Presuppositional Exhaustification*

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Abstract Grammatical theories of Scalar Implicatures make use of an exhaustivity operator **exh**, which asserts the conjunction of the prejacent with the negation of excludable alternatives. We present a new Grammatical theory of Scalar Implicatures according to which **exh** is replaced with **pex**, an operator that contributes its prejacent as asserted content, but the negation of scalar alternatives at a *non-at-issue* level of meaning. We show that by treating this non-at-issue level as a *presupposition*, this theory resolves a number of empirical challenges faced by the old formulation of **exh** (as well as by standard neo-Gricean theories). The empirical challenges include projection of scalar implicatures from certain embedded environments ('*some* under *some*' sentences), their restricted distribution under negation, and the existence of common ground-mismatching and oddness-inducing implicatures. We argue that these puzzles have a uniform solution given a **pex**-based theory of implicatures and independently motivated principles concerning presupposition projection and the conditions and constraints under which they may be locally and globally accommodated.

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1 Presuppositional exhaustification: Basic assumptions and implementation

According to Grammatical accounts of Scalar Implicatures (SIs), SIs are triggered by an exhaustification operator, **exh**, which asserts both its prejacent and the negation of each of its excludable alternatives (Chierchia et al. 2011, a.o.). This view is captured in (1) (some of the specifics of (1) are based on the account in Magri 2009 and anticipate the discussion to follow):

(1) For a structure ϕ of propositional type and local context c.[1]

a. $[\![\mathbf{exh}(\phi)]\!] = [\![\phi]\!] \wedge \bigwedge \neg [\![\psi]\!] : \psi \in Excl(\phi) \wedge [\![\psi]\!] \in R$.

b. $Excl(\phi)$ is a subset of the set of formal alternatives of ϕ, such that, for each $\psi \in Excl(\phi)$, $[\![\psi]\!]$ isn't logically entailed by $[\![\phi]\!]$ (or equivalently, such that $[\![\phi]\!]$ is logically consistent with $\neg[\![\psi]\!]$).

c. R = a contextually assigned 'relevance' predicate which minimally satisfies the following two conditions:[2] (i) the prejacent, ϕ, is relevant, i.e. $[\![\phi]\!] \in R$, and (ii) any proposition that is contextually equivalent to the prejacent is also in R (i.e., if $[\![\phi]\!] \cap c \equiv [\![\psi]\!] \cap c$, then $[\![\psi]\!] \in R$).

1 Following standard practice, we will throughout the paper represent a context c as a set of worlds ('context set') compatible with all the propositions mutually believed by the participants in c. We also sometimes use the term 'common ground' to informally describe the context set.

2 Conditions (i) and (ii) are necessary for the range of data we are concerned with in this paper. Generally (i) and (ii) are not seen as sufficient (Chierchia et al. 2011, Fox & Katzir 2011, Roberts 2012, Trinh & Haida 2014). This is compatible with our conclusions in this paper, but the weaker condition stated in the text is sufficient for our purposes.

The entry in (1a) implies that the prejacent of **exh**, ϕ, and the SIs, $\neg\psi$ for each excludable alternative, are both communicated at the at-issue (assertive) level of meaning. In this paper, we present evidence that the SIs triggered by **exh** should not be wholly at issue: specifically, SIs behave with respect to properties like projection and mismatches with the common ground akin to a species of non-at issue, presupposed content. For concreteness we propose that **exh** be replaced with **pex** in (2), an exhaustification operator which asserts the prejacent ϕ, but **presupposes** the SIs, $\neg\psi$.[3] In section 5, we return to the question whether modelling the non-at issue component of exhaustification as strictly presuppositional is ultimately correct, and consider to what extent this dimension can instead be modelled as belonging to a different class of non-at issue content.

(2) For a structure ϕ of propositional type and a local context c:

a. $[\![\textbf{pex}(\phi)]\!] = \begin{cases} \textbf{presupposition: } \bigwedge \neg[\![\psi]\!] : \psi \in Excl(\phi) \wedge [\![\psi]\!] \in R \\ \textbf{assertion: } [\![\phi]\!] \end{cases}$

b. $Excl(\phi)$ is defined as in (1-b).

c. R is defined as in (1-c).

In terms of its effect on different ingredients of meaning, **pex** is the mirror image of the overt exhaustifier *only*, on standard accounts of the latter (Horn 1969): **pex** presupposes what *only* asserts and vice versa.[4]

We also assume, following Magri (2009), that **pex** is obligatorily adjoined to any structure of propositional type at least once.[5] On this kind of implementation, standard cases where SIs appear to be optional are modeled as cases in which exhaustification is rendered vacuous due to the effect of the relevance parameter R; in such cases, the alternative that would be responsible for the missing SI is not in R.

As a simple illustration, a sentence like *some students passed* will be parsed as in (3-a). If its only (excludable) alternative is as in (3-b), then if that alternative is also relevant in the context of utterance (i.e., if $[\![$(3-b)$]\!] \in R$), the output of (3-a) would be (3-c).

(3) Some students passed.

3 Bade & Sachs (2019) also propose an amendment to **exh** in (1). It is, however, orthogonal to the issue we discuss in this paper.

4 We briefly return to the relationship between *only* and **pex** in the summary section. It should be noted that our proposal for SIs bears some resemblance to certain proposals for the meaning of cleft sentences (e.g. Velleman et al. 2012, Büring & Križ 2013), on which the exhaustivity inference of clefts is introduced at the level of presuppositions while the assertive level conveys just the meaning of the prejacent.

5 Meyer (2015) derives the distribution of **exh** from more general principles. As far as we can see, her approach would also work for our data, but for ease of presentation we adopt Magri's stipulation.

a. LF: **pex**[Some students passed]
b. *Excl*(*some students passed*) = *All students passed*
c. Presupposition: not all students passed;
Assertive content: some students passed.[6]

The central claim of this paper is that **pex** resolves a number of empirical challenges faced by the standard, non-pressuppositional formulation of **exh**. These include observations about the way in which SIs project from certain embedded environments, as well the oddness-inducing SIs studied in Magri (2009). Based on those results, we will argue that the Grammatical theory should be formulated in terms of **pex**. As we will see, there are various modifications of, or supplements to, standard **exh**-based theories that, to varying degrees, deal with some of our puzzles. Yet we will aim to show that, given the options, only an **pex**-based theory provides a principled and uniform approach to our puzzles: in each case, we base our account on the interaction between different ingredients of meaning as triggered by **pex** and how those interact with independently motivated principles and constraints on presupposition projection and local and global accommodation. After discussing the advantages of **pex** over **exh**, we explore ways dealing with the intuition that, in plain cases, SIs don't feel like standard presuppositions.

The plan is as follows. In section 2 we show that **pex** accounts for the complex pattern of SIs in '*some-under-some*' constructions (discovered in Chierchia 2004), which raises problems for both **exh**-based theories and Neo-Gricean theories. In section 3 we show that **pex** explains the limited availability of SIs in downward entailing contexts by unifying it with the phenomenon of presupposition cancellation. In section 4 we argue that **pex** makes better predictions than standard **exh** relative to oddness patterns generated by mismatches between SIs and the common ground (Magri 2009). In section 5 we reconsider plain cases of scalar enrichments and discuss broader methodological questions about the precise sense in which the SIs triggered by **pex** are non-at issue and specifically presuppositional. In section 6 we summarize and point out the connection between our proposal and broader questions regarding the cut between presuppositional and assertive content (the 'triggering' problem for presuppositions).

2 *Some* under *some*

In this section we analyze a pattern of inference that arises from sentences in which a weak scalar item is embedded in the scope of another (hence '*some* under *some*'). The pattern poses a problem for existing theories of SIs, and to our knowledge has never been satisfactorily addressed. We will show that **pex**, coupled with a certain

6 We will use the terms 'assertive' and 'at-issue' content interchangeably.

theory of presupposition projection ('Strong Kleene'), successfully derives the data, thus providing an argument in favor of **pex**.

2.1 Data

Consider (4), where a weak scalar item (*some*) is embedded under another, and two potential implicatures it gives rise to, labeled 'Local' and 'Strong Global' SIs (terminology adapted from Gotzner & Benz 2018):

(4) Some of the girls found some of their marbles.

a. Local SI: *Some of the girls found some but not all of their marbles*
b. Strong Global SI: *None of the girls found all of their marbles*

Gotzner & Benz (2018) report experimental evidence that suggests that subjects readily derive the strong global implicature for '*some* under *some*' sentences like (4). Note that the strong global SI, taken together with the prejacent, entails the local SI (i.e., the conjunction of (4) and (4-b) entails (4-a)). This pattern of inference is predicted by virtually all existing theories of SIs, most straightforwardly by any theory that allows (4) to trigger the alternative *some of the girls found all of her marbles*.

