# Presupposed Ignorance and Exhaustification

Benjamin Spector — Institut Jean Nicod, CNRS-ENS-EHESS
Yasutada Sudo — University College London

**Abstract.** This paper investigates the interactions between presuppositions and scalar implicatures. We start our discussion with a previously undiscussed puzzle which we call *presupposed ignorance* and offer a preliminary account of it. We then claim that certain types of interactions between presuppositions and scalar implicatures, namely those involving Strawson-decreasing presupposition triggers and weak scalar items, can be understood as special cases of presupposed ignorance. But we also point out that this cannot be the whole story, as it runs into problem with examples involving Strawson-increasing presupposition triggers with weak scalar items. To counter this problem, we propose that the mechanism of scalar strengthening, namely the exhaustivity operator (*EXH*), interacts with the mechanism responsible for presupposed ignorance in an intricate manner, thereby giving rise to the complex empirical patterns we observe.

**Keywords:** Presupposition, Scalar implicature, Presupposed ignorance, Exhaustification

## 1. Introduction

This paper investigates the intricate interactions between presuppositions and scalar implicatures in sentences like the following.

(1) a. John is aware that some of the students smoke.
    b. John is unaware that some of the students smoke.

These sentences contain a factive presupposition trigger (*(un)aware*) and a scalar item (*some*). In the present paper, we will attempt to answer the following simple question: what kind of scalar inferences so these sentences trigger? However, our answers will turn out to be rather complex. On the one hand, as previously observed by Sharvit and Gajewski (2008) and Gajewski and Sharvit (2012), (1b) has a reading that presupposes that some but not all of the students smoke (as we will see later, our theory derives a weaker inference, which we argue can be strengthened by means of a separate mechanism). On the other hand, we observe that (1a), specifically when *some* is stressed, has a reading that presupposes that all of the students smoke. We will furthermore observe that this is only one of several possible readings for (1a), and that prosody plays an important role in determining the perceived presuppositions of a sentence such as (1a).

This rather complex empirical picture forces our theory to have a certain degree of complexity as well. We will posit two different mechanisms for scalar inferences. One of them is based on a previously unnoticed puzzle, which we call *presupposed ignorance*, which we discuss in the next section. We claim in Section 3 that the scalar inferences that sentences like (1b) have are part of the larger phenomenon of presupposed ignorance. We, however, point out in Section 4 that the scalar inferences of sentences like (1a) are not amenable to the same explanation. We will offer a solution that makes use of an exhaustivity opetaror (*EXH*). By assuming that *EXH* is a presupposition hole with respect to negated alternatives, and that it applies before the mechanism responsible for presupposed ignorance applies, we will account for the scalar inferences that both of the above sentences may have.

## 2. Presupposed Ignorance

We will illustrate the problem of presupposed ignorance using the additive presupposition trigger *too*. It is standardly assumed that it triggers an additive presupposition without affecting the assertive content of the sentence it occurs in. More concretely, *John, too, PRED* asserts that John PRED and presupposes that another salient individual (called the 'antecedent') PRED. This straightforwardly explains the contrast below.

(2) Mary will go to Yale.
  a. John, too, will go to an Ivy League university.
  b. #John, too, will go to Harvard.

Now, against this backdrop, consider (3), which is infelicitous.

(3) Mary will go to Yale. #John, too, will go to Yale or Harvard.

The unacceptability of this example is not straightforwardly explained by the standard view. That is, since *Mary will go to Yale* entails that Mary will go to Yale or Harvard, *Mary* should be should be able to serve as a good antecedent for *too* in the second sentence.

We suggest that what goes wrong in the second sentence of (3) is that it involves additional inferences, which we call *presupposed ignorance inferences*, to the effect that it is must not be known whether the individual which served as an antecedent (in this case, Mary) will go to Yale nor whether will go to Harvard. These inferences clashes with the asserted content of the first sentence, which explains the infelicity of (3). In fact, if the first sentence is changed to a disjunctive sentence, the examples becomes felicitous, as demonstrated by (4).

