Maximize Presupposition and Gricean Reasoning[*]

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Abstract: Recent semantic research has made increasing use of a principle, *Maximize Presupposition*, which requires that under certain circumstances the strongest possible presupposition be marked. This principle is generally taken to be irreducible to standard Gricean reasoning because the forms that are in competition have the same assertive content. We suggest, however, that *Maximize Presupposition* might be reducible to the theory of scalar implicatures. (i) First, we consider a special case: the speaker utters a sentence with a presupposition p which is not initially taken for granted by the addressee, but the latter takes the speaker to be an authority on the matter. Marking the presupposition provides new information to the addressee; but it also follows from the logic of presupposition *qua* common belief that the presupposition is thereby satisfied (Stalnaker 2002). (ii) Second, we generalize this solution to other cases. We assume that even when p is common belief, there is a very small chance that the addressee might forget it ('Fallibility'); in such cases, marking a presupposition will turn out to generate new information by re-establishing part of the original context. We also adopt from Singh (2011) the hypothesis that presupposition maximization is computed relative to local contexts – and we assume that these too are subject to Fallibility; this accounts for cases in which the information that justifies the presupposition is linguistically provided. (iii) Finally, we suggest that our assumptions have benefits in the domain of implicatures: they make it possible to reinterpret Magri's 'blind' (i.e. context-insensitive) implicatures as context-sensitive implicatures which just happen to be misleading.

1 Maximize Presupposition

1.1 The Principle

Following Heim (1991) and Sauerland (e.g. 2003, 2008), several researchers have recently made use of a principle, *Maximize Presupposition*, which requires that one choose from a pre-determined set of competitors the Logical Form that *marks the strongest presupposition* compatible with what is assumed in the conversation (these assumptions are henceforth called 'context', in the sense of Stalnaker's 'context set').[1] The analysis comes in several varieties (Percus 2006), but for the moment we will assume that *Maximize Presupposition* has the following properties:

(i) The principle is triggered by certain *lexical items*, which have a pre-determined set of alternatives. In this respect the analysis is similar to the neo-Gricean account of scalar implicatures, which are triggered by lexically determined scales. In the present case, however,

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[1] The expression 'context set' is from Stalnaker 1978. *Maximize Presupposition* has been further discussed in Percus 2006, Chemla 2008b, and Magri 2009. Further applications can be found Heim 2005; Schlenker 2003, 2004, 2005a.

the alternatives are intended to have different presuppositional rather than different assertive strengths.[2]

(1) Presuppositional alternatives
The presuppositional alternatives of a clause *F* are all the clauses obtained by replacing one or more items in *F* with their lexical alternatives.
Alt(F) = {F': F' is obtained from F by replacing one or several lexical items in F with some of their alternatives}

Thus if there is a scale {know, believe}, Alt(John believes that it is raining) = {John knows that it is raining}.

(ii) *Maximize Presupposition* only compares Logical Forms whose assertive components are *contextually equivalent,* i.e. if they have the same assertive component relative to the context.

(2) Identity of assertive content
Let *F* and *F'* be two clauses which do not yield presupposition failures relative to the context C. *F* and *F'* have the same assertive content relative to C just in case:
$\{w \in C: F \text{ is true}^C \text{ in } w\} = \{w \in C: F' \text{ is true}^C \text{ in } w\}$[3]

Thus *John believes that it is raining* and *John knows that it is raining* must have the same assertive component in order to be compared by *Maximize Presupposition* (one might well think that it follows from the lexical meaning of *believe* and *know* that these two sentences have the same assertive content; but we argue below that this is not the case).

(iii) Among the competitors, *Maximize Presupposition* selects the Logical Form that carries the strongest presupposition compatible with the context.[4] For the moment, we assume that presupposition failure is handled in semantic terms: a clause whose presupposition is not met is neither true nor false (we come back to this point in the conclusion):

(3) Presuppositional strength
A clause *F* carries a stronger presupposition than *F'* just in case $\{w \in W: F' \text{ is neither true}^{\{w\}} \text{ nor false}^{\{w\}} \text{ in } w\} \subset \{w \in W: F \text{ is neither true}^{\{w\}} \text{ nor false}^{\{w\}} \text{ in } w\}$, where W is the set of all possible worlds ($\subset$ is used for *strict* inclusion).[5]

For instance, it is immediate that *F* = *John knows that it is raining* carries a stronger presupposition than *F'* = *John believes that it is raining*: since *F'* contains no presupposition trigger, the set of worlds in which it is neither true nor false is just the null set, which is a subset of the set of worlds in which *F* is neither true nor false.

(iv) The principle can then be stated as follows:

(4) Maximize Presupposition (preliminary statement[6])
If a sentence *S* is a presuppositional alternative of a sentence *S'* (i.e. $S \in Alt(S')$) and

[2] However, see Chemla 2007b for French data that are problematic for *Maximize Presupposition* when the scales are taken to be lexically specified.

[3] We write $true^C$ for 'true with respect to the context (set) C'; the relativization to C - in addition to w - is necessary because a formula may result in presupposition failure due to *global* properties of C.

[4] This requirement holds of what Percus 2006 calls 'Maximize Presupposition à la Sauerland'. It doesn't quite hold of what he calls 'Maximize Presupposition à la Schlenker', nor of the proposal that he himself endorses. We come back to this point below.

[5] Here too, $true^{\{w\}}$ and $false^{\{w\}}$ mean: true or false relative to the context (set) {w}.

[6] We assume for the moment that *Maximize Presupposition* applies at the level of entire sentences, but following Percus 2006 and Singh 2011 we will revise this assumption in Section 3.2.

the context C is such that:
(i) the presuppositions of *S* and *S'* are satisfied within C;
(ii) *S* and *S'* have the same assertive component relative to C;
(iii) *S* carries a stronger presupposition than *S'*,
then *S* should be preferred to *S'*.

In a context C in which (i) it is raining, and (ii) *John knows that it is raining* has the same assertive component as *John believes that it is raining*, the former sentence should preferred to the latter because it marks a stronger presupposition. Conversely, from an utterance of the sentence *John believes that it is raining* one should infer that it is not presupposed that it is raining – or else the alternative with *know* should have been preferred (this inference is what Sauerland calls an 'implicated presupposition' and Percus an 'anti-presupposition').

Several further examples are discussed in the literature. Singh 2011 provides a recent survey with the data in (5)-(7). In each case, (a) is deviant because by *Maximize Presupposition* its presuppositional alternative (b) should be preferred since (i) the presupposition of both sentences is satisfied; (ii) (a) and (b) are contextually equivalent; (iii) (b) expresses a stronger presupposition than (a). The lexical alternatives involved are: {a, the}; {all, both}; {think, know}.

(5) a. #A sun is shining.
b. The sun is shining.

(6) a. #All of John's eyes are open.
b. Both of John's eyes are open.

(7) a. #John thinks that Paris is in France.
b. John knows that Paris is in France.