To this we add the observation, following Chierchia (2004), that a *some under some* sentence can also trigger the local SI side by side with what we call a 'Weak Global' SI, which is of the general form '*not all... some...*', as shown in (5).[7,8]

(5) Some of the girls found some of their marbles. And some found all of them.

a. Local SI: *Some of the girls found some but not all of their marbles*
b. Weak Global SI: *Not all of the girls found some of their marbles*
$\equiv$ *Some of the girls didn't find any of their marbles*

The Weak Global SI together with the prejacent (the first sentence of (5)) does *not* entail the Local SI. Note importantly that the second sentence of (5) is not compatible with computing the Strong Global SI for the first sentence in (5), yet

7 The terms 'Strong' and 'Weak' might be misleading in this context, since (4-b) as a whole is not logically stronger than (5-b) as a whole. Rather this terminology is meant to reflect just the logical relationship between the quantifiers 'none' and 'not all'.

8 Chierchia's example is with embedded disjunction under *some*, which has the same logical profile:

(i) Someone smokes or drinks. (Chierchia 2004:61)

a. Local SI: Someone smokes or drinks but not both
b. Weak-Global SI: Not everyone smokes or drinks

both the inferences in (5-a)-(5-b) still arise; therefore the pattern in (5-a)-(5-b) does not depend for its existence on deriving the Strong Global SI.

This means that for a '*some* under *some*' sentence, a theory of SIs needs a way to derive both the local and the weak global inferences, **without** necessarily computing the strong global SI. This is summarized in (6).

(6) **Desideratum**: Given a sentence of the form $Some_x[\ldots\ some_y \ldots\ P(x,y)]$, derive the following implicatures:

a. $\exists x[\ldots\ \exists y \wedge \neg\forall y\ [\ldots P(x,y)]]$ (Local SI)

b. $\neg\forall x[\ldots\ \exists y[\ldots P(x,y)]]$ $(\equiv\ \exists x[\ldots\ \neg\exists y[\ldots P(x,y)]]$ (Weak-global SI)

As it turns out, (6) presents a difficulty for all existing theories of SIs known to us, Grammatical and Neo-Gricean alike.[9] Below we focus on the predictions of the grammatical **exh** theory and show that they are inadequate.

2.2 An exh paradox

In a standard **exh**-based theory, it is possible to derive just the Local SI, and it is possible to derive just the Weak-Global SI. But deriving both is, as far as we can see, not possible without ad-hoc stipulations. The structure in (7) at first glance looks like the correct LF representation to derive (6):

(7) $\textbf{exh}_1$[some of the girls λ_x $\textbf{exh}_2$ [some of the marbles λ_y [x found y]]]

Structure (7) seems promising because each **exh** operator is meant to deliver one of the two inferences we're after: $\textbf{exh}_2$ is supposed to deliver the Local SI, by targeting the embedded 'some', and $\textbf{exh}_1$ is supposed to deliver the Weak Global SI, by targeting the matrix 'some'. However, the interpretation (7) actually yields, which is given in (8), is too weak, in particular the part in (8-b).

(8) Inferences predicted from the parse in (7):

a. *some of the girls founds some but not all of their marbles* (prejacent of $\textbf{exh}_1$)

b. *not all of the girls founds* ***some but not all*** *of their marbles* (output of $\textbf{exh}_1$)

9 We are grateful to Danny Fox for pointing out to him the pattern in (5), and to Paul Marty for helpful discussion. Franke & Bergen (2020) report results from a relevant production and comprehension experiment. They pursue a broad model comparison approach and conclude that an **exh**-based approach outperforms other simpler models, but don't apply a **pex**-based model to their data. It would be interesting to carry out the modelling for the **pex**-based, but we have not been able to do so at this time.

While (8-a) is equivalent to the desired local SI, (8-b) is weaker than the desired Weak Global SI: it only guarantees that some girls found **either** none **or** all of their marbles, but what is needed is to guarantee that some girls found none of the marbles.

To get the desired weak global SI we would want to replace '*some but not all*' in (8-b) with a plain '*some*'. The culprit for that *some but not all* is of course the presence of $\mathbf{exh}_2$ downstream; but we cannot just choose to remove $\mathbf{exh}_2$ from the structure, because its presence is required to generate the local SI in (8-a).

One might suggest that **exh** can optionally delete/disappear from alternatives. Then the (relevant) alternative to the higher **exh** could have the embedded **exh** deleted from it, as shown in (9-b):[10]

(9) a. *Prejacent*: some girls λ_x $\mathbf{exh}_2$ [some of their marbles λ_y [x found y]]
b. *Alternative*: all girls λ_x $\cancel{\mathbf{exh}_2}$ [some of their marbles λ_y [x found y]]

That would work, but it is mysterious why $\mathbf{exh}_2$ could disappear from alternatives. Note that the overt exhaustifier *only* doesn't have this option; (10) cannot have the relevant inference, which would be possible if *only* could be deleted in an analogous way. (10) in fact strongly conveys that all girls found some of their marbles.

(10) Some girls only found SOME of their marbles.
a. $\rightsquigarrow$ Not all girls found **some-but-not-all** of their marbles.
b. $\not\rightsquigarrow$ Not all girls found **some** of their marbles.

One way of trying to justify the deletion of $\mathbf{exh}_2$ in (9-b) is to hold that it follows as an effect of applying a principle of Economy to the step-wise computation of (7).[11] Fox & Spector (2018) proposed an Economy condition which in effect bans the insertion of **exh** in DE environments (in normal circumstances). With Economy, the basic idea would be that the SI associated with matrix $\mathbf{exh}_1$ in (7) is computed first, delivering (11-a). We then compute the SIs associated with each of the embedded tokens of $\mathbf{exh}_2$, but only if each is independently licensed by Economy. Economy licenses the computation of an SI for the first conjunct of (11-a), since $\mathbf{exh}_2$ occurs in an UE-environment, but not for the second one, since there $\mathbf{exh}_2$ occurs in a DE-environment. We can represent this result as in (11-b), which supports the target reading in (11-c).

10 Chierchia (2004) seemed to have suggested a remedy along similar lines to (9), though couched in a different framework for computing SI. In his system, SI are produced not with the help of a syntactic **exh** operator but by the hard-coded semantic compositional rules. Chierchia's (2004:62) suggestion was that SI are "removed in DE(=Downward Entailing) contexts". While this is also the guiding intuition behind our account, we were not able to understand Chierchia's pre-**exh** system in enough detail to evaluate his attempt to cash out this intuition.

11 This line of reasoning was employed by Elliott & Marty (2019) to account for related data.

(11) a. [some of the girls λ_x $\mathbf{exh}_2$ [some of the marbles λ_y [x found y]]] $\wedge$ $\neg$[all of the girls λ_x $\mathbf{exh}_2$ [some of the marbles λ_y [x found y]]]

b. [some of the girls λ_x $\mathbf{exh}_2$ [some of the marbles λ_y [x found y]]] $\wedge$ $\neg$[all of the girls λ_x $\cancel{\mathbf{exh}_2}$ [some of the marbles λ_y [x found y]]]

c. [some of the girls found **some-but-not-all** of their marbles] $\wedge$ $\neg$ [all of the girls found **some** of their marbles]

Economy, however, is a principle which guides the selection of *parses* for expressions; it is not a principle that allows one to selectively ignore the contribution of the syntactic pieces of *one and the same parse* at different levels of meaning produced by that parse. Therefore, we do not find this sketch of explanation based on Economy a real theoretical option. Within a grammatical theory of SIs, in which **exh** is optional, Economy could only affect the selection of whether to parse an expression like (12) from options like (12-a) or (12-b) (a.o., not relevant for deriving our target reading). Once (12-a) is selected, $\mathbf{exh}_2$ is a syntactic item, which not being a focused item for exh_1, should be uniformly present across alternatives, just as any other overt or covert non-focused items.

(12) Some of the girls found some of their marbles.

a. $\mathbf{exh}_1$[some of the girls λ_x $\mathbf{exh}_2$ [some of the marbles λ_y [x found y]]]

b. $\mathbf{exh}_1$[some of the girls λ_x [some of the marbles λ_y [x found y]]]

This then is the conundrum for the standard **exh**-based theories in trying to account for (6): the embedded **exh** is required for one task (local SI), but its contribution interferes with achieving the other task (weak global SI).

2.3 A pex solution

We now show that **pex** derives our desideratum. The key point is that, on defendable assumptions about presupposition projection, a separation between the presuppositional and at-issue content of **pex** allows the presence of an embedded **pex** to not necessarily affect the contribution of material higher-up in the structure.

Let us look at the relevant LF in (13), where **pex** replaces **exh**:

(13) $\mathbf{pex}_1$[some girls λ_x $\mathbf{pex}_2$ [some of the marbles λ_y [x found y]]]

To see what is predicted for (13), we need to know how quantifiers handle presuppositions in their scope, because (13) features a presupposition trigger—$\mathbf{pex}_2$—in the scope of the matrix quantifier (and it also features the same $\mathbf{pex}_2$ at the level of the alternative that $\mathbf{pex}_1$ negates; see below). Our analysis will henceforth rest on a specific (yet independently argued for) framework for presupposition projection: the Strong Kleene trivalent logic (George 2008, Fox 2013, Winter 2019 a.o.). We show now that given this logic for projection, the embedded **pex** will be semantically 'transparent' when it comes to evaluating the contribution of the higher **pex**, avoiding the conundrum faced by **exh**-based theories.