(4) Mary will go to Yale or Harvard. John, too, will go to Yale or Harvard.

Presupposed ignorance inferences are not limited to presuppositions triggered by additive particles. For instance, they arise with factive predicates like *unaware*, as shown by (5). As we will explain later on, it is crucial that the presupposition trigger here is negative, or more precisely, Strawson-decreasing.[1]

[1] A function $f$ from propositions to propositions is Strawson-decreasing if the following holds: for any two (bivalent) propositions $\phi$ and $\psi$ such that $\phi$ entails $\psi$, for every world $w$ such that both $f(\phi)(w) \neq \#$ and $f(\psi)(w) \neq \#$, if $f(\psi)(w) = 1$, then $f(\phi)(w) = 1$. This definition can easily be generalized to functions applying to the denotations

(5) Mary will go to Yale. #But John is unaware that she will go to Yale or Harvard.

Furthermore, other 'ignorance inducing items' besides disjunction give rise to similar inferences.[2]

(6) a. Mary has three children. #John, too, has at least two children.
b. Context: it is common knowledge that Mary has three children
John is unaware that Mary has at least two children.

Compare the above examples with items that do not trigger ignorance, as in (7) and (8) (although the contrasts might not be very sharp, as they sometimes do give rise to ignorance inferences).

(7) a. Mary will go to Yale. John, too, will go to one of the Ivy League universities.
b. Mary has three children. John, too, has more than one child.
c. Berlin is freezing. Göttingen, too, is cold.

(8) a. Context: It is common knowledge that Mary has three children.
John is unaware that Mary has more than one child.
b. Context: It is common knowledge that Mary will go to Yale.
John is unaware that Mary will go to an Ivy League university.

Here, we suggest a preliminary account of presupposed ignorance inferences. The most crucial aspect of our analysis is that presupposed ignorance involves reference to alternatives. More specifically, we posit the following principle

(9) **Presupposed Ignorance Principle** (PIP):
$\phi_p$ is infelicitous in context $c$ if $\phi_p$ has an alternative $\psi_q$ such that
a. $q$ is not weaker than $p$; and
b. $c$ satisfies $q$ (= $q$ is common knowledge in $c$).
(where $\phi_p$ is a sentence $\phi$ whose presupposition is $p$)

Let us apply this to the example (3) ('Mary will go to Yale. #John, too, will go to Yale or Harvard'). It is assumed that disjunction 'A or B' generally has three alternatives: 'A', 'B', and 'A and B' (Sauerland, 2004). Thus, the second sentence of the example has the following three alternatives.

of expressions which have a non-propositional type ending in $t$.

[2] One might find the examples in (6) not so bad. Roughly put, if the current topic of the conversation is about who has more than one child, the examples seem more acceptable, but a sense of infelicity does arise if the question under discussion is about how many children every person has. In fact, similar contextual tricks render the above example (3) acceptable. Specifically, if one changes the example slightly, e.g. with Oxford and Cambridge, one might find it more or less acceptable, especially in a context where we are interested in finding out who will go to Oxbridge. We claim that these observations are in fact not incompatible with the analysis to be developed below, if the contextual effects on alternatives are taken into consideration. But as this is orthogonal to our main point, we will not dwell on this issue any further here. See Fox and Katzir (2011) for relevant discussion. What is important for us is the contrasts between (6) and (7) and (8)

(10) a. John, too, will go to Yale.
b. John, too, will go to Harvard.
c. John, too, will go to Yale and Harvard.

What are the presuppositions of these alternatives? Assuming that the antecedent is fixed to Mary, they presuppose the following, respectively.

(11) a. Mary will go to Yale.
b. Mary will go to Harvard.
c. Mary will go to Yale and Harvard.

Since these presuppositions are stronger than the presupposition of the uttered sentence (i.e. that Mary will go to Yale or Harvard), the PIP entails that the sentence in question is infelicitous if any of the following is the case.