If we wish to handle sentences that contain pronouns, we must refine our definition of contexts: instead of taking these to be sets of possible worlds, we should define them as sets of tuples of the form <world, speaker, addressee, denotation of 1, denotation of 2, ... >.[10] The theory can then be illustrated with a more subtle case, which originated in the presuppositional analysis of pronominal features developed in Cooper 1983 and much subsequent research (see Heim and Kratzer 1998 for a textbook presentation). The basic idea is that she_i (with index i) evaluated under an assignment function s denotes #, and thus triggers a presupposition failure, unless s(i) is female. If s(i) is indeed female, then she_i evaluated under s denotes s(i), as is natural. But problems arise when the analysis is extended to person features. It is plausible that you_i evaluated under s triggers a presupposition that s(i) is an addressee (hence the deviance observed if one says *You should keep quiet* while talking to Peter and pointing towards Sam). By parity of reasoning, one could posit that a third person pronoun he_i carries the presupposition, not just that s(i) is male, but also that s(i) is neither the speaker nor the addressee. But this analysis immediately runs into two problems:
(i) First, the presupposition is too strong for cases of referential uncertainty such as (8), in which one certainly does not presuppose that the person talked about fails to be the speaker:

(8) [Uttered by a speaker with bad eyes in front a mirror].
He looks like me.... in fact, he is me!

(ii) In addition, the analysis makes incorrect predictions in quantified examples:

[10] In this way, a notion of 'referential presupposition' can be implemented (e.g. a presupposition that the pronoun pro_i denotes the speaker). We can then say that it is presupposed in C (construed as a set of tuples of the form <world, speaker, addressee, denotation of 1, denotation of 2, ... >) that pro_i denotes the speaker just in case for each member c of C, denotation of i in c = speaker of c.

(9) Every individual (including me) admires himself.

A standard rule of presupposition projection in universally quantified structures is that *every element that satisfies the restrictor must satisfy the presupposition of the nuclear scope*. This explains why the sentence *Every director admires herself* is only acceptable if all directors are presupposed to be females.[11] But it is immediate that this analysis will lead us astray in (9), since by construction the bound variable *himself* ranges both over the speaker and over non-speakers.

A relative consensus has emerged to treat third person features as carrying no presupposition at all. But if we stopped here, we would be at a loss to explain why in 'normal' cases one cannot say *He is happy* to mean that the speaker is happy. The solution is provided by *Maximize Presupposition*: it requires that I_i *am happy* be preferred to He_i *is happy* if it is presupposed that s(i) denotes the speaker. Thus He_i *is happy* can only be used if *it is not presupposed that s(i) is the speaker*.[12]

1.2 Theoretical Issues

Apart from its clear empirical interest, *Maximize Presupposition* raises two theoretical questions: (i) is it reducible to Gricean reasoning? (ii) does it require a theory of presupposition based on trivalence, as our definition in terms of definedness conditions in (3) seems to suggest?

- *Is Maximize Presupposition Gricean?*

Maximize Presupposition is taken by recent research to be a primitive principle. Percus 2006 explicitly asks whether it can be reduced to other pragmatic principles, in particular to the analysis of scalar implicatures; but he warns that it cannot be:

> Don't say to yourselves: Of course a sentence like *Mary knows that she is pregnant* blocks *Mary thinks that she is pregnant* (...): the first sentence is stronger than the second - that is, true in fewer worlds -and a Maxim-of-Quantity-style injunction to be informative will tell us to choose the stronger option. That would be faulty reasoning. The injunction to be informative does not tell us to use *Mary knows that she is pregnant* over *Mary thinks that she is pregnant* when it is taken for granted that Mary is pregnant!

A similar conclusion is reached by Sauerland 2008.[13] Our goal is to develop arguments for the opposite conclusion, by suggesting that under certain assumptions *Maximize Presupposition* can be derived from Gricean reasoning – and specifically from the theory of scalar implicatures.[14]

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[11] The facts are different if one speaks a (formal) dialect of English in which a pronoun with feminine features can range over both male and female individuals. The same point could be made with other languages (e.g. French) which do not have such a dialect.

[12] This is of course a weaker condition than one which requires that it be presupposed that s(i) *not* be the speaker (the difference is that only the former condition allows for cases in which the speaker is agnostic, and thus takes it to be possible both that s(i) denotes the speaker and that it denotes a non-speaker). See Chemla 2008b for a discussion of cases in which precisely this strengthening is in fact made.

[13] Sauerland 2008 asks whether *Maximize Presupposition* can be derived from scalar reasoning if one adopts the theory of presuppositions of Schlenker 2007, 2008. His conclusion, which is negative, seems to me to be entirely correct (but if the present analysis is on the right track, it will be *compatible* with the theory of Schlenker 2009, 2010).

[14] An anonymous referee asks whether one couldn't reduce *Maximize Presupposition* to some *other* kind of Gricean reasoning – a possibility which certainly cannot be exluded. The referee further suggests that we consider the 'Attentiveness' maxim from Schwarzschild 1997, which was designed to explain why elements that are semantically given must be marked as such. Specifically, Schwarschild 1997 assumed that an 'intonational background matching' function relates given material to matching antecedents in the discourse; this function can

- *Does* Maximize Presupposition *require a trivalent analysis of presupposition?*

Many standard accounts of presupposition are developed within trivalent systems (e.g. Heim 1983 within a dynamic framework; or Peters 1979, Beaver and Krahmer 2001, George 2008a, b, Fox 2008 within versions of Kleene's strong logic). Other accounts are not (van der Sandt 1992, Geurts 1999, Schlenker 2008, 2009, 2010 Chemla 2007a). The standard definition of *Maximize Presupposition* is based on trivalence; but does it provide an argument *in favor* of trivalent accounts? We will suggest that it does not.

- *Plan*

Our argument for a Gricean treatment of *Maximize Presupposition* has three steps.

• In the first step, we explain, following Stalnaker 2002, how presuppositions can *sometimes* produce information: a speaker who asserts a sentence with presupposition *p* thereby indicates that he believes that it is common belief that *p*; if the addressee takes the speaker to be an authority on the matter, this will suffice to make it the case that (i) the addressee believes that *p*, and (ii) it becomes common belief that *p*. (i) guarantees that new information is in fact generated, while (ii) ensures that the presupposition is still genuinely satisfied.[15]

• The second step generalizes this solution to other cases. First, we assume that even when *p* is common belief, there is a very small chance that addressee might forget or fail to pay attention to it ('Fallibility'); in such cases, marking a presupposition will turn out to generate new information by re-establishing part of the original context. Second, we adopt from Singh (2011) the hypothesis that presupposition maximization is computed relative to local contexts – with the crucial assumption that these too are subject to Fallibility; this accounts for cases in which the information that triggers *Maximize Presupposition* is linguistically provided.

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also make a random assignment, in which case the mapping is essentially unconstrained. The Attentiveness Maxim stipulates that one should 'assume a Background Matching function with the fewest random assignments possible'. As the referee suggests, this maxim can be taken to reflect the fact that "part of being a cooperative participant in a conversation is demonstrating that you are paying attention by marking as given (...) material that has already been introduced in the conversation". Attentiveness could well be related to *Maximize Presupposition*, but I believe the unification is easier to effect if Attentiveness is reduced to *Maximize Presupposition* rather than the converse.

1. Suppose first that a meaning M is given just in case it is *presupposed* that M is salient in the preceding discourse (in a sense that could for instance be made precise along the lines of Schwarzschild 1999). We could in principle derive Attentiveness from *Maximize Presupposition*: for each constituent that appears in a sentence, if its meaning is given, we can *mark* this as a presupposition (about the prior discourse) by using the right Background Matching function (more generally, by not focusing it).