In Strong Kleene, the method for computing the presuppositions of a complex expression ϕ consists of first specifying its bivalent truth conditions (Truth conditions and Falsity conditions). These are the conditions under which, roughly speaking, ϕ is guaranteed to have a bivalent truth value, even if some of its sub-constituents do not have a bivalent truth value. The conditions under which it is not possible to determine such a bivalent value for ϕ are the conditions under which ϕ is assigned the third truth value, #. The predicted presupposition of ϕ is the disjunction of its truth and falsity conditions (i.e., the conditions under which it is not #). See George 2008 and Fox 2013 for a more thorough discussion and technical implementation; this general description is sufficient for our purposes.[12]

We also need to reformulate our lexical entry for **pex** from (2-a) to respect the switch to a trivalent framework. The most natural way of doing so that would be in line with our core proposal is given in (14):

(14) $$[\![\mathbf{pex}(\phi)]\!] = \begin{cases} 1, \text{ if } [\![\phi]\!]=1 \wedge \bigwedge([\![\psi]\!]=0) : \psi \in Excl(\phi) \wedge [\![\psi]\!] \in R \\ 0, \text{ if } [\![\phi]\!]=0 \\ \#, \text{ otherwise} \end{cases}$$

This entry says that the conditions under which **pex**(ϕ) is true are the expected ones, but the conditions under which **pex**(ϕ) is false are identical to the conditions under which ϕ is false. As long as we're restricting our attention to alternatives of ϕ that are strictly stronger than ϕ, which is what we do throughout the paper, the predicted presupposition here (i.e. the disjunction of truth and falsity) derive our core proposal, namely the presupposition is that all the excludable relevant alterantives are false.[13,14] As a simple illustration:

12 We work with the the Strong-Kleene system because we could not see a way to derive the desideratum with a different logic of presuppositions (not given the LF in (13), anyway). Thus, if our account of '*some* under *some*' in terms of **pex** is correct, it also serves as an indirect argument that Strong Kleene is the right system for modeling presupposition projection in general.

13 In the more general case, i.e. when merely non-weaker alternatives are also considered as excludable (and relevant), then the predicted presupposition is merely disjunctive: either the prjacent is false, or all excludable (relevant) alternatives are false. Equivalently: if the prejacent is true, all excludable (relevant) alternatives are false.

14 One could imagine an alternative entry where the exclusion of alternatives is duplicated in the falsity conditions (the addition is underlined):

(i) $$[\![\mathbf{pex}(\phi)]\!] = \begin{cases} 1, \text{ if } [\![\phi]\!]=1 \wedge \bigwedge([\![\psi]\!]=0) : \psi \in Excl(\phi) \wedge [\![\psi]\!] \in R \\ 0, \text{ if } [\![\phi]\!]=0 \, \underline{\wedge \bigwedge([\![\psi]\!]=0) : \psi \in Excl(\phi) \wedge [\![\psi]\!] \in R} \\ \#, \text{ otherwise} \end{cases}$$

(15) She found some of her marbles.

a. $[\![\mathbf{pex}((15))]\!] = \begin{cases} 1, \text{ if she found some but not all her marbles} \\ 0, \text{ if she found none of her marbles} \\ \#, \text{ otherwise} \end{cases}$

b. Predicted presupposition:
either she found none of her marbles, or some but not all her marbles ($\equiv$ she didn't find all her marbles).

Armed with these assumptions, we now go back to our LF in (13). The task is to specify its truth and falsity conditions. According to (14), this LF is true if the prejacent of the matrix exhaustifier ($\mathbf{pex}_1$) is true and the alternative to it is false; false if the prejacent is false; and # otherwise. For convenience, the prejacent and alternative for $\mathbf{pex}_1$ are shown in (16), so the interpretation of the whole LF is succinctly represented in (17).

(16) The prejacent and (relevant) alternative of $\mathbf{pex}_1$ in (13):

a. *prejacent*: some girls λ_x $\mathbf{pex}_2$ [some of the marbles λ_y [x found y]]

b. *alternative*: all girls λ_x $\mathbf{pex}_2$ [some of the marbles λ_y [x found y]]

(17) $[\![(13)]\!] = \begin{cases} 1, \text{ if } [\![(16\text{-a})]\!] = 1 \wedge [\![(16\text{-b})]\!] = 0 \\ 0, \text{ if } [\![(16\text{-a})]\!] = 0 \\ \#, \text{ otherwise} \end{cases}$

To unpack (17), we need to know the truth and falsity conditions of (16-a), and the falsity conditions of (16-b). Starting with (16-a), this is an existential statement; Strong Kleene's logic produces the following 3-valued semantics for such statements:

(18) **Strong Kleene semantics for existential quantifiers.** An expression of the form $[\mathbf{Some}\ \boldsymbol{\xi_x} : \boldsymbol{\psi_x}]$ (ξ is the restrictor and ψ the scope of the quantifier) is **True** if (i) holds, **False** if (ii) holds, and # if neither (i) nor (ii) hold.

(i) $\exists x \in [\![\xi]\!] : [\![\psi]\!](x) = 1$ (Truth conditions)

(ii) $\forall x \in [\![\xi]\!] : [\![\psi]\!](x) = 0$ (Falsity conditions)

Applying (18) to (16-a), we get that for (16-a) to be True it is necessary that some girls find some-but-not-all of their marbles, and for it to be False it is necessary that all girls don't find any marbles. ψ in our case is of the form '$\mathbf{pex}_2$(x found some of x's marbles)', and its 3-valued semantics was given in (15-a).

That would produce the same presupposition as (14) if only strictly stronger alternatives are considered, and a non-disjunctive presupposition in the more general case (cf. footnote 13). As the discussion below will hopefully make clear, however, the entry in (14) is a crucial ingredient in deriving our desideratum for *some under some*; (i) would not give us the right result.

(19) $$[\![(16\text{-a})]\!] = \begin{cases} 1, & \text{if some girls founds some-but-not-all marbles} \\ 0, & \text{if all girls didn't find any marbles} \\ & \quad (\equiv \text{no girls founds any marbles}) \\ \#, & \text{otherwise} \end{cases}$$

This allows us to update the meaning for the whole LF in (17) as follows:

(20) $$(17) = [\![(13)]\!] = \begin{cases} 1, & \text{if some girls founds some-but-not-all marbles} \\ & \quad \wedge [\![(16\text{-b})]\!] = 0 \\ 0, & \text{if no girls founds any marbles} \\ \#, & \text{otherwise} \end{cases}$$

Turning to (16-b), this is a universal statement; Strong Kleene's system produces the following 3-valued semantics for universal statements:

(21) **Strong Kleene semantics for Univeral quantifiers.** An expression of the form $\mathbf{[All\ \xi_x : \psi_x]}$ (ξ is the restrictor and ψ the scope of the quantifier) is **True** if (i) holds, **False** if (ii) holds, and # if neither (i) nor (ii) hold.

(i) $\forall x \in [\![\xi]\!] : \ [\![\psi]\!](x) = 1$ (Truth conditions)

(ii) $\exists x \in [\![\xi]\!] : \ [\![\psi]\!](x) = 0$ (Falsity conditions)

Applying (21) to (16-b), we get that for (16-b) to be False it is necessary that some girls don't find any of their marbles. This result obtains crucially due to the fact that $\mathbf{pex}_2$ does not contribute anything to the Falsity condition of its prejacent. In other words, $\mathbf{pex}_2$ is vacuous here because '$\mathbf{pex}_2$(x found some of x's marbles)' (our ψ) is false just in case the existential statement 'x found some of x's marbles' is false, namely iff x found none of x's marbles. It is this fact that is responsible for deriving the weak-global SI that was problematic for the **exh** theory (see below).[15]

We now reached the final truth and falsity conditions for the whole LF. They are as follows:

(22) $$[\![(13)]\!] = \begin{cases} 1, & \text{if some girls founds some-but-not-all of their marbles} \\ & \quad \wedge \text{some girls didn't find any of their marbles} \\ 0, & \text{if no girls founds any of their marbles} \\ \#, & \text{otherwise} \end{cases}$$

The description of the truth conditions in (22) are exactly the two inferences we were after: the first line of it is the local SI and the second line the weak-global SI.

15 As the savy reader may notice, the line of reasoning in the text also predicts that **pex** under negation will not contribute anything to the truth conditions of the negated sentence. We argue in section 3.1 below that this is exactly what explains why SIs are not normally detected under negation.