(12) a. It is common knowledge that Mary will go to Yale.
b. It is common knowledge that Mary will go to Harvard.
c. It is common knowledge that Mary will go to Yale and Harvard.

In other words, the sentence is only felicitous if the following are all true.

(13) a. It is not common knowledgen that Mary will go to Yale.
b. It is not common knowledge that Mary will go to Harvard.
c. It is not common knowledge that Mary will go to Yale and Harvard.

These are the presupposed ignorance inferences. As mentioned above, the infelicity of (3) is explained by the fact that (13a) clashes with what the first sentence asserts.

We can account for the additional examples mentioned above using the PIP, but as this is routine, we will leave this task to the reader (for cases involving *at least* $n$, the alternatives need to be of the form *exactly* $m$ and *at least* $m$).

Arguably, the way the PIP is formulated is rather *ad hoc* at this moment. In particular, its connection with the type of inference called 'anti-presuppositions' should be investigated further (Percus, 2006, 2010; Sauerland, 2008). We will essentially leave this important issue for further research, as our main interest here is the interactions between presuppositions and scalar implicatures.[3]

[3] However, it is worth remarking that the PIP and the standard mechanism that generates anti-presuppositions, called *Maximize Presupposition* (Heim, 1991) are distinct and that the latter does not generate presupposed ignorance inferences. One common formulation of Maximize Presupposition is as follows (another version uses contextual equivalence instead of mutual Strawson-entailment, but this difference is inconsequential for the point we are making here).

(i) *Maximize Presupposition*
$\phi_p$ is infelicitous in context $c$ if $\phi_p$ has an alternative $\psi_q$ such that:

In what follows, we discuss two separate cases, i.e. (1a) and (1b), in turn. First, we will focus on examples like (1b) which involve Strawson-decreasing presupposition triggers like *unaware*, and argue that the observed inference can be understood as a presupposed ignorance inference. However, in the subsequent section, we will see that the PIP makes wrong (or, to be more precise, incomplete) predictions for examples like (1a) that involve Strawson-increasing presupposition triggers like *aware*. We will argue that such examples involve the mechanism responsible for scalar implicatures, namely the exhaustivity operator *EXH*. With independently motivated auxiliary assumptions about *EXH*, we can explain the role of prosody in the complex patterns we observe.

## 3. Strawson-Decreasing Contexts

Consider the following example involving the factive presupposition trigger *unaware* and a scalar item *some*, repeated from (1b).

(14) John is unaware that some of the students smoke.

Throughout the paper, we will concentrate on the narrow scope reading of *some*, relative to *unaware* (a narrow-scope reading would be forced by using *most* instead of *some*, which would yield a similar scalar inference but does not create a similar scopal ambiguity). Under this reading, as previously pointed out by Sharvit and Gajewski (2008) and Gajewski and Sharvit (2012), the most natural interpretation seems to involve a scalar implicature *only in the presupposition*. That is, the assertion is simply the negation of 'John believes that there are some students who smoke', without any scalar implicature, while the presupposition is that some but not all of the students smoke, with a scalar implicature. In fact, the sentence is infelicitous if it is known that all of the students smoke.

The key feature of the above example is the Strawson-decreasing presupposition trigger *unaware*, which is negative in the assertion but the positive in the presupposition, and analogous observations can be made across weak scalar items like *some* occurring in the scope of Strawson-decreasing operators.

Gajewski & Sharvit claim that this observation can be used to adjudicate between certain theoretical views on scalar implicature. In particular, they argue that it is problematic for purely pragmatic views on scalar implicature computation, and also for a kind of grammatical theory that makes use of the exhaustivity operator (*EXH*). Furthermore, they put forward an analysis based on Chierchia's (2004) grammatical theory of scalar implicature coupled with a multi-dimensional theory

---

a. $\phi_p$ and $\psi_q$ Strawson-entail each other; and

b. $q$ asymmetrically entails $p$; and

c. $c$ satisfies $q$.