2. The opposite reduction is hard to effect: while semantic givenness can be treated as a special case of presupposition, presupposition is not easily treated in terms of givenness. The difficulty is that given material need not be presupposed, at least not in the standard sense – as was emphasized by Rooth 1996 and Schwarzschild 2004, among others. For instance, in their discussion of (i), (ib) is deviant because the presupposition triggered by the cleft conflicts with the question; no such conflict arises in (ia), in which it is given but not presupposed that someone won.

(i) Did anyone win?
a. Probably not, because it's unlikely that Mary_F won, and she's the only one who ever wins.
b. #Probably not, because it's unlikely that it's Mary_F who won, and she's the only one who ever wins.

[15] (i) follows from (ii), but for clarity we distinguish the two conditions. In Section 3.3.1 we will tentatively suggest that in some cases we must appeal to the fact that the context (rather than the addressee's belief state) is changed when a stronger presupposition is marked.

• Finally, we suggest that our assumptions have benefits in the domain of implicatures: they make it possible to reinterpret Magri's 'blind' (i.e. context-insensitive) implicatures as context-sensitive implicatures which just happen to be misleading. Our reinterpretation of Magri's finding has some empirical advantages in cases in which the generation of his blind implicatures requires access to contextual information.

A consequence of our argument is that *Maximize Presupposition* is neutral in the debate between trivalent and bivalent accounts of presupposition; all that matters is that presuppositions should put constraints on a local context – no matter how this comes about (e.g. by way of semantic trivalence, or by way of pragmatic constraints). Our analysis of *Maximize Presupposition* is thus compatible with different views of presupposition projection (though it does make appeal to local contexts).

2 Deriving *Maximize Presupposition* in a special case

2.1 Goal

We claim that *Maximize Presupposition* is *sometimes* reducible to the theory of scalar implicatures if we adopt a key insight of Stalnaker's (2002) most recent analysis of the notion of 'common ground' (we use the latter term interchangeably with 'global context', though we will later have to take into account 'local contexts' as well; technically, the 'common ground' is usually taken to be the set of propositions that are taken for granted in the conversation, while the 'context set' is their intersection; only the latter notion will play a technical role in what follows).

The basic observation is that *it is sometimes enough to present oneself as presupposing that p to ensure that the common ground ends up satisfying p* (as we will see, this result does not depend on 'presupposition accommodation' in the usual sense). In such cases, a speaker who utters a sentence *S* with presupposition *p* can guarantee that *p* becomes part of the common ground. If in addition marking the presupposition *p* has the effect of convincing the addressee that *p*, choosing *S* over a competitor *S'* that marks no presupposition (or a weaker one) will have the effect of producing more information; as a result, if *S* is an alternative of *S'*, *S* should be preferred to *S'*.

Timing issues are crucial to our argument, so we start by making explicit the sequence of events we envisage; this choice is justified in Section 2.4.

(i) At time t, the speaker believes that *p*, but it is not the case that the addressee believes that *p*. Therefore *p* is not part of the common ground. However, the addressee believes that the speaker is an 'authority' on *p* (using the terminology of Chemla 2008b): the addressee believes that, if the speaker believes that *p*, *p* is indeed true.

(ii) At time t+1, the speaker utters a sentence *S* with presupposition *p* (rather than a sentence S' with a weaker presupposition). In so doing, he makes it clear that he believes that, when the presupposition *p* of *S* will be checked, it will be part of the common ground.

(iii) At time t+2, the speech act participants update their beliefs to take into account what happened at time t+1. As we show below, this suffices to make *p* part of the common ground.

(iv) At time t+3, the speech act participants check that the presupposition *p* of *S* was indeed satisfied at time t+2.

Following Stalnaker 2002, we henceforth identify the common ground with *what is common belief between the speech act participants* (this notion is formally defined in the next section).

2.2 Common Belief

Let us start by laying out our assumptions about belief and, more importantly, common belief, whose logic is crucial to our argument. In this section we strictly follow Stalnaker 2002, making explicit some of the results that he assumes.[16]

1. The beliefs of each speech act participant i are represented by an accessibility relation R_i. *i believes F in w* (written: $w \models B_i F$) just in case for every world w' satisfying $w R_i w'$, F holds in w' (written: $w' \models F$). We assume that the accessibility relations are transitive and euclidean:[17]
(a) Transitivity: $\forall w \forall w' \forall w'' (wR_iw' \wedge w'R_iw'' \rightarrow wR_iw'')$
(b) Euclideanity: $\forall w \forall w' \forall w''(wR_iw' \wedge wR_iw'' \rightarrow w'R_iw'')$
If B_i is the belief operator for individual i, it can be shown that:
(a) implies that $B_i F \rightarrow B_i B_i F$ is valid ('Positive Introspection')
[*Proof:* Suppose that (i) $w \models B_i F$. If there is no w' for which $w R_i w'$, $B_i B_i F$ is trivially true. Now suppose that w' satisfies $w R_i w'$. If w'' satisfies $w' R_i w''$, by transitivity we obtain: (ii) $w R_i w''$, hence by (i) $w'' \models F$. This shows that $w \models B_i B_i F$].

(b) implies that not $B_i F \rightarrow B_i$ not $B_i F$ is valid ('Negative Introspection')
[*Proof*: Suppose that $w \models$ not $B_i F$. So for some world w', $w R_i w'$ and $w' \models$ not F. Now consider any world w'' for which $w R_i w''$. By (b), $w'' R_i w'$, and thus $w'' \models$ not $B_i F$. It follows that $w \models B_i$ not $B_i F$]

An important remark immediately follows from (b):

(10) If $w R_i w'$, it follows from (b) that $w' R_i w'$.
[*Proof:* just apply (b) to $w R_i w'$ and $w R_i w'$]

2. *F is common belief at world w* just in case all speech act participants believe that *F*, all believe that all believe that *F*, etc. In symbols, *F* is common belief at w just in case:
$w \models B_1 F, w \models B_2 F, w \models B_1 B_2 F, w \models B_2 B_1 F, w \models B_1 B_1 F, w \models B_2 B_2 F$, etc.

Let us say that *w' is reachable from w* just in case some path π leads from w to w' through a series of steps of the form $<w_i, w_{i+1}>$ for which either $w_i R_1 w_{i+1}$ or $w_i R_2 w_{i+1}$. In the former case, we say that $<w_i, w_{i+1}>$ is a 1-step of π, and in the latter case we say that $<w_i, w_{i+1}>$ is a 2-step of π. If π starts with a sub-path π_1 and continues with a sub-path π_2, we will simply write $\pi = \pi_1 \pi_2$. If one of those, say π_1, is reduced to a single step $<w_i, w_{i+1}>$, we also write $\pi = <w_i, w_{i+1}> \pi_2$. With this terminology, we can give a simple semantic characterization of common belief:

(11) *F* is common belief at w just in case *F* holds in every world reachable from w.