So if we just concentrate on the inferences coming from the truth conditions of the LF, we have derived our desideratum, repeated in (23):

(23) **Desideratum** (repeated from (6)): Given a sentence of the form $Some_x[...\ some_y...\ P(x,y)]$, derive the following implicatures:

a. $\exists x[...\ \exists y \wedge \neg\forall y\ [...P(x,y)]]$ (Local SI)

b. $\neg\forall x[...\ \exists y[...P(x,y)]]$ $(\equiv\ \exists x[...\ \neg\exists y[...P(x,y)]]$ (Weak-global SI)

The Strong Kleene system we relied on to obtain this result makes predictions not only about the truth and falsity conditions of LFs, but also about their presuppositions. Recall that the presupposition of an LF according to Strong Kleene are the disjunction of its truth conditions and falsity conditions. The disjunctive presupposition predicted for (22) is thus:

(24) Presupposition predicted for (22):
Either none of the girls found any of her marbles, (F conditions)
or some girl found some but not all of her marbles and some girl didn't find any of her marbles.[16] (T conditions)

With the help of some logic, (24) turns out to be equivalent to the following (material) implication:

(25) Presupposition predicted for (22):
[If some girl found some of her marbles, then [some girl didn't find any of her marbles and not all girls found all of their marbles.]]

In section 5 we argue that, in many ordinary cases, the (non-at issue) contributions of **pex** will normally not be detected *qua* presuppositions because they are usually quietly accommodated prior to evaluating the LF. This applies here too, although a *minimal* accommodation of (24) is not very plausible to begin with, since it would entail a rather odd common ground against which to evaluate the assertive component.[17] As Fox (2013) notes, it is a general feature of Strong Kleene's logic that it derives disjunctive presuppositions for quantified sentences, ones that in most situations will not serve as a natural common ground against which to evaluate the assertive component. Fox suggested that hearers can employ a number of strategies to alleviate this kind of strangeness, and those strategies are applicable here too. One strategy is that hearers appeal to presupposition strengthening: accommodating a proposition strictly stronger than the predicted presupposition. For disjunctive presupposition $\phi \vee \psi$ hearers could thereby accommodate ϕ, ψ or the conjunction

17 Such a common ground would exclude worlds in which every girl found some of her marbles as well as worlds where some girls found none of their marbles but the other girls found all of their marbles.

$\phi \wedge \psi$, and for a conditional presupposition $\phi \to \psi$ the accommodations could be $\neg\phi$, ψ, or $\neg\phi \wedge \psi$. But accommodation is restricted by Stalnaker's (1978) imperative that a sentence must be informative relative to the common ground against which it is uttered. For the conditional in (25), accommodation of the negation of the premise to the common ground is therefore blocked. Therefore we predict strengthening of (25) to the consequent of the conditional to be the remaining natural strategy:

(26) <u>Presupposition strengthened from (25)</u>:
Some girl didn't find any of her marbles and not all girls found all of their marbles.

Presupposition (26), together with the information that some girls found some of their marbles—which comes from the assertive component (the truth conditions) of the LF—yields the two inferences we were after.

3 pex and the restricted distribution of SIs under negation

This section discusses the distribution of SIs under negation. We will point at the advantages of **pex** in explaining both why, normally, SIs are perceived as not being computed under negation (section 3.1), and why they sometimes are computed in those positions, by unifying the latter cases with the phenomenon of 'presupposition cancellation' via local accommodation (section 3.2).

3.1 The vacuity of pex under negation

SIs are not normally computed in the scope of negation. The sentences in (27), if read with neutral intonation (default accenting), do not allow the indicated readings which can be described as enriching a weak scalar item (*or, some*) with a SI in the scope of negation. This is corroborated by the infelicity of the continuation sentences in parentheses, which would only be compatible with the enriched meaning.

(27) a. Alex didn't talk to Mary or Sue. (#She talked to both)
$\not\rightsquigarrow$ *it is not true that Alex talked to just one of them*
b. I don't think someone cheated. (#I think they all did)
$\not\rightsquigarrow$ *it is not true that (I think that) some-but-not-all cheated*

Existing grammatical theories have to say something special to block this, since if **exh** was freely available in the syntax there is no *a priori* reason why in (27) it couldn't be embedded under negation, resulting in the problematic parses in (28):

(28) a. not [**exh** [Alex talked to Mary or Sue]] (*not* > *or-but-not-both*)
b. not (believe) [**exh** [someone cheated]] (*not* > *some-but-not-all*)

In order not to overgenerate this, Fox & Spector (2018) propose an economy condition which generally bans the presence of **exh** under negation.[18]

Given the **pex** theory, however, the economy condition on the distribution of exhaustification is not needed. Due to the revised semantics of **pex**, the correct result is obtained even with an embedded occurrence of **pex**.

To see this, consider the LF of (28-b) under the **pex** theory, in (29-a).[19] The embedded **pex** will derive the presupposition that not all cheated, (29-b). Since it is a presupposition, it will project through negation to the matrix level. The presupposition is entailed by the assertive component of the whole sentence, which is just a negated existential—the basic semantics of the sentence.

(29)
a. [not [**pex** [someone cheated]]]
b. Projected presupposition: *not all cheated*
c. At-issue content of (29-a): *no one cheated*

Thus, in these simple cases a structure with **pex** embedded under (one) negation is not distinguishable from its **pex**-less parse (modulo the entailed presupposition), which explains without further stipulations why SIs are not normally detectable in these environments.[20]

3.2 pex and Presupposition Cancellation

This **pex**-based approach allows us to account for related fact about SIs, namely that under special conditions they *can* appear under negation. Specifically, when the target sentences are pronounced with the 'contradiction contour' (Horn 1989)— H* pitch on negation, L+H* on the scalar item and LH% as the boundary tone—we get the reading that was missing in (27) (see e.g. Meyer 2016 for recent discussion).

(30)
a. Alex didn't$_{H*}$ talk to Mary OR$_{L+H*}$ Sue$_{LH\%}$... she talked to both!
b. I don't$_{H*}$ think SOME$_{L+H*}$one cheated on the exam$_{LH\%}$... everyone did!

18 Their condition can be obviated in certain conditions, cf. our discussion surrounding (30). Fox & Spector (2018) build their economy condition on the observation that computing a SI under negation weakens the overall interpretation of the sentence, and weaker meanings are generally dispreferred to stronger ones. Enguehard & Chemla (to appear) propose a similar constraint on the insertion of **exh**, though they motivate their principle on different grounds than Fox & Spector (2018).

19 We continue to assume that matrix **pex** is also present, but in this case it will be vacuous so it isn't represented. we also abstract away from the contribution of 'believe' in (28-b) and drop it from the representation for the purpose of simplicity

20 In unpublished work, Ahn et al. (2020) argue that **pex** in anohter case predicts detectable presuppositions.

This pattern bears a striking resemblance to the phenomenon known as **presupposition cancellation**. In presupposition cancellation, presuppositional content in the scope of negation does not project through it, but appears to be at-issue. Some illustrative examples are in (31):

(31) a. Mary isn't$_{H*}$ late to the meeting AGAIN$_{L+H*\ LH\%}$… she has never been late before!
(negation denies the presup. of [**again** ϕ], i.e. "ϕ happened before")

b. Mary didn't$_{H*}$ STOP$_{L+H*}$ smoking$_{LH\%}$… she never used to!
(negation denies the presup. of **stop**, namely "used to")

c. Mary can't$_{H*}$ climb THE$_{L+H*}$ tree in the garden$_{LH\%}$… because there are two of them!
(negation denies the uniqueness presupp. of **the**)

d. Chris didn't$_{H*}$ MANAGE$_{L+H*}$ to solve the problem$_{LH\%}$… it was quite easy for him (Horn 1989)
(negation denies the 'it-was-hard' presupp. of **manage**)

(30) and (31) have the same prosodic signature, and moreover they both require the continuation sentence to be felicitous with this prosody. This similarity suggests that the two phenomena—SI under negation and presupposition cancellation—should be accounted for by the same mechanism. Crucially, our approach based on **pex**—according to which SIs are presuppositions—allows for such a unified account.

Assume following Heim (1983) that presupposition cancellation is possible because under certain conditions presuppositions can be "locally accommodated" under negation. Let us further model local accommodation as is standard within trivalent logic, using the $\mathscr{A}$ operator (Beaver & Krahmer 2001). $\mathscr{A}$ turns a trivalent proposition into a bivalent one by collapsing undefinedness with falsity:

(32) With $\phi = \underline{p}p'$:

$$[\![\mathscr{A}(\phi)]\!] = \begin{cases} 1, \text{ if } [\![\phi]\!] = 1 & \text{(i.e. if } p \wedge p'\text{)} \\ 0, \text{ if } [\![\phi]\!] = \# \text{ or } 0 & \text{(i.e. if } \neg p \text{ or } \neg p'\text{)} \end{cases}$$

When (32) is embedded under negation, the whole sentence is predicted to be true if the presupposition is false; this derives presupposition cancellation:[21]

(33)
$$[\![not(\mathscr{A}(\phi))]\!] = \begin{cases} 1, \text{ if } [\![\phi]\!] = \# \text{ or } 0 & \text{(i.e. if } \neg p \text{ or } \neg p'\text{)} \\ 0, \text{ if } [\![\phi]\!] = 1 & \text{(i.e. if } p \wedge p'\text{)} \end{cases}$$

21 This assumes standard semantics for negation which flips truth- and falsity-conditions.

On our **pex**-based proposal, SIs under negation are derived with the same mechanism: these are cases where an $\mathscr{A}$ operator takes scope in between negation and **pex**. We illustrate the analysis in (34).