(ii) Sentence $S$ Strawson-entails sentence $S'$ iff for all worlds $w$, $[\![S]\!]^w = 1$ and $[\![S']\!]^w \neq 0$.

Essentially the PIP is Maximize Presupposition without the first clause. This is essential for generating presupposed ignorance inferences, since (3) does not Strawson-entail (or contextually entail) its alternatives in (10). So Maximize Presupposition yields no inferences for (3).

of presupposition in the style of Karttunen and Peters (1979). We think that their conclusions are too strong, and also that the analysis they suggest runs into empirical problems, but for reasons of space, we will not delve into these points here (see a much longer version of the present paper, Spector and Sudo 2014). Instead, we make the following simple claim here: the scalar inference observed for (14) can be understood as a presupposed ignorance inference.

Here is how our account works for (14). We assume that (14) has (15) as its alternative.

(15) John is unaware that all of the students smoke.

Because this alternative has a stronger presupposition to the effect that all of the students smoke, the PIP states that (14) is infelicitous if it is common knowledge that all of the students smoke.

Notice that this inference is weaker than what one might perceive (and what Gajewski & Sharvit ascribe to (14)). That is, what we predict has negation above 'it is commonly known that', while (14) might sound as presupposing that not all of the students smoke. But this is not a bad prediction, as the sentence is actually felicitous in a context where it is not common knowledge that not all of the students smoke, provided that it is also not common knowledge that all of the students smoke (i.e. it is not common knowledge whether all of the students smoke), as in the following example.

(16) (CONTEXT: We know some of the students smoke, but don't know whether all do.)
Prof. Jones knows nothing about the students. He's unaware that some of the students smoke, for example.

Nonetheless, the stronger presupposition that not all of the students smoke seeems to be the one we often perceive, especially out of the blue. To explain this, we adopt the proposal of Chemla (2008), which spells an explicit pragmatic mechanism whereby anti-presuppositions of the form $\neg CG(p)$ can be strengthened into $CG(\neg p)$ (where $CG$ stands for 'it is common knowledge that').

To conclude, the PIP explains in our view the scalar inferences triggered in Strawson-decreasing contexts. However, as we will now see, it runs into a problem with examples involving Strawson-increasing elements.

## 4. Strawson-Increasing Contexts

We illustrate the problem of Strawson-increasing operators with the positive counterpart of (14), given in (17).

(17) John is aware that some of the students smoke.

Unlike (14), (17) can be quite naturally used in contexts where it is common knowledge that all of the students smoke (again, one can use *most* to force the narrow scope reading), as illustrated by

(18).

(18) A: All of the students are smokers in this department! Do professors know this?
B: Well, Prof. Jones is aware that some of the students smoke.

Notice that the relevant reading is different from the embedded SI reading, which assert that John believes that some but not all of the students and presupposes the same thing. This would be infelicitous in (18). Also, it is also not the case that there is no scalar implicature in (18). Rather, the assertion triggers the scalar implicature that Prof. Jones does not know all of the students smoke. Furthermore, even if it is granted that scalar implicatures are optional, there still is a stark contrast in acceptability between (14) and (17) in contexts where it is common knowledge that all of the students smoke.

This observation is problematic for the PIP.[4] In fact, what the PIP predicts is the same presupposed ignorance inference as we derived for (14). Specifically, the relevant alternative *John is aware that all of the students smoke* presupposes that all of the students smoke, which is stronger than the presupposition of (17). Thus it is wrongly predicted that the example in (18) should be infelicitous.