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[16] See also Fagin et al. 1995 and Osborne and Rubinstein 1994 for a technical discussion of common belief / common knowledge.
[17] Stalnaker 2002 also assumes that the accessibility relations are serial:
(i) Seriality: $\forall w \exists w' wR_iw'$
Seriality guarantees that that i's beliefs are coherent: for no world w and formula F is it the case that $w \models B_i$ (F $\wedge$ not F) (because this would imply that for some w', $w' \models$ (F $\wedge$ not F), which cannot be).

3. Let us start by assimilating the common ground to *what is common belief between the speaker and the addressee*. Stalnaker's observation is that the following pattern of reasoning is valid (we refer to the speaker as individual 1 and to the addressee as individual 2):

(12) If (i) it is common belief that 1 believes that it is common belief that F
and (ii) 2 believes that F,
then (iii) it is common belief that F.

We will use the symbols *C* for the 'common belief' operator, and B_1 and B_2 for the belief operators corresponding to the speaker and addressee respectively. Because timing issues will sometimes matter, we will write as a superscript on the symbol $\models$ the time t at which we evaluate belief and common belief. The result in (12) means that for any world w, time t and sentence *F*:

(13) If (i) $w \models^t C B_1 C F$
(ii) $w \models^t B_2 F$,
then (iii) $w \models^t C F$

The proof follows from the characterization of common belief in (11):
(a) From (i), we infer that *F* holds in every world reachable from w along a path that contains at least one 1-step (and it is immediate that the converse holds as well). To see this, we suppose that w* is reachable from w along a path π with at least one 1-step, and we argue by cases.
Case 1. π is of the form π_1 s π_2, where s is a 1-step and π_1 and π_2 are non-empty paths. (i) means that for every world w' reachable from w, for each world w'' for which w' R_1 w'', for each world w''' reachable from w'', *F* holds at w'''. This immediately entails that w* $\models$ F.
Case 2. π is of the form <w, w'> π', where <w, w'> is a 1-step and π' is a possibly empty path. By the remark in (10), w' R_1 w', and thus w* is reachable along the path <w, w'> <w', w'> <w', w'> π', which takes us back to Case 1.
Case 3. π is of the form π' <w', w*>, where <w', w*> is a 1-step and π' is a possibly empty path. By the remark in (10), w* R_1 w*, and thus w* is reachable along the path π' <w', w*> <w*, w*> <w*, w*>, which also takes us back to Case 1.
(b) From (ii), it follows that *F* holds in every world reachable along a path that only contains 2-steps. [The proof is by induction on the length of the path: suppose that w* is reachable from w along a path of n+1 2-steps ($n \geq 1$), of the form $\pi =$ <w, w_1> ... <w_{n-1}, w_n> <w_n, w*>. Since w_{n-1} R_2 w_n and w_n R_2 w*, by Transitivity w_{n-1} R_2 w*, hence w* is reachable along the path <w, w_1>...<w_{n-1}, w*>, which only contains n steps. By the Induction Hypothesis, w* $\models$ F].
(c) From (a) and (b), it follows that *F* holds in every world reachable from w. From the characterization in (11), it follows that *F* is common belief at w.[18]

[18] Two technical remarks should be added.
1. First, as an anonymous referee notes, we could have opted for a proof-theoretic strategy, along the following lines: we start from the definition of common belief of *F* as 'all B_1, B_2 sequences of operators can be applied truly to *F*'; we note that any sequence of B_i's can be (a) extended by adding one further B_i (because $B_i F \rightarrow B_i B_i F$), and (b) contracted by removing one B_i if there are initially at least two (because $B_i B_i F \rightarrow B_i F$, a fact which follows from (10)); we then derive from (13)(i) that all B_1, B_2 sequences that contain at least one B_1 in a non-terminal position can applied truly to *F*, and we discuss other possible sequences by making use of (a), (b), and (13)(ii). I believe the discussion by cases would mirror our model-theoretic proof.
2. Second, as E. Chemla observes, Condition (i) in (12) can be weakened to:
(i') It is common belief that 1 believes that it is *shared* belief that F

2.3 Derivation of Maximize Presupposition *in this special case*

We are now in a position to sketch a neo-Gricean derivation of *Maximize Presupposition* in this special case. We assume that the addressee does not initially believe the presupposition *p* of a sentence *S*, but takes the speaker to be an authority on *p*: the addressee believes that, if the speaker believes *p*, *p* is true.[19] Furthermore, we assume that (a) *S* and *S'* have the same assertive component relative to C; and (b) *S'* carries no presupposition, or a weaker one than *S*.

(i) At time t, then, the speaker believes that *p*, the addressee does not, but the addressee believes that the speaker is an authority on *p* (a belief that holds at all subsequent moments):

(14) a. $w \models^t B_1 p$
b. $w \not\models^t B_2 p$
c. for all $t' \geq t$, $w \models^{t'} B_2 (B_1 p \Rightarrow p)$

(ii) At time t+1, the speaker utters *S*. In so doing, he shows (i.e. makes it common belief) that he believes (at t+1, and at all subsequent moments) that at t+2 (which is right before the time at which the presupposition of *S* is checked), it will be common belief that *p*.

(iii) At time t+2, the speech act participants update their beliefs to take into account what happened at time t+1.
a. Because of what happened at t+1, it is common belief at t+2 that the speaker believes at t+2 that it is common belief at t+2 that *p*.
b. It follows from a. that at t+2 the addressee believes that the speaker believes that *p*.
c. From b. and (14)c, it follows that at t+2 the addressee believes that *p*.
d. From a., c. and (13) applied at t+2, *p* is thus common belief at t+2.

---

where F is shared belief just in case both 1 and 2 believe that F. In fact, given Transitivity and Euclideanity, (i), (i') and (i"), given below, are all equivalent:
(i") It is shared belief that 1 believes that it is common belief that F.
It is immediate that (i) entails (i') and (i"). To see that (i') entails (i), it suffices to show that under (i') F holds in every world reachable along a path with at least one 1-step. Let π be such a path. π is of the form $\pi = \pi_1 \langle w_1, w_2 \rangle \pi_2$, where $\langle w_1, w_2 \rangle$ is the right-most 1-step in π. If π_2 is empty, w_2 is reachable along the path $\pi_1 \langle w_1, w_2 \rangle \langle w_2, w_2 \rangle \langle w_2, w_2 \rangle$; by the remark in (10), since $\langle w_1, w_2 \rangle$ is a 1-step, so is $\langle w_2, w_2 \rangle$, and by (i') F holds at w_2. If $\pi_2 = \langle w_2, w_3 \rangle$ or $\pi = \langle w_2, . \rangle \ldots \langle . , w_3 \rangle$, by the Transitivity of R_2 $\langle w_2, w_3 \rangle$ is a 2-step. w_3 is reachable along the path $\pi_1 \langle w_1, w_2 \rangle \langle w_2, w_2 \rangle \langle w_2, w_3 \rangle$, so by (i') F holds at w_3. The argument that (i") entails (i) is similar: we consider a path π with at least one 1-step, and thus π is of the form $\pi = \pi_1 \langle w_1, w_2 \rangle \pi_2$, where this time $\langle w_1, w_2 \rangle$ is the *left*-most 1-step. If π_1 is empty, π and $\langle w_1, w_2 \rangle \langle w_2, w_2 \rangle \langle w_2, w_2 \rangle \pi_2$ both lead from w_1 (which in this case is identical to w) to the same world - call it w*. $\langle w_1, w_2 \rangle$ is a 1-step, and by the remark in (10) so is $\langle w_2, w_2 \rangle$. Since w* is reachable along the path $\langle w_1, w_2 \rangle \langle w_2, w_2 \rangle \langle w_2, w_2 \rangle \pi_2$, by (i") F holds at w*. If $\pi_1 = \langle w, w_1 \rangle$ or $\pi_1 = \langle w, . \rangle \ldots \langle . , w_1 \rangle$, by the Transitivity of R_2 $\langle w, w_1 \rangle$ is a 2-step. $\langle w_1, w_2 \rangle$ is a 1-step, and by the remark in (10) so is $\langle w_2, w_2 \rangle$. w* is reachable along the path $\langle w, w_1 \rangle \langle w_1, w_2 \rangle \langle w_2, w_2 \rangle \pi_2$, so by (i") F holds at w*.
[19] We could make a weaker assumption, namely that if the addressee believes that the speaker *presupposes* that *p*, then the addressee believes that *p*. The latter assumption is stated in (ii); the assumption that the addressee take the speaker to be an authority on *p* is stated in (i). (iia) is stronger than (ia), and hence (ii) as a whole is weaker than (i).