(34) I don't$_{H*}$ think SOME$_{L+H*}$one cheated on the exam$_{LH\%}$... they all did!
  a. not [$\mathscr{A}$ [**pex** [someone cheated]]]
  b. $\rightsquigarrow$ *it is not true that some-but-not-all cheated*

Indeed, in our theory deriving an embedded SI under negation **requires** application of $\mathscr{A}$ immediately below negation;[22] as we showed in (29), without $\mathscr{A}$ the information that the relevant alternative is locally exhaustified will project through negation rather than enter the at-issue/assertive content that negation targets. This helps explain the restricted distribution of embedded SIs: local accommodation under negation is known to be possible only as a last-resort mechanism, to rescue an otherwise inconsistent discourse (Gazdar 1979, Heim 1983). On the hypothesis that local accommodation involves the insertion of $\mathscr{A}$ under negation, this means that inserting $\mathscr{A}$ under negation is possible only to rescue an inconsistent discourse. Note that the continuation sentences in (30) threatens the consistency of the whole discourse, so inserting $\mathscr{A}$ is possible, and the embedded SI reading arises, which accounts for why the continuation sentence is necessary for the embedded SI reading to arise. In addition, we hypothesize that embedding $\mathscr{A}$ under negation requires, in addition, the contradiction contour (perhaps just the $L+H*$ part of it), accounting for the contour's obligatoriness when cancelling presupposed SIs, as illustrated in (30), and more standard presuppositions, as illustrated in (31).[23,24]

22 Note that such configuration is equivalent to embedding the bivalent **exh** under negation without $\mathscr{A}$: $[\![not(\mathscr{A}(\mathbf{pex}(\psi)))]\!] = [\![not(\mathbf{exh}(\psi))]\!]$.

23 The correlation between local accommodation and the contradiction contour is arguably not exception-free. Cancelling the existence presupposition of 'the' (as opposed to its uniqueness presupposition, cf. (31-c) doesn't seem to require or even allow a $L+H*$ accent on *the*:

(i) Mary didn't$_{H*}$ meet the king of France... because there is no king of France.

We are not sure why the existence presupposition of *the* might be different. It is worth mentioning that Coppock & Beaver (2015) argue that the existence inference is not hard-coded as a presupposition of *the*, as opposed to the uniqueness inference.

24 An interesting challenge for the **pex**-based account, pointed out to us independently by Peter Lasersohn and an anonymous reviewer, concerns what to say about cases similar to those in (28) but with expressions that do not seem to have scalar terms, such as (i). Given obligatory **pex**, and paralleling our account of simple sentences with weak scalar terms under negation, we seem to be committed to a parse as in (ii).

(i) Mary did not sing.

(ii) not [**pex** [MARY sang]]

4 pex, global accommodation, and common ground mismatching SIs

The third puzzle for theories of SIs involves odd assertions of expressions with scalar terms seem to trigger SIs which are inconsistent with the common ground. Typical examples are sentences like (35-a)-(35-b), which are odd given normal information about the world such as that Italians come from the same country and that height is a relatively stable property.

(35) *C*: *standard adult background information*
  a. #Some Italians come from a warm country.
  b. #Sue is sometimes tall.

According to Magri (2009), the oddness of the sentences in (35) is due to a clash between the SIs they give rise to, by way of **exh**, and the common ground. We review Magri's basic account in section 4.1. Although we accept the key components of Magri's overall account, we argue based on a broader set of oddness cases, presented in sections 4.2-4.3, that it should be formulated in terms of **pex** rather than **exh**.

4.1 A review of Magri's theory

Magri (2009) explains the oddness pattern in (35) as follows. A sentence like (35-a) has a scalar alternative *all Italians come from a warm country*. This alternative is obligatorily exhaustified (negated), and the result of the exhaustification entails that not all Italians come from the same country – an inference which directly conflicts with the common ground belief that Italians come from the same country. The same line of explanation applies to (35-b): the scalar alternative to this sentence, namely *Sue is always tall*, undergoes exhaustification, leading to the strange inference that Sue is sometimes but not always tall.

Consider a context where it is relevant whether any or all of Mary, Peter or Sue sang. If **pex** in (ii) could exclude the alternatives *Peter sang* and *Sue sang*, (i) should carry the presupposition that Peter and Sue did not sing. We won't be able to give full consideration to this issue here, but we note one approach consistent with our **pex**-based account: assume following Groenendijk & Stokhof (1984) that the formal alternatives to *MARY* can only be relevant pluralities that include Mary (or more generally, exhaustification of ϕ can only exclude alternatives ψ that asymmetrically entail ϕ, Sauerland 2004, Magri 2009). Then **pex** in (ii) excludes the alternatives *Mary+Peter sang*, *Mary+Sue sang*, and *Mary+Sue+Peter sang* rather than the *Peter sang* and *Sue sang*. For the variant of (i) without negation, these exclusions still correctly predict the inferences that Peter didn't sing and Sue didn't sing—e.g. the latter follows from *Mary sang* and *Mary+Sue didn't sing*. And for the negated assertion in (i), the plural exclusions also make the correct prediction: E.g. the projected implicature *Mary+Peter didn't sing* is entailed by the assertion (i), as are the two other projected implicatures. Hence all presuppositions predicted by **pex** are entailed by the assertion. Note that the restriction on excludable alternatives we propose here requires constraining/refining the mechanism of formal alternatives used in our original definition (2).

As Magri points out, the observation that SIs can clash with the common ground and generate oddness is problematic for standard neo-Gricean theories of SIs. Neo-Griceans conceive of SIs as computed by listeners to ensure that speakers come out as cooperative and rational conversational partners. So why would interlocutors compute an SI that is inconsistent with the common ground, and generates oddness? Why not stick, in cases like (35-a)-(35-b), with the literal interpretations which do not clash with the common ground and can convey useful information such as that Italy is warm and that Mary is tall?

Magri argues that the Grammatical account of SI is best suited to incorporate the notion of common ground-mismatching SIs. Working with standard **exh** (see (1)), his Grammatical account rests on two stipulations concerning the distribution and computation of **exh**:[25]

(I) **exh** is obligatorily attached to proposition type structures.

(II) For any context c, alternatives to the prejacent ϕ which are logically non-weaker[26] but contextually equivalent to the prejacent in c must be negated in the course of computing **exh(**ϕ**)** in c (i.e. such alternatives cannot be dismissed as irrelevant for the purposes of **exh**).

In addition, Magri proposes an oddness filter that works together with (I) and (II) to determine the set of utterances that are marked as odd:

(III) **Oddness filter.**
If **exh**(ϕ) mismatches the common ground in context C, then **exh**(ϕ) is odd in C.

The basic idea, then, is that sentences like (35-a)-(35-b) are obligatorily parsed as in (36-a)-(36-b). These LFs generate the enriched readings in (37-a) and (37-b) respectively, which in turn clash with the common ground C. Applying the oddness filter (III), we then get that (35-a)-(35-b) are predicted to be odd in C.

(36) a. **exh** [Some Italians come from a warm country]
b. **exh** [Sue is sometimes tall]

25 Stipulation (I) we already mention in Section 1. Stipulation (II) is already incorporated in how **exh** was defined in (1). Specifically, it was stipulated there that R, the Relevance parameter that restricts the propositions among $Excl(\phi)$ that **exh** negates, always includes any contextually-equivalent alternative to the prejacent ϕ. It follows that any contextually-equivalent but logically-non-weaker alternative than the prejacent must be negated by **exh**.

26 For the following, a restriction to logically stronger alternatives as Magri (2009) assumes would also be feasible and compatible with our suggestion in footnote (ii). But given the empirical support for the weaker restriction we discussed above, we adopt the weaker restriction in (1), (2), and here.

(37) a. Some Italians come from a warm country $\wedge$ $\neg$all Italians come from a warm country
b. Sue is sometimes tall $\wedge$ $\neg$Sue is always tall

Why are stipulations (I)-(III) needed? If we gave up on the obligatoriness of **exh** (I), we could select parses without **exh**, thereby rescuing these expressions from triggering the problematic enrichments. If we gave up on the notion that **exh** is blind to context and only refers to logical entailment in (II), and used instead a notion of contextual-entailments, we could say that the application of **exh** for (36-a)-(36-b) is vacuous (in a normal context): in each case, the prejacent is contextually equivalent to its logically stronger alternative, so the latter would not be negated and no clash with the common ground would ensue. Finally, if we dropped the oddness filter (III), we could say that when a speaker asserts any expression which clashes with the common ground, listeners should revise their beliefs about what is in the common ground prior to assessing the truth value of the utterance; the utterance might still be judged false, but no oddness due to a clash with the common ground need result.[27]

4.2 An overgeneration problem

Magri's account of oddness, although promising, faces a problem when we compare different kinds of mismatches with the common ground. It predicts that any expression which mismatches with the common ground will be filtered out as odd, but this is not borne out. Consider first the following contrast:

(38) C : *normal adult background information*
a. #Some tigers are carnivorous.
b. Only SOME tigers are carnivorous.
c. Some but not all tigers are carnivorous.

