
 “that the speaker wants it to be the case that Bill read one article and the addressee tells him/her that Bill read one article or that Bill didn’t read one article and the addressee tells him/her that Bill didn’t read one article”

In future work, I speculate about what property of this combination of assertion and presupposition results in bias with statements containing *wonder/want-to-know* and with matrix polar questions.

## 6 Conclusion

I have shown that existing approaches to the licensing of weak *even* in matrix polar questions cannot be extended to explain the distribution of weak *even* in embedded polar questions. The distinct strategies proposed by Abels 2003 and Guerzoni 2003, 2004 for allowing weak *even* to trigger a non-pathological presupposition in a polar question overgenerate; specifically, they predict unattested interpretations of polar questions containing weak *even* that are embedded under responsive verbs like *know* and *tell*. I intend to develop my own account of the distributional patterns presented here in future work. I have suggested that the distribution of weak *even* in embedded polar questions resembles its distribution in other non-monotonic environments like in the scope of non-monotonic quantifiers (Crnič 2011, 2014). As emphasized in Crnič's work, the distribution of weak *even* in non-monotonic environments is highly context-dependent and subject to constraints of plausibility. I speculate that plausibility may explain why weak *even* is more easily accepted when embedded under rogative verbs like *wonder* than when embedded under responsive verbs like *know*.

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