(i) If (a) $w \models^t B_2 B_1 p$, then (b) $w \models^t B_2 p$

(ii) If (a) $w \models^t B_2 B_1 C p$, then (b) $w \models^t B_2 p$

We come back to the choice between (i) and (ii) in Section 3.3.1.

More concisely, in the actual world w and at time t+2, we have:

(15) a. $w \models^{t+2} C\ B_1\ C\ p$
b. $w \models^{t+2} B_2\ B_1\ p$ (from a.)
c. $w \models^{t+2} B_2\ p$ (from b. and (14)c)
d. $w \models^{t+2} C\ p$ (from a., c. and (13))

(iv) At time t+3, the speech act participants check that the presupposition *p* of *S* is common belief. By (iii), this is indeed the case - which justifies the speaker's belief mentioned in (i).

Importantly, we did not appeal to accommodation in the usual sense to derive our result - more precisely: we did not have to say that the addressee (temporarily or permanently) modifies his view of the common ground *in order* to prevent *F* from resulting in a presupposition failure (we come back to the issue of 'context repair' in Section 2.5). All we needed was the assumption (i) the addressee took the speaker to be an authority on *p*, and (ii) that if the speaker asserts *S* it thereby becomes common belief that the speaker believes that the presuppositions of *S* are common belief (or rather, 'will be common belief' when the presuppositions in question are checked).

This derivation gives rise to two results.

1. Initially (at t), the addressee did not have the belief that *p*. At t+2, he does: he has gained information because the speaker decided to utter a sentence *S* with a presupposition *p*, rather than an alternative with a weaker presupposition or no presupposition at all.
2. Although *p* was not initially common belief, it *is* common belief by the time the presupposition is checked: given our other assumptions, this turned out to be a 'self-satisfying' presupposition.

There is no doubt, then, that *S* turned out to be more informative than *S'* (because of 1.). Since *S* and *S'* form a scale, the speaker *had* to choose *S* over *S'* if he wanted to be maximally informative. We have thus succeeded in deriving *Maximize Presupposition* from Gricean reasoning in this special case.

2.4 Timing Issues

It was crucial in our analysis that presuppositions are checked *after* the information that the sentence was uttered has been taken into account. One might object that this goes against the very definition of what pre-suppositions are: it would make more sense to require that a presupposition triggered by a sentence *S* be satisfied *before S* is uttered, i.e. before time t in the chronology of Section 2.1.

Stalnaker 2002, whose analysis is faced with the same challenge, argues that demonstratively used pronoun require the timing we posited:

> Suppose Alice says "She is the senior senator from California", pointing to a woman standing in the corner. A certain woman must be salient for her use of "she" to be appropriate and successful (where salience is presumably to be explained in terms of common belief), but it was Alice's speech act, and the accompanying gesture, that made her salient. (Stalnaker 2002 p. 711)

The point can also be made on the basis of indexical pronouns, as is emphasized in Stalnaker 1998 and amplified in von Fintel 2008:

> I would urge people who have doubts about the legitimacy of accommodation to ponder Stalnaker's example: the first person singular pronoun "I" needs to be interpreted with respect to the context—surely, nobody would

deny this. But, clearly, what counts cannot possibly be the context prior to the utterance, since there is no speaker to serve as the denotation of "I". So, the relevant context is the context of the utterance, the context "as it is changed by the fact that the speech act was made". (von Fintel 2008)

The same conclusion can be reached on the basis of self-referential statements. While self-reference obtained by means of presuppositional expressions is often discussed in the context of studies of paradoxes, as in (16)a-b, the same (underlined) expressions can produce logically unexceptionable statements, as in (16)c-d:

(16) a. This very sentence is false.
b. The present statement is false.
c. This very sentence starts with a demonstrative.
d. The present statement starts with a definite description.

It is clear that these presuppositions have no chance of being satisfied unless they are checked *after* information about the utterance is taken into account.[20]

2.5 Other Informative Presuppositions

It is crucial for our argument that the examples under consideration involve genuinely informative presuppositions, i.e. presuppositions which (i) are not satisfied before the utterance is made, but which (ii) become part of the common ground *by virtue of the logic of common belief* soon after the utterance is made. (If 'context repair' were involved, the theory would have to look quite different: we would need to posit that in computing the Gricean principle of quantity, one considers as alternatives some sentences which are technically deviant/ungrammatical; this is not an assumption we wish to make here.)

Is there independent evidence for the existence of informative presuppositions of this sort? Let us add one argument to those that are adduced in Stalnaker 1998, 2002 and von Fintel 2008. It is based on a conflict between a condition imposed by a presupposition trigger ('proposition p should be presupposed') and a condition that stems from a maxim of manner ('proposition p should not be presupposed, on pain of making certain words useless and thus eliminable'). First, we note that it is often difficult to put in a definite description material that could be omitted without changing the denotation (this discussion follows Schlenker 2005b):

(17) a. ??John's blond father has arrived.
b. John's blond brother has arrived.

(17)a is a bit odd because John can have at most one father, and for this reason the denotation of *John's blond father* must be the same as that of *John's father*. But if so, why add the adjective *blond*? (17)b, by contrast, is acceptable if John has at least two brothers, only one of whom is blond.

Importantly, there are a variety of exceptions to this rule:

(18) [Talking about the American President]
a. ?? The dark-haired President is stupid.

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[20] The same argument can be made on the basis of performative utterances which contain explicit indexicals – as is arguably the case of *hereby* in (i):

(i) [Considering these evils,] I hereby promise to remain away from all motion pictures except those which do not offend decency and Christian morality.
(from the 1933 charter of the National Legion of Decency: http://en.wikipedia.org/wiki/National_Legion_of_Decency)

b. The stupid President will cause a disaster.
c. The fantastic President will take us out of this quagmire.

(19) a. A young American poetess is left by her French husband for the Czechoslovakian wife of an American lawyer.[21]
b. So you are a compassionate Republican? Well, my lesbian daughter doesn't think that Republicans are so compassionate these days.