While (38-a) has the signature of a Magri-style oddness, (38-b)-(38-c) feel markedly different: intuitively, it seems more appropriate to classify them as downright false

27 Interestingly, Degen et al. (2015) show that standard RSA models make incorrect predictions concerning the interpretation of Magri-style sentences relative to that provided independently by ordinary speakers. Specifically, standard RSA models over-weight prior expectations about the world, and as a result do not predict scalar enrichments that conflict with those prior expectations. That result reenforces Magri's conjecture that standard Gricean models predict that listeners shouldn't compute common ground mismatching SIs, but should instead combine the literal readings of expressions like 'Sue is sometimes tall' with prior common ground beliefs/expectations (height is stable) to get (unattested) enrichments such as that 'Sue is (stably/simply) tall. Del Pinal (2020), which also defends Magri's core approach to oddness, includes a critical discussion of various recent neo-Gricean-friendly attempts to explain oddness without appealing to the notion of common ground mismatching SIs.

rather than as odd. Magri's theory, as currently formulated, predicts that all the examples in (38) should be equally odd in C; they are all covertly exhaustified in accordance with stipulation (I), and the resulting interpretation is inconsistent with the common ground, so the oddness filter in (III) predicts them to all pattern together and be classified as odd.[28]

One might initially take this data to suggest that an exhaustivity inference that mismatches to the common ground will be judged odd only if there are contributed by a covert operator, using **exh** (as in (38-a)), but merely false if it is triggered by an overt operator/material (as in (38-b)-(38-c)). This is not the correct generalization however. The minimally different data in (39) shows a contrasting pattern compared to (38):

(39) C : *normal adult background information*

a. Some tigers are herbivorous.
b. #Only SOME tigers are herbivorous.
c. Some but not all tigers are herbivorous.

In (39) the sentence with the covert exhaustification sounds merely false, while the one with *only* sounds odd – the inverse of (38). The key difference from (38) is that the prejacent here (*some tigers are herbivorous*) is held in the common ground to be false rather than true. Note that this difference does not affect the (c) examples – (39-c) is judged not odd (but false), like (38-c).

Can these patterns be explained by holding that, despite the intended description of the common ground, readers tend to revise the common ground differently across the target cases? There is something right about this suggestion: consider an assertion of ϕ by S which is inconsistent with the common ground C as represented by the listener L. Since hypotheses about what is in the common ground are in general defeasible, L could take S's assertions of ϕ as evidence that C is not actually the common ground. Indeed, this is plausibly part of what is happening in the non-odd cases in (38)-(39). From this perspective, the puzzle is precisely to explain why, although relatively to Magri's account the expressions in (38) have (nearly) the same truth-conditional meaning, and so do the ones in (39), only some of those expressions succeed as calls to revise the common ground. That this is so can be illustrated by

28 We assume that redundancy doesn't categorically lead to oddness: specifically, assertions which are strictly entailed by background information can be used as reminders, to make content salient or to make sure that interlocutors are on the same page. The kind of contexts we are imagining is one in which uttering *tigers are carnivorous* is clearly not as odd as uttering *some tigers are carnivorous*.

contrast in the kinds of continuations that our target expressions support such as the following:

(40) *C*: *normal adult background information*

a. A: Some tigers are carnivorous. #I know you think that is an insane thing to say, but I read that in recent issue of *Science*.

b. Only some/some but not all tigers are carnivorous. I know you think that is an insane thing to say, but I read that in recent issue of *Science*.

This also sheds light on why oddness filters such as Magri's (III)—and precursors such as the principle that assertions should be neither trivial nor collapse the common ground—are not sufficiently fine grained, given Magri's theory of exhaustification, to explain contrasts like those above. If mismatches between assertions and the hypothesized common ground can be used as evidence to revise the common ground, then why can we do this in general for (38-b)-(38-c) but not for (38-a), or for (39-a) and (39-c) but not for (39-b)?

In our view, the patterns in (38)-(39) reveals that oddness-inducing inferences are sensitive to different ingredients of meaning. Specifically, we claim that oddness arises when the common-ground-conflicting information is contributed at a **presuppositional** level. The non-odd sentences—(38-b),(38-c), (39-a) and (39-c)—are not odd because they convey the common-ground-conflicting information (i.e. *not all tigers are carnivorous*/*some tigers are herviborous*) at the **assertive/at-issue**. The contrast in the *only* examples (38-b)-(39-b) is thus explained on the basis of the fact that while (38-b) merely has a false assertion, (39-b) has a false presupposition. In (39-a) (and (39-c)) the false information is, again, conveyed with at-issue material, which is why they are not odd. Following this generalization, the oddness of (38-a) is explained if the exhaustive inference is conveyed at a presuppositional level, as predicted by our hypothesis that SI are presuppositions.

To sum up, the problem for Magri's system in light of (38)-(39) is that it does not make use of the distinction between presuppositional content and at-issue content for the purpose of explaining oddness. This problem can be easily fixed by reformulating Magri's theory in terms of **pex**.

4.3 Oddness and pex

According to our account of exhaustification, **pex** triggers an asserted vs. presupposed entailment structure that is the mirror image of that triggered by *only*. The definition of **pex** is repeated from (2) in a simplified form:

(41) Given ϕ and a set of excludable alternatives $Excl(\phi)$, $\mathbf{pex}(\phi)$ presupposes the negation of each (relevant) member of $Excl(\phi)$ and asserts ϕ:

$$\mathbf{pex}(\phi) = \begin{cases} \textbf{presupposition: } \bigwedge \neg\psi : \psi \in Excl(\phi) \cap R \\ \textbf{assertion: } \phi \end{cases}$$

Using **pex** we can formulate a refined version of Magri's theory that doesn't overgenerate oddness. Specifically, we can maintain his (I) and (II) from section 4.1—the core elements of Magri's theory—yet drop the overly strong oddness filter in (III). Instead, we introduce the weaker oddness filter in (42) which is sensitive the the interaction between the common ground and different ingredients of meaning:

(42) **Revised oddness filter.** Let ϕ be a sentence with a presupposition p and assertion p' (notation: $\phi = \underline{p}p'$). Then asserting ϕ is odd in c if
  (i) $p \wedge p'$ is inconsistent with c, **and**
  (ii) p' is consistent with c.

According to (42), an assertion of ϕ is odd if it has a presupposition that is inconsistent with the common ground. It is also odd if the update of the common ground with the presupposed and assertive content of ϕ is inconsistent with the common ground, while neither the assertive content on its own is consistent with the common ground. (42) is an extension of a reasonable and independently justified constraint on accommodation. As various theorists have pointed out, presupposed information that is inconsistent with the common ground cannot be accommodated. If a speaker wants to convey information that challenges commonly-held beliefs, one must do so fully at the at-issue level of meaning. Unlike Magri's original oddness filter, this filter straightforwardly allows interlocutors to assert weird beliefs even against hypothesized common grounds relative to which they are inconsistent—but such weird or conspiratorial contents should be fully fronted to the at-issue content of assertions. (cf. Heim 1992).

Given **pex** and the revised oddness filter in (42), we can explain the target oddness patterns. Consider first examples (38-a) and (39-a), repeated in (43) and (44), given their LFs with **pex** in (43-a) and (44-a). In each case, the underlined part represents the part of the content that is presupposed. (43-a) presupposes that it is not the case that all tigers are carnivorous. Since this presupposition is inconsistent with the common ground in C, it is correctly predicted to be odd by the revised oddness filter. In contrast, (44-a) presupposes that it is not the case that all tigers are herbivorous. This presupposition is consistent with (in fact entailed by) the common ground in C; it is the assertive component alone in (44-a) that mismatches the common ground, so the revised oddness filter does not rule it odd (even if it is judged to be obviously false by the interlocutors).

(43) #Some tigers are carnivorous.

a. **pex**[some tigers are carnivorous]
= $\underline{\neg\text{all tigers are carnivorous}} \wedge \text{some tigers are carnivorous}$

(44) Some tigers are herbivorous.

a. **pex**[some tigers are herbivorous]
= $\underline{\neg\text{all tigers are herbivorous}} \wedge \text{Some tigers are herbivorous}$

Consider next the *only* examples in (38-b) and (39-b), repeated in (45) and (46). According to standard accounts, *only* ϕ presupposes its prejacent, ϕ, and asserts the negation of each excludable focus alternative of ϕ. In the case of (45), we get the presupposition that some tigers are carnivorous, which is consistent with (in fact entailed by) the common ground in C. It is thus easy to see that (45) is not filtered out by the revised oddness filter. In the case of (46), we get the presupposition that some tigers are herbivorous, which is inconsistent with C and is thus marked as odd by the revised oddness filter. Both of these predictions are adequate.

(45) Only SOME tigers are carnivorous.

a. only [SOME tigers are carnivorous][29]
= $\underline{\text{some tigers are carnivorous}} \wedge \neg\text{all tigers are carnivorous}$

(46) #Only SOME tigers are herbivorous.

a. only [SOME tigers are herbivorous]
= $\underline{\text{some tigers are herbivorous}} \wedge \neg\text{all tigers are herbivorous}$.