In order to solve this problem, we postulate a different scalar strengthening mechanism: the **exhaustivity operator (*EXH*)** (Groenendijk and Stokhof, 1984; Chierchia, 2006; Chierchia et al., 2012; Fox, 2007; van Rooij and Schulz, 2004; Spector, 2003, 2007).[5] Here we use Fox's operator as defined in (19) (though nothing here hinges on choosing this definition rather than one based on Groenendijk and Stokhof's 1984 original proposal – see Spector 2014)

(19) $[\![\boldsymbol{EXH}_{Alt}\ \phi]\!]^w = [\![\phi]\!]^w = 1 \wedge \forall\psi \in Alt[IE_{(\phi,Alt)}(\psi) \Rightarrow [\![\psi]\!]^w = 0]$,
Where $Alt$ denotes a set of propositions (the alternatives of $\phi$), and $IE_{(\phi,Alt)}(\psi)$ stands for '$\psi$ is innocently excludable given $\phi$' and $Alt$ in the sense of Fox (2007),[6] i.e.
$\psi \in \bigcap\{\, A \subseteq Alt \mid A$ is a maximal set such that $\{\, \neg p \mid p \in A' \,\} \cup \{\, \phi \,\}$ is consistent$\,\}$.

The above definition of *EXH*, however, does not say what happens when $\phi$ and $\psi$ have presuppositions. Here we claim that *EXH* is a presupposition hole for the negated alternatives. In other words, a sentence of the form '*EXH*($\phi_p$)' presupposes $p$ and all the presuppositions of the negated alternatives. We think that this is conceptually appealing, given that negation is a presupposition

[4] It is also problematic for Gajewski & Sharvit's account, as nothing in their account of presuppositional scalar inferences is sensitive to monotonicity in the assertive dimension. See Spector and Sudo (2014) for detailed discussion on this.

[5] We leave it open whether our account could be reformulated in terms of pragmatic approach to scalar implicatures (in which case *EXH* should be viewed as a shortcut for Gricean reasoning, as in van Rooij and Schulz 2004; Spector 2003, 2007). Thus, what we claim here does not necessarily motivate a grammatical view of scalar implicature computation (contrary to what Gajewski & Sharvit conclude from their observation on Strawson-decreasing examples).

[6] The notion of innocent excludability is necessary to account for disjunction (and other ignorance inducing items like *at least* $n$), but for other cases involving scalar items like *some* vs. *all*, it amounts to the same thing as 'non-weaker than'.

hole and *EXH* is essentially a type of negation. Here is a formal rendering of this idea in a trivalent theory of presupposition.

(20) $$[\![\boldsymbol{EXH}_{Alt}\ \phi]\!]^w = \begin{cases} 1 & \text{iff } [\![\phi]\!]^w = 1 \wedge \forall\psi \in Alt[IE_{(\phi,Alt)}(\psi) \Rightarrow [\![\psi]\!]^w = 0] \\ 0 & \text{iff } [\![\phi]\!]^w = 0 \vee \exists\psi \in Alt[IE_{(\phi,Alt)}(\psi) \wedge [\![\psi]\!]^w = 1] \\ & \quad \wedge \neg\exists\psi_q \in Alt[IE_{(\phi,Alt)}(\psi) \wedge [\![\psi]\!]^w = \#] \\ \# & \text{iff } [\![\phi]\!]^w = \# \vee \exists\psi \in Alt[IE_{(\phi,Alt)}(\psi) \wedge [\![\psi]\!]^w = \#] \end{cases}$$

For technical reasons, we need to be careful about the notion of consistency behind the definition of innocent excludability, given that in a trivalent framework there are several natural but distinct possible definitions of familar logical notions such as consistency and logical consequence. We assume that a set of (possibly trivalent) propositions is consistent if there is a world in which every member of the set is true.[7]

With this definition of *EXH*, we can account for the reading of (17) that we are after. That is, due to the innocently excludable alternative *John is aware that all of the students smoke*, which presupposes that all of the students smoke, the entire sentence inherits this presupposition. Consequently, the sentence presupposes that all of the students smoke.

But what about the PIP? In order for our account to work, the following assumption is necessary: the PIP applies after *EXH*. If so, for our example (17), the input to the PIP already presupposes that all of the students smoke, and it does not have an alternative with a stronger presupposition. Consequently, the application of the PIP is vacuous, and no presupposed ignorance inference is predicted. This explains why (18) is felicitous.