In each of these cases, however, the additional modifier does provide new information – e.g. that the speaker finds the President stupid, as in (18)b; or fantastic, as in (18)c. The facts follow if the maxim of manner involved *does have access to the fact that these are informative presuppositions*. On the other hand, these facts are hard to explain if only context repair is at stake. Once one has decided to 'pretend' that the context is one in which the President is taken to be stupid/fantastic, we must still explain why in this context the maxim of manner does not *prohibit* one from uttering the modifiers, since these are redundant. (Alternatively, we could postulate that the maxim of manner takes into account an alternative which is technically defective or deviant. But this would require a theory with a very different architecture from what is usually assumed.)

2.6 Insufficiency of the present analysis

Our derivation of *Maximize Presupposition* relies on the assumption that initially (at time t) the addressee did not believe *p*. But it would seem that even when the addressee does believe *p*, *Maximize Presupposition* is in no way obviated. Suppose the speaker uses a pronoun pro_i with a pointing gesture towards the addressee. There is little doubt that the pronoun refers to the addressee, and that this fact is common belief. But if so, scalar reasoning should have no 'bite': the speaker should be allowed to use either second or third person features - an incorrect prediction, since *you* is clearly obligatory.

The rest of this paper develops the necessary assumptions to extend to the general case our initial derivation of *Maximize Presupposition*. There are two key components to the analysis. First, we assume that communicative agents are fallible, and that there is always a very slight chance that the addressee might forget information about the context set; in some cases, marking a presupposition will thus have the effect of re-establishing part of the context that was impaired. Second, we will see that this measure must be applied not just to the global context, but also to the knowledge that communicative agents have of all local contexts; in this way, we adapt to our framework Singh's idea that *Maximize Presupposition* is computed relative to local contexts (Singh 2011).

3 Generalizing the analysis: Fallibility and Local Contexts

3.1 Fallibility

3.1.1 Introducing Fallibility

When the global context already entails a presupposition, we assume that *Maximize Presupposition* has some 'bite' because there is always a very slight chance that the addressee's beliefs will be weakened in arbitrary ways. This leads us to an initial statement of the assumption of Fallibility:

(20) Fallibility
At any point t in a conversation, for any proposition *p* which was believed by the

[21] From a review of James Ivory's *Le Divorce,* at: http://parisvoice.com/03/oct/html/showtime/movie.cfm

addressee t-1, there is a small chance that an error will make the addressee forget *p*. We write as $B_2^{\not p}$ the version of the addressee's belief operator that corresponds to the realization of this risk; and similarly we write as $C^{\not p}$ the version of the common belief operator that corresponds to common ground as affected by Fallibility with respect to *p*. So we have in such a situation:

$w \models^t B_2\ p$ (the adressesee's unweakened belief state entails that *p*)
$w \not\models^t B_2^{\not p}\ p$ (the adressesee's weakened belief state does not entail that *p*)

As a consequence, even if it should have been common belief that *p*, due to the addressee's error this will no longer be the case:

$w \models^t C\ p$ (the unweakened common ground entails that *p*)
$w \not\models^t C^{\not p}\ p$ (the weakened common ground does not entail that *p*)

We must still explain what happens if the speaker marks a presupposition *p* when the addressee has been affected by Fallibility. We assume that in such cases, the speaker's action will force the addressee to check the information he has access to; in case the addressee would have believed *p* without the error, this will restore the addressee's belief that *p*. But by the technical results of the previous section, this will in turn suffice to (re-)establish the common belief that *p*.

(21) Recoverability
Suppose that in the world of evaluation w, for any proposition[22] *p,* for any time t and for any time t' ≥ t ,
if
(i) $w \models^{t'} C^{\not p} B_1 C^{\not p}\ p$
(ii) $w \models^t B_2\ p$
then
(iii) $w \models^{t'} B_2^{\not p}\ p$
and hence (by (12))
(iv) $w \models^{t'} C^{\not p}\ p$

In other words, we assume that the fact that the speaker marked *p* as being presupposed will trigger a process by which the addressee will check his private information – and will come to the belief that *p* in the end. Now by the technical results we borrowed from Stalnaker 2002, this will guarantee that at later times the common belief that *p* is regained.

It remains to adapt standard Gricean principles of preference to a framework that countenances Fallibility. We assume for the moment that if a sentence *S* transmits to the addressee at least as much true information as sentence *S'* in all cases, and transmits strictly more true information than *S'* in some cases triggered by Fallibility, then it is to be preferred to *S'*.[23]

With these assumptions in place, let us see how *Maximize Presupposition* can be derived for a class of cases that were not handled by the reasoning of Section 2. We consider (22)a in a context C in which it is obviously raining.

(22) a. #John believes that it is raining.
b. John knows that it is raining.

---

[22] For simplicity, we restrict attention to the case of propositional presupposition triggers. By adding variables if necessary, the case of predicative presupposition triggers could be reduced to the propositional case.
[23] In Section 3.3.1, we will suggest that the addressee's beliefs about the context must sometimes be taken into account as well – thought this raises some difficult problems.

The problem for our initial attempt was that relative to the initial context, (22)a and (22)b have exactly the same informational content: it already follows from the context that it is raining, and thus (22)a does not produce any more information than (22)b. But now consider the consequences of Fallibility: there is a very small but non-null probability that the addressee's belief state gets weakened to one from which it does *not* follow that it is raining. We write *p = it is raining* and *S = John knows that it is raining* (we assume for simplicity that no further error arises between t and t+2).

(i) At time t, it is common belief relative to the initial context, *but not relative to the addressee's weakened belief state, nor to the weakened context,* that p.

(23) a. $w \models^t C\ p$
b. $w \not\models^t B_2^{\not p}\ p$
c. $w \not\models^t C^{\not p}\ p$

(ii) At time t+1, the speaker utters *S*. In so doing, he shows (i.e. makes it common belief, even relative to the weakened common ground) that he believes (at t+1, and at all subsequent moments) that at t+2 (which is right before the time at which the presupposition of *S* is checked), it will be common belief that *p*.

(iii) At time t+2, the speech act participants update their beliefs to take into account what happened at time t+1.
-Because of what happened at t+1, it is common belief at t+2 that the speaker believes at t+2 that it is common belief at t+2 that *p*:

(24) $w \models^{t+2} C^{p}\ B_1\ C^{p}\ p$

By assumption, *p* follows from the 'official' (unweakened) context, hence also from the addressee's unweakened belief state:

(25) $w \models^{t+2} B_2\ p$

By the assumption of Recoverability stated in (21), we can infer from (24) and (25) that (26) holds:

(26) $w \models^{t+2} B_2^{p}\ p$

-By (12), we can infer from (24) and (26) applied at moment t+2 that (27) holds:

(27) $w \models^{t+2} C^{p}\ p$

(iv) At time t+3, the speech act participants check that the presupposition *p* of *S* is common belief. By (iii), this is indeed the case - which justifies the speaker's belief mentioned in (i).

In sum: at t, the addressee's weakened belief state did not entail that it was raining; but at t+2, it does. This result would not have been achieved if *John believes that it is raining* had been chosen over *John knows that it is raining*: it is because the factive presupposition was marked that we obtained the step in (24), which proved crucial to derive the result in (27).