The cases in (38-c) and (39-c), repeated in (47)-(48), are also handled adequately. The key observation, in these cases, is that all the common ground-mismatching content is asserted, and so the revised oddness filter doesn't predict them to be odd:

(47) Some but not all tigers are carnivorous.

a. = some tigers are carnivorous $\wedge$ $\neg$all tigers are carnivorous

(48) Some but not all tigers are herbivorous.

a. = some tigers are herbivorous $\wedge$ $\neg$all tigers are herbivorous

Finally, let us go back to Magri's original examples, (36-a)-(36-b). We focus on (36-a), repeated here in (49):

(49) #Some Italians come from a warm country.

29 Strictly speaking (45-a) and (46-a) are also parsed with **pex** in the matrix. But we assume that in this case **pex** doesn't negate any Relevant alternative (since the alternative triggered by *some* are already captured by *only*), so we ignore it. The same applies to (47)-(48).

a. **pex** [some Italians come from a warm country]
= $\underline{\neg\text{all Italians warm country}} \wedge$ some Italians warm country.

Based on (49-a), we get the presupposition that not all Italians come from a warm country. The common ground *C* entails that all Italians come from the same country, but does not entail that Italy is or is not warm. Accordingly the presupposition in (49-a), taken on its own, is strictly compatible with the common ground. In addition the at issue content of (49-a) is not itself incompatible with *C*. Crucially, however, the conjunction of the presupposed and at issue content of (49-a) is incompatible with *C*. Accordingly, the revised oddness filter predicts correctly that it should be filtered out.

At this point, it is worth reemphasizing the basic intuition behind our revised oddness filter: information that is inconsistent with the common ground, and whose assertion may have the goal of radically revising it, should be expressed as at-issue content alone. As we saw, this was indeed the case in all the intuitively non-odd examples (44), (45), (47) and (48). Accordingly, a Magri-style sentence that has, relative to a specific common ground *C*, the same entailments as (49), repeated below in (50-a), except that it makes the controversial information more at-issue, is expected to be intuitively less odd. This prediction is attested by the contrast in examples like (50-a) and (50-b), where asserting the latter is intuitively a more direct and successful way to call for revision of *C*, specifically, of the belief that Italians come from the same country:

(50) C: *stable background knowledge*

a. #Some Italians come from a warm country
b. Some but not all Italians come from a warm country.
c. #Some Italians come from a warm country. ??For a few actually come from northern Europe, which is cold.
d. Some but not all Italians come from a warm country. For a few actually come from northern Europe, which is cold.

The key contrast between (50-a) and (50-b) is brought out by the corresponding contrast in the continuations that each supports. Although relative to the target common ground (50-a) and (50-b) have the same truth-conditions, only the explicit $\exists \wedge \neg\forall$ variant makes the $\neg\forall$ entailment at issue, which explains why a continuation which targets that entailment as a topic is licensed in (50-d) but not in (50-c).[30]

30 A reviewer asks whether current theories of SIs, ours included, will need an independent account of why variants of Magri-sentences like (i) sound felicitous, given normal background information, or at least much better than the (original) counterparts like (50-a).

(i) Some Italians come from a warm country, but not all of them do.

A similar contrast, which was introduced and discussed in Russell (2012), provides additional evidence for **pex**. Consider the pattern in (51). Given the polarity of the interjection (a negative one, as in 'oh no!') and the goals/desires in C, to make sense of (51-d) interpreters should compute its $\neg\forall$ implicature. Interestingly, this doesn't 'rescue' the plain $\exists$ assertion in (51-d) from oddness. This is not what we would expect, in this kind of context, if it had the same truth-conditions and presupposed vs. assertive structure as its $\exists \wedge \neg\forall$ counterpart in (51-a). The acceptability of (51-b) and (51-c), which we have independent reason to think make the $\neg\forall$ entailment at issue, suggests that the negative interjection, in this context, targets the $\neg\forall$.

(51) Goal/desire in C: *we want our students to pass*
- a. Crap! Some but not all of our students passed!
- b. Crap! Only some of our students passed!
- c. Crap! Not all of our students passed!
- d. #Crap! Some of our students passed!

An analogous puzzle is observed if we consider instead an interjection with a different polarity (a positive one, as in 'thank goodness!'). To make sense of (52-c), given the positive polarity of the interjection and the goals/desires in C, the $\exists$ implicature should be computed. Interestingly, this doesn't rescue the $\neg\forall$ assertion in (52-c) from oddness. This is not what we would expect, in this context, if it

a. **pex**[Some Italians come from a warm country], but not all of them do.

Given our assumptions, we are committed to the presence of an embedded **pex** as in (i-a). Now, note that this complex sentence as a whole has an assertive content that directly conflicts with the common ground. (There is also no reason to think that, in general, such utterances involve a mid-sentence change of mind—indeed, the variant 'although some Italians come from a warm country, not all of them do' is nearly synonymous, although it explicit controls for mid-sentence change of mind.) Accordingly, it is reasonable to hold (as we have done in other cases of such explicit conflicts) that such sentences induce a revision of the initial hypothesis about the content of the common ground (this may involve backtracking to interpret the first conjunct against the revised common ground). Given a common ground that allows for the possibility that Italians don't all come from Italy, the $\neg\forall$ implicature of the first clause may or may not be computed. If the SI is not computed, we don't have any difficulty. If the SI is (likely) computed, the redundancy of the second conjunct is not too problematic since it has two legitimate functions (i) it makes explicit material that was non-at issue by the end of processing the first clause and (ii) it ensures that the $\neg\forall$ implicature will be computed, which may be important insofar as there is some chance, given the conditions in this case, that the listener doesn't compute it. Finally, the (even small) likelihood that the $\neg\forall$ implicature may not be computed by the listener is key to understand why in cases like (i) it is relatively acceptable for speakers to introduce that content explicitly even if risking potential redundancy. From this perspective, analogous cases with standard presupposition triggers, like *John knows it is raining, and it is*, sound worse because the presupposition is more deterministic, i.e., there is no serious/realistic chance that the listener will interpret as assertion of 'A knows p' other than as entailing that p.

had the same truth-conditions and presupposed vs. assertive structure as its $\neg\forall \wedge \exists$ counterpart in (52-b). The oddness of (52-d), which we have independent reason to think makes the $\exists$ inferences non-at issue, suggests that the positive interjection, in this context, targets the $\exists$ inference/entailment.

(52) Goal/desire in *C*: *we don't want all our students to fail*
  a. Whew! Some of our students passed!
  b. Whew! Not all but some of our students passed!
  c. #Whew! Not all of our students passed!
  d. #Whew! Only some of our students passed!

As Russell observes, the assertive content of the continuations must be aligned with the polarity of the interjection for these mini-discourses to be felicitous, and 'implicated' content somehow doesn't seem to have assertive status. Given **pex**, we have a natural explanation for Russell's observation, namely, that the implicated content is presupposed, hence not at issue. In (51-d), the $\neg\forall$ inference, even if computed, is not at issue, thus can't be the target for the negative interjection. In (52-c) the $\exists$ inference, even if computed, is not at issue, thus can't be the target for the positive interjection.[31]

In this section we provided an argument for the hypothesis that SIs incorporated at the presuppositional level, based on one well-known feature of presuppositions: namely, that when presuppositions are inconsistent with the common-ground, they are in general very hard to accommodate and the result is a feeling of oddness. This conclusion complements the result of our previous puzzles, which took advantage of a different property of presuppositions: namely, the unique ways in which presupposed material projects from certain embedded environments and the specific conditions required for such material to be locally accommodated.

31 Following Russell (2012), one might try to capture patterns like (51)-(52) by revising the notion of relevance, e.g., by requiring that the prejacent of **exh** should maximize relevance (relative to prior expectations) and thus must not be less relevant to the conversation than any SIs it gives rise to. To serve the domain of alternatives restricting function that relevance serves under a Magri-style theory with obligatory **exh**, this would have to be implemented as saying that alternatives that at least as relevant as the prejacent are not exhaustified. In the cases considered in this section, obligatory **exh** with such a revised notion of relevance might make the same predictions as **pex**. However, by capturing an analogous distinction in terms of presupposed/non-at issue vs. assertive content, we in addition predict specific projection patterns for SIs that will help with the puzzles conserving negation and some under some sentences. In contrast, this approach based on relevance doesn't directly make any predictions about the projection behaviour of SIs, and thus doesn't provide a uniform solution to our three puzzles.