A nice feature of the present account is that with certain natural auxiliary assumptions, it explains a number of additional facts.

Firstly, under the relevant reading of (17), it is natural to give focus prominence on *some*. This can be understood as due to the focus sensitivity of *EXH*.

Secondly, we observe that a very similar reading arises with an overt *only* in the matrix clause, as in (21). CAPITALISATION indicates a prosodic prominence in the following examples.

(21) John is only aware that SOME of the students smoke.

*EXH* and *only* are often said to have a number of interpretive commonalities, including focus sensitivity. Furthermore, it can be demonstrated independently that *only* is a presupposition hole with

[7] Another logically possible notion of consistency states that a set of propositions is consistent* iff there is a world in which none of the members is false. These two notions differ in a trivalent setting. See Spector and Sudo (2014) for extensive discussion of a theory that makes use of consistency*, which we argue has empirical drawbacks.

respect to negated alternatives, just like *EXH* under our view. The following example illustrates this point.

(22) Of these three boys, only John went back to London.

That is, this sentence presupposes that all of the three students came from London and were not in London at the relevant time, which are presuppositional inferences triggered by *went back*. These similarities between *EXH* and *only* naturally fall out under our analysis.

Thirdly, we observe that prosodic prominence on the scalar item *some* is somewhat marked in a Strawson-decreasing context, as illustrated by in (14), unlike what is observed in (17). Furthermore, *only* cannot be inserted in the matrix clause in (14) if construed as associated with *some*.

(23) a. *John is unaware that SOME of the students smoke.
b. *John is only unaware that SOME of the students smoke.

These data can be explained in terms of a ban against vacuous applications of *EXH* and *only*: these operators give rise to infelicity if they fail to exclude any alternative. Let us see how this constraint accounts for (23). Consider (23b) first. Notice that due to the negative operator *unaware*, the argument of *only* (called the *prejacent*) 'John is unaware that some of the students smoke' entails its alternative 'John is unaware that all of the students smoke', provided that the latter does not suffer from presupposition failure. Recall that *only* is a presupposition hole, so if the latter were to be negated, its presupposition ought to be satisfied, but then it cannot be negated, because its assertive content is entailed by the prejacent. Consequently, the application of *only* here cannot negate anything and hence is vacuous, which leads to infelicity. We explain the unacceptability of (23a) in the same manner, with the additional assumption that focus marking on *some* tends to correlate with the presence of *EXH*. Then, on the assumption that *EXH* is subject to the same constraint against vacuous uses, the marked character of (23b) is explained. Furthermore, as predicted by this account, with a high scalar item *all*, the contrast between *unaware* and *aware* flips.

(24) a. *John is (only) aware that ALL of the students smoke.
b. John is (only) unaware that ALL of the students smoke.

To state the relevant constraints on *EXH* and *only* more succinctly, applications of these operators result in infelicity if the prejacent Strawson-entails all of its alternatives.

Fourthly, it should be remarked that without focus-marking on *some* (or on a constituent that includes *some*), there can be no *EXH* associating with *some* (or with a constituent that includes *some*), and as a result (17) is predicted to trigger the same presupposed ignorance inference as (14). Consider the example in (25) with focus prominence on the matrix subject, which induces de-accenting of the following material.

(25) Only JOHN is aware that some of the students smoke.

We observe that this example indeed triggers the same presupposed ignorance inference as (14), i.e. it is not common knowledge that all of the students smoke – as with (14), this can be strengthened into an inference that not all of the students smoke (which is the presupposition that Gajewski and Sharvit's 2012 proposal associates with such a sentence).

Before closing, since we have introduced a second mechanism, *EXH*, let us come back to our first example of presupposed ignorance, (3). Notice in particular that such disjunctive sentences have scalar implicatures generated by the conjunctive alternative. In order to see this clearly, let us consider the following variant of the example.