3.1.2 Motivating Fallibility

Fallibility is a technical assumption which is largely justified theory-internally; but it is not wholly unmotivated. In the possible worlds framework we adopted, entailment by the common ground (or for that matter by an agent's beliefs) is a *very* demanding notion: even if the speaker believes that there is a .000001% chance that the addressee will 'forget' a

particularly proposition, it is enough to exclude the latter from the common ground. Our analysis assumes that such weakenings are possible, without making commitment about their likelihood (except that it is non-null). The *source* of these weakenings could in principle be analyzed in various ways – it need not involve forgetfulness in a literal sense; for instance, if one takes a proposition p to be part of the common ground just in case it is common belief that the speech act participants *attend* to p, the common ground might be weakened because a participant suddenly stops *paying attention* to p – rather than literally forgetting it. On this interpretation, it is particularly natural to posit that p will be regained as soon as it is marked as presupposed, as this will force the addressee to start paying attention to p again. Thus our mechanism of weakening is rather versatile, and need not commit us to strong claims about generalized memory lapses in the population.

An objection should be addressed, however. If the common ground can always be weakened in arbitrary ways, don't we predict that a speaker could simply keep repeating a given sentence without end? After all, after asserting *It's snowing*, there would *still* be a slight chance that this proposition might get forgotten by the addressee – which would authorize the speaker to re-assert it while still obeying the requirement that assertions must have a chance of modifying the addressee's beliefs. To put the problem more abstractly: if Fallibility has enough bite to explain why one picks the logically stronger member of two contextually equivalent triggers, why does it not also predict that assertions could be reiterated without end? A natural answer is that within our modified framework, utterances should be justified by more than just a *slight* chance of modifying the beliefs of the addressee; they should have a *high* chance of doing so. Intuitively, uttering *It's snowing* isn't entirely without cost (it takes time, effort, etc), and hence the speech act should be justified by a reasonable expected pay-off. In the case of *Maximize Presupposition*, by contrast, we compare members of a presuppositional scale; the choice is not between uttering a sentence and not uttering it, but between uttering one or another member of a scale – with the assumption that there is a slight chance that one member might produce more information than the other. Since there is no reason to posit that the stronger member is somehow more costly than the other, it is natural to assume that the former will be preferred. Importantly, this reasoning leads to the expectation that Fallibility should have analogous consequences in the analysis of scalar implicatures quite generally, since they too involve a choice between members of the same scale. Precisely this prediction is discussed in Section 4.

3.2 Local Contexts

3.2.1 Percus's Problem

Percus 2006 raised an important challenge for all theories that claim that *Maximize Presupposition* applies globally, maximizing the presupposition that an entire sentence triggers. The problem is that *Maximize Presupposition* is active in cases in which a presupposition is licensed by the linguistic material contained in a sentence rather than by the global context. One of Percus's examples is given in (28):

(28) a. Everyone with exactly two students assigned the same exercise to both of his students.
b. #Everyone with exactly two students assigned the same exercise to all of his students.

(28)b is presumably ruled out because *both*, which is presuppositionally stronger than *all*, could have been used but wasn't. However the presence of *both* in (28)a does not modify the presuppositional strength of the entire sentence. As Percus notes (using a slightly different framework), {w∈W: (28)a is neither true$^{\{w\}}$ nor false$^{\{w\}}$ in w} = Ø = {w∈W: (28)b is neither

true$^{\{w\}}$ nor false$^{\{w\}}$ in w}; in other words, (28)a carries no presupposition whatsoever, just like (28)b.

This leads Percus to propose a different version of *Maximize Presupposition*, according to which one *first* orders the members of a presuppositional scale by strength (independently of the particular context in which the principle is applied), and *then* one chooses the strongest item compatible with the context at hand.

Singh 2011 argues against this solution on conceptual grounds:

> As a constraint regulating the semantics/pragmatics interface, [Percus's solution] strikes me as somewhat unnatural. I know of no other principles of semantics/pragmatics that display preferences among LFs that are sensitive not to their semantic or contextual meanings but rather solely to the lexical items contained within them. A reformulation of [*Maximize Presupposition*] in terms of the meanings of sentence-level structures and contexts of use would allow us to ask questions that arise naturally at this level of analysis, e.g., Do the relevant rules/principles apply at the root, or in embedded positions/local contexts? Are the relevant rules/principles context-sensitive, or are they blind to contextual information?

In addition, we would like to argue that Percus's solution is insufficiently sensitive to the context of the conversation. Consider the scale <believe, know>. As has been amply shown in the philosophical and linguistic literature, one cannot just paraphrase *x knows that p* as: *x believes that p* with a presupposition that *p* is true. Often, the belief must be justified to count as 'knowledge'; and even a definition of *x knows p* as: *x has a justified belief that p, and p is true* falls short in some cases (e.g. Gettier 1963, Kratzer 2002). There is a vast literature on the *precise* component besides factivity that *know* has and that *believe* lacks. The details are immaterial for our discussion: the only important point is that at least part of this additional meaning belongs to the assertive component. Thus in (29), *know* means something like: *believes with good rational grounds*:

(29) Like the rest of us, John believes that Fermat's conjecture is true – but he doesn't *know* it, or else he would have proven it.

We can tell that this additional part of the meaning belongs to the assertive component because it is interpreted within the scope of the negation in (29) (if it were presuppositional, it should project out of the scope of the negation, which would yield the inference that John's belief *is* entirely justified; but this is precisely what the sentence denies).

Now our suggestion is that it is only in case *believe* and *know* are contextually taken to have the same assertive component that *Maximize Presupposition* applies. In other words, the competition only arises in case the context licenses the inference: *if x believes that p and if p is true, then x knows that p* (the converse entailment is presumably always valid). To see this, consider the contrast in (30):

(30) a. *Context*: the speaker is talking to one of his friends.
John believes that I have a sister.
=> it is NOT taken for granted that the speaker has a sister
=> it is taken for granted that the speaker does not have a sister
b. *Context*: a defendent is talking to a journalist.
My lawyer believes that I am innocent. (I feel totally comfortable with my whole destiny in his hands.)
≠> it is NOT taken for granted that the speaker is innocent
≠> it is taken for granted that the speaker isn't innocent

(30)a illustrates a standard effect of *Maximize Presupposition*: the failure to use *know* yields an inference that it is not taken for granted that the speaker has a sister; in fact, as Chemla 2008b discusses, one normally obtains a stronger inference: it *is* taken for granted that the

speaker does *not* have a sister.[24] By contrast, in (30)b (slightly simplified from a real life example), no such inference obtains.[25] A natural explanation is that the standards for what counts as 'knowledge' are much higher in a trial than in day-to-day life. For this reason, *know* fails to compete with *believe* in (30)b: *My lawyer knows that I am innocent* and *My lawyer believes that I am innocent* do not have the same assertive content, even on the assumption that the speaker is in fact innocent (see also Stanley 2004 for the role of context in knowledge attributions).