5 pex in plain cases

Despite its promise for dealing with the puzzling behavior of SIs in the cases we discussed, one might worry about the consequences of **pex** for ordinary cases of SIs. Consider again a standard example of a scalar enrichment:

(53) *C*: *compatible with none, some but not all, or all students having passed.*
  a. A: Did any students pass?
  b. B: Some students did.
  c. **pex**[Some students passed] = $\underline{\neg\text{all students passed}}$ $\wedge$ some students passed

In simple dialogues like (3), A can understand B's assertion as implicating that 'not all students passed'—without thereby holding that the common ground itself entails that. This seems to be quite different from typical cases in which the presuppositions of utterances must be entailed by the common ground. Indeed, standard tests for presupposition-hood such as the 'Hey Wait A Minute' test (HWAM; von Fintel 2004) fail for such ordinary SIs, as suggested by the oddness of the following reply by A:

(54) a. A: Did any students passed?
  b. B: Some students did.
  c. A: #Hey wait a minute! I didn't know that not all of them did!

However, there are independent cases in which presuppositions don't have to be backgrounded and are easily (globally) accommodated. One notable case, illustrated in (55), is the prejacent of *only*: B's response in (55-b) is perfectly felicitous even if it is not part of the common ground that John was at the party.[32] Another famous example, illustrated in (56) concerns the presuppositions of possessives:

(55) a. A: Who went to the party?
  b. B: Only John was there.

(56) a. A: Why are you leaving?
  b. B: I have to pick up my sister at the airport.

As we said earlier, there are important constraint on global accommodation. One is the inspiration for our revised oddness filter: accommodated content should not be too controversial, i.e., inconsistent with the the common ground (Karttunen 1974, Lewis 1979, von Fintel 2008, a.o.). Another condition is that, given the

32 We thank Kai von Fintel (p.c.) for the observation about *only* and for pointing out its relevance to this discussion.

target assertion and common ground, interlocutors should be able to figure out what specific proposition is to be accommodated. Both conditions are satisfied by the replies (55-b), (56-b), and also by ordinary cases of scalar enrichments such as B's reply in (53-b). Interestingly, in cases where global accommodation is expected, HWAM! responses tend to sound a bit weird as well:

(57) a. A: Who went to the party?
b. B: Only John was there.
c. A: ??HWAM! I didn't know John was there!

(58) a. A: Why are you leaving?
b. B: I have to pick up my sister at the airport.
c. A:?HWAM! I didn't know you had a sister!

We can conclude, then, that there is a class of presupposition triggers which is identifiable by the projection behavior of their presupposed content and how easily such content is accommodated when it is not inconsistent with the common ground. **pex**, we suggest, belongs to this class.

There is still a worry, however. Some might feel that although the HWAM! responses in (57) and (58) are a bit odd, they are nevertheless markedly better than the one in (54). This raises several questions. Why do even easy-to-accommodate presuppositions do better at HWAM!-style tests than typical SIs? Specifically, what distinguishes, relative to their behavior in HWAM! tests, presupposed SIs from other presuppositions that are usually accommodated?

The crucial difference is that the SI computations triggered by **pex** are subject to Relevance. Compared to standard presupposition triggers (e.g. *again*, *knows*, *only*, possessives), **pex** is less deterministic concerning what information, if any, is presupposed since only *relevant* formal alternatives are subject to exhaustification (cf. (2-a) and (1-c)). Consider a version of (53) where it is not part of the CG that not all students passed. Suppose A is reluctant to accommodate the (potential) $\neg\forall$ presupposition of B's assertion. Instead of voicing a HWAM!-style response, A has another option, namely, assume that the $\forall$-alternative of B's utterance is not relevant. Arguably, restricting the set of Relevant alternatives so as to exclude a problematic presupposition is less disruptive to the flow of conversation than explicitly challenging it with a 'HWAM!' response. Insofar as interlocutors try to minimize the disruption of information exchange, the latter response will thus be dispreferred. Crucially, there is no parallel move available for sentences with triggers like *again*, *only*, and possessives. Their presuppositions are entrenched and cannot be dismissed as irrelevant: if a hearer refuses to accommodate them, they have no choice but to halt the conversation and protest.

This explanation of the difference between **pex** and other presupposition triggers in HWAM!-style environments has further interesting predictions, which we think are attested. We said that, in plain cases like (54), HWAM!-style responses are odd because, due to relevance, the targeted SI is optional. Now, consider parallel dialogues in which the SI targeted by the HWAM-response is obligatory. The prediction is that (although the target assertions are odd) in such cases the HWAM! response should improve in acceptability:

(59) C: Normal background information.

a. A: How was your trip across Europe?
b. B: #/??Some Italians come from a beautiful country!
c. A: HWAM! I didn't know Italians don't all come from the same country

The prediction is not that the dialogue as a whole is natural; it is only that the HWAM! response itself improves in acceptability compared to its counterpart in plain cases such as (54). We think this prediction is attested, but further empirical work would be welcomed.

At this point, it may be useful to clarify what precise commitments we are incurring in treating the SIs triggered by **pex** as 'presuppositions'. Our suggestion can be summarized as the claim that there is a strong family resemblance between SIs and standard presuppositions, albeit an imperfect one:

(i) SIs project from certain embedded environments in the ways expected of standard presuppositions. This is the lesson of the *some* under *some* and the exhaustification under negation puzzles in Sections 2-3.

(ii) When SIs are obligatorily triggered, they can't be accommodated (and the corresponding utterances are judged infelicitous) if they are inconsistent with the common ground. This parallel the constraints on global acommodation exhibited by other kinds of presupposition triggers. This is the lesson of the Magri-style oddness in Section 4.

(iii) SI-enriched interpretations are felicitous in contexts where the SIs are merely compatible with (and not entailed by) the common ground. In this respect, SIs are closer to non-presupposed, non-at issue content, such as parentheticals, than to standard cases of presupposed, non-at issue content (yet as we saw above, some presupposition triggers such as overt exhautifiers and possessives are also systematically accommodated).

Focusing just on (ii)-(iii), one may be tempted to adopt a version of **pex** according to which the prejacent is the assertive content and the excluded alternatives are simply non-at issue (as opposed to strictly presupposed). Yet (i)—i.e., the projection puzzles—suggest that the species of non-at issue content we are dealing with is that of standard presuppositions. Clearly, (i) and (iii) pull in different directions within the taxonomy of non-at issue content. Still, we modeled SIs as closer to presuppositional content than to non-presuppositional, non-at issue content for two reasons: first, we don't yet know of any theoretical implementations of the latter that predicts the observed projection behavior, and secondly, we argued in this section that there is a subclass of fairly standard presupposition triggers that behave like **pex** with respect to (iii). Having said that, given a formal model of non-at issue, non-presupposed content that issues in the desired projection behavior of SIs, one could re-formulate **pex** in terms of assertive vs. strictly non-at issue content. From our perspective, this would amount to a welcome variation of the main hypothesis we are advancing in this paper.

6 Summary and Outlook

To summarize, our proposal to treat the Scalar Implicatures (SIs) triggered by a grammatical exhaustivity operator as having non-at issue—specifically presuppositional—status, helps explain two kinds of puzzling observations about the behavior of SIs. The first concerns the projection behavior of embedded SIs, including why SIs tend to be absent under negation (and in other downward entailing environments) yet arise under intonation patters like those used to make standard presuppositions at issue under negation, and why they project in the intricate ways they do in *some under some* sentences. The second puzzle concerns why SIs are computed in cases in which the resulting enriched readings (but not the non-enriched literal readings) clash with the common ground and yet (unlike parallel sentences that make the SIs explicit) can't in general be used by speakers to get listeners to radically revise their hypotheses about the common ground. By replacing the flat standard exhaustification operator with **pex**—a presupposition trigger with respect to any negated (relevant) alternatives of the prejacent—we have the key to component of a uniform account of these properties of SIs. For each of our puzzles, there are piecemeal patches or stipulations that can refine the predictions of standard grammatical accounts of **exh**, but none of this seem to work as a uniform solution to our puzzles. In contrast, once we adopt **pex**, we need only appeal to general and independently motivated principles concerning presupposition projection and limits on the global accommodation of presupposition.

An important question is how our proposal relates to the triggering problem for presuppositions and in general with current accounts of the division between assertive and other kinds of content. The triggering problem is the question of how we can predict which aspects of the meaning of a lexical items are presupposed. As far as we know, this is still an open problem (Abrusán 2011, Tonhauser et al.

2013, Tieu et al. 2019). But note that our **pex** is less problematic for approaches to the triggering problem inspired by Schlenker's (2007) work than standard **exh** is. If the presupposition-assertion division is ignored, our **pex**, the standard **exh**, and the standard lexical entry for *only* are all equivalent. Schlenker develops a pragmatic analysis that implies that a lexical item α with a conjunctive meaning such as $p \wedge q$ can only occur if either p or q is presupposed. Both *only* and **pex** are consistent with Schlenker's proposal, but **exh** is not: *Only* presupposes its prejacent and asserts exhaustivity; **pex** asserts the prejacent and presupposes exhaustivity; and **exh** doesn't have any presuppositions nothing and asserts both the prejacent and the negation of any excludable alternatives. Schlenker's (2007) intuition that a contribution must not lead to multiple novel inferences or answer different questions remains one of the leading intuitions guiding current approaches. From this theoretical perspective, the hypothesis that **pex** is a presupposition trigger is not surprising. Indeed, we speculate that the difference between *only* and **pex** might in fact be a useful test case for theorizing on the typology of inferences.

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