(26) a. Mary speaks French but not German. #John, too, speaks French or German.
b. Mary speaks French or German. John, too, speaks French or German.

Clearly, the second sentence of (26b) implicates that John does not speak both languages, which we would like to generated with *EXH*.

Interestingly, however, it turns out that this cannot be done if *EXH* is applied above *too*. Here is why. With this scope relation, the sole alternative of 'John, too, speaks French or German' that can be negated by *EXH* would be the following conjunctive alternative.

(27) John, too, speaks French and German.

This sentence presupposes that Mary speaks both French and German. Thus, the second sentence of (27) already has a strong presupposition, and hence the PIP is vacuous, because all of the alternatives relevant for the PIP, namely the sentences in (28), presuppose the same thing.

(28) a. *EXH*(John, too, speaks French)
b. *EXH*(John, too, speaks German)
c. *EXH*(John, too, French and German)

Although the strong presupposition accounts for the infelicity of (26a), it also rules out the acceptable example (26b). Furthermore, it wrongly predicts the following to be felicitous.

(29) Mary speaks French and German. #John, too, speaks French or German.

In addition, we do not generate presupposed ignorance inferences.

It turns out that the correct inferences are predicted if *too* takes scope over *EXH*. If this is the case, the presupposition of the second sentence of (26a) would be that Mary only speaks one of the two languages. This seems to be on the right track given the observations so far. Furthermore, we obtain the correct presupposed ignorance inferences. Specifically, the alternatives relevant for the PIP are the following.

(30) a. too(*EXH*(John speaks French))
b. too(*EXH*(John speaks German))
c. too(*EXH*(John speaks French and German))

These presuppose the following respectively (with Mary being the antecedent).

(31) a. Mary speaks French and not German.
b. Mary speaks German and not French.
c. Mary speaks French and German.

Since these presuppositions are all non-weaker than the presupposition of the second sentence of (26a), we derive the following presupposed ignorance inferences.

(32) a. It is not commonly known that Mary speaks French but not German.
b. It is not commonly known that Mary speaks German but not French.
c. It is not commonly known that Mary speaks French and German.

What we cannot explain at this moment is why this scope relation is the only one that is available. If this is due to a general constraint regarding the relative scope of *EXH* and *too*, we expect the following to be infelicitous as well:

(33) Mary read all of the books. John, too, read some of them.

It is not clear to us whether this is felicitous or not, and we may need to gather more data about such cases. Note that there is no difficulty in explaining why (34) is felicitous, if we assume that the scale $\langle$cold, freezing$\rangle$ is only optionally activated, as we have already noticed (cf. our comments regarding (7c)).

(34) Berlin is freezing. Göttingen, too, is cold.

However, it seems to us that not only is (34) felicitous, it can actually give rise to the implicature that it is not freezing in Göttingen. To generate this implicature, we would need to assume that *EXH* has been inserted in the second sentence, but then, in order for the PIP not to rule out the sentence, *EXH* must scope over *too* in this case (contrary to (29), for which we assumed that *EXH* cannot scope over *too*). We leave this issue to further research.

## 5. Conclusions

In this paper, we saw that two types of inferences can be generated by scalar items in presuppositional environments. On the one hand, in the scope of a Strawson-decreasing operator like *unaware*, as in (14), a weak scalar item like *some* generates the presupposed ignorance inference that it is not common knowledge that the presupposition of the alternative with a strong scalar item like *all* obtains. We explained this by means of the PIP. On the other hand, in the scope of a Strawson-increasing operator like *aware*, as in (17), a weak scalar item can generate a stronger presupposition by inheriting the presupposition of the alternative with strong scalar item (although it can also have a similar reading as in the Strawson-decreasing case, typically when the scalar item is de-accented). We attributed this to the presupposition projection properties of the operator *EXH*, namely the fact that *EXH* is a hole for presuppositions. On the assumption that *EXH* applies before the PIP does, it makes the application of the PIP vacuous in Strawson-increasing environments (cases like (17)).