A similar analysis applies to (31):

(31) *Context:* Some time before Andrew Wiles's discovery, a mathematician tells one of his colleagues about his children.
My 10-year-old believes that Fermat's conjecture is true.
≠> it is NOT taken for granted that Fermat's conjecture is true

Someone who listened in on the conversation would not infer that the speech act participants do not take for granted that Fermat's conjecture is true; rather, the natural inference is just that the 10-year-old's beliefs do not quite meet the standards of mathematical knowledge yet. A related case is presented by (32):

(32) *Context:* CISCO's Board discusses the evolution of the stock, and in particular the fact that Buffett has just sold some shares. The Chairman of the Board says:
a. If Buffett believes we are losing money, he will sell even more shares tomorrow.
b. If Buffett knows we are losing money, he will sell even more shares tomorrow.
a'. If Buffett believes we are losing money, he is guilty of insider's trading.
b'. If Buffett knows we are losing money, he is guilty of insider's trading.

(32)a does not yield the inference that the speech act participants do not take for granted that CISCO is losing money – even though this is a presupposition triggered by the alternative in (32)b. It is plausible that in this context, *Buffett believes that we are losing money* and *Buffett knows that we are losing money* have rather different assertive components: the latter implies that Buffett has had direct access to information about the company – which licenses the claim in (32)b'; the claim in (32)a', by contrast, is probably false: *believe* triggers no 'direct access' implication, and the fact that Buffett made inferences about the company does not entail that he is guilty of insider's trading.

In order to capture these fine-grained facts, we must have access to information about the context to determine whether *x knows that p* is or isn't contextually equivalent to *x believes that p* combined with the presupposition that *p* is true. Percus's context-insensitive proposal would need to be amended to handle this fact.

3.2.2 Singh's Solution

Singh 2011 offers a different solution to Percus's problem. His goal is to propose a reformulation of *Maximize Presupposition* [= MP] "which attempts to retain the original

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[24] Chemla 2008b argues that antipresuppositions, like implicatures, often undergo an 'epistemic step': from w $\models^t$ not Op F, one infers: w $\models^t$ Op not F, where *Op* is a belief or a common belief operator.

[25] The full context is the following:

(i) Gatien met Brafman socially through friends well before his legal problems began. (...) But in May 1996, when drug-enforcement agents raided his home one day at 6 a.m., Gatien decided to trust his first impression of Brafman rather than go lawyer-shopping. "**I know Ben believes I'm innocent,**" he says. "I feel totally comfortable with my whole destiny in his hands."
(New York Magazine, "Little Big Man", http://nymag.com/nymetro/news/crimelaw/features/1984/index1.html)

character of MP as a principle that discriminates between LFs based on the definedness conditions they impose on the context of evaluation". For Singh, examples such as (28)

teach us that the constraint cannot be applied at the root, but must instead be active in embedded positions. A natural way to allow for this is to allow the context of evaluation to change throughout the interpretation of a complex sentence. In effect, the context that is relevant for the application of MP will be the local context c_0 of some embedded constituent, and c_0 may be different from the global context c. I believe this move is a natural one to make, given that the appeal to dynamically changing contexts was to a great extent motivated by presuppositional facts in the first place (...).

Singh's statement of *Maximize Presupposition* is given in (33):

(33) Singh's Local *Maximize Presupposition*
Maximize Presupposition is checked locally: for every sentence *S*, check that *Maximize Presupposition* is satisfied for each clause *F* embedded in *S* in *F*'s local context.

It is interesting to note that Singh's analysis can solve the problem we discussed with *know* vs. *believe*: since Singh's principle, unlike Percus's, is sensitive to a context, he has the means to posit that it is only in case two clauses *F* and *F*' have the same assertive component *relative to their (local) context* that they can be treated as alternatives. In (31) and (32), the local context of the clauses *x believes that p* does not guarantee contextual equivalence with *x knows that p*, and hence *Maximize Presupposition* does not apply.

(34) Maximize Presupposition (local version)
If a clause *F* is a presuppositional alternative of a clause *F*' (i.e. $F \in Alt(F')$) and the global context C and the syntactic environment *a_b*[26] under consideration are such that:
(i) C guarantees that the presuppositions of *F* and *F*' are satisfied within their local context c in *a_b*
(ii) *F* and *F'* have the same assertive component relative to their local context c in *a_b*;
(iii) *F* carries a stronger presupposition than *F'*,
then *F* should be preferred to *F'*.

It remains that, within Singh's system, *Maximize Presupposition* must be taken as primitive: no mechanism is offered to derive the principle from more elementary pragmatic considerations.

3.2.3 Adding Fallibility

We propose to adopt Singh's proposal, but to turn it into a Gricean analysis by adding to it a notion of Fallibility. Following Singh, we will assume a framework that countenances a notion of 'local contexts'; these can be derived in at least two ways: in the framework of Heim 1983, they are part and parcel of a dynamic and trivalent semantics; in the framework of Schlenker 2009, 2010 they are computed on the basis of a bivalent, non-dynamic semantics.

We argued above that Fallibility can provide a Gricean derivation of *Maximize Presupposition* when it applies to the presupposition of an entire sentence. We will now adapt the principle to Singh's localist framework. The basic idea is as follows:
• the local context of an expression recapitulates the information that follows from the preceding discourse together with the global context[27];

[26] By a syntactic environment *a_b,* we mean a string with a 'hole; in it, to be turned into *a F b* or *a F' b* depending on which alternative is picked (with a requirement that the result should be well-formed).
[27] In the theory of Schlenker 2009, 2010, there is a precise sense in which the local context of an expression 'recapitulates' the information present in the global context and in the preceding discourse: the local context is

• there is always a small but non-null chance that the addressee might forget something that was said in the preceding discourse, with the result that the local context could be weakened in arbitrary ways;
• in such cases, marking a stronger presupposition will have the effect of restoring information that was lost because of Fallibility.

Fallibility is thus generalized to apply not just to global contexts, but also to local contexts. We will just need two assumptions:
(i) A presupposition *p* triggered relative to a local context *c* is satisfied at t just in case it is common belief that *c* entails *p*. We will write this as:

(35) $w \models^t C\ (c \leq p)$

(ii) We will take propositions such as $c \leq p$ to be subject to Fallibility, just like any other proposition.

We can now reproduce with respect to local contexts the reasoning we made with respect to Fallibility applied to global contexts. The new parts of the reasoning are in bold.

(i) At time t, it is common belief relative to the initial context, *but not relative to the addressee's weakened belief state, nor to the weakened context,* that $c \leq p$.

(36) a. $w \models^t C(c \leq p)$
b. $w \not\models^t B_2^{c \leq p}(c \leq p)$
c. $w \not\models^t C^{c \leq p}(c \leq p)$

(ii) At time t+1, the speaker utters *S*. In so doing, he shows (i.e. makes it common belief, even relative to the weakened common ground) that he believes (at t+1, and at all subsequent moments) that at t+2 (which is right before the time at which the presupposition of *S* is checked), it will be common belief that $c \leq p$.

(iii) At time t+2, the speech act participants update their beliefs to take into account what happened at time t+1.
-Because of what happened at t+1, it is common belief at t+2 that the speaker believes at t+2 that it is common belief at t+2 that $c \leq p$:

(37) $w \models^{t+2} C^{c \leq p} B_1 C^{c \leq p}(c \leq p)$

By assumption, *p* follows from the 'official' (unweakened) global context, hence also from the addressee's unweakened belief state:

(38) $w \models^{t+2} B_2(c \leq p)$

By (21), we can infer from (37) and (38) that (39) holds:

(39) $w \models^{t+2} B_2^{c \leq p}(c \leq p)