## References


Chemla, E. (2008). An epistemic step for anti-presuppositions. *Journal of Semantics 25*(2), 141–173.

Chierchia, G. (2004). Scalar implicatures, polarity phenomena, and the syntax/pragmatics interface. In A. Belletti (Ed.), *Structures and Beyond: The Cartography of Syntactic Structures*, pp. 39–103. Oxford: Oxford University Press.

Chierchia, G. (2006). Broaden your views: Implicatures of domain widening and the "Logicality" of language. *Linguistic Inquiry 37*(4), 535–590.

Chierchia, G., D. Fox, and B. Spector (2012). Scalar implicature as a grammatical phenomenon. In C. Maienborn, K. von Heusinger, and P. Portner (Eds.), *Semantics: An International Handbook of Natural Language Meaning*, pp. 2297–2331. Berlin: de Gruyter.

Fox, D. (2007). Free choice and the theory of scalar implicatures. In U. Sauerland and P. Stateva (Eds.), *Presupposition and Implicature in Compositional Semantics*, pp. 71–112. Palgrave Macmillan.

Fox, D. and R. Katzir (2011). On the characterization of alternatives. *Natural Language Semantics 19*(1), 87–107.

Gajewski, J. and Y. Sharvit (2012). In defense of grammatical approach to local implicatures. *Natural Language Semantics 20*(1), 31–57.

Groenendijk, J. and M. Stokhof (1984). *Studies on the Semantics of Questions and the Pragmatics of Answers*. Ph. D. thesis, University of Amsterdam.

Heim, I. (1991). Artikel und Definitheit. In A. von Stechow and D. Wunderlich (Eds.), *Semantik: Ein internationales Handbuch der zeitgenössischen Forschung/Semantics: An International Handbook of Contemporary Research*, pp. 487–535. Berlin: de Gruyter.

Karttunen, L. and S. Peters (1979). Conventional implicature. In C.-K. Oh and D. Dinneen (Eds.), *Syntax and Semantics 11: Presupposition*, pp. 1–56. New York: Academic Press.

Percus, O. (2006). Antipresuppositions. Technical report, Japan Society for the Promotion of Science. Report of the Grant-in-Aid for Scientific Research (B), Project No. 15320052.

Percus, O. (2010). Antipresuppositions revisited. Talk given at CRISCO, Université de Caen, March 4, 2010.

Sauerland, U. (2004). Scalar implicatures in complex sentences. *Linguistics and Philosophy 27*(3), 367–391.

Sauerland, U. (2008). Implicated presuppositions. In A. Steube (Ed.), *The Discourse Potential of Underspecified Structures*, Language, Context and Cognition, pp. 581–600. Berlin: Mouton de Gruyter.

Sharvit, Y. and J. Gajewski (2008). On the calculation of local implicatures. In C. B. Chang and H. J. Haynie (Eds.), *WCCFL 26*, pp. 411–419.

Spector, B. (2003). *Aspects de la Pragmatique des Operateurs Logiques*. Ph. D. thesis, Université Paris 7.

Spector, B. (2007). Aspects of the pragmatics of plural morphology: On higher-order implicatures. In U. Sauerland and P. Stateva (Eds.), *Presuppositions and Implicatures in Compositional Semantics*, pp. 243–281. New York: Palgrave-Macmillan.

Spector, B. (2014). Comparing exhaustivity operators. Ms., Institut Jean Nicod (CNRS–ENS–EHESS).

Spector, B. and Y. Sudo (2014). Presupposed ignorance and exhaustification: how scalar implicatures and presuppositions interact. Ms., Institut Jean Nicod (CNRS–ENS–EHESS) and UCL (under review).

van Rooij, R. and K. Schulz (2004). Exhaustive interpretation of complex sentences. *Journal of Logic, Language and Information 13*(4), 491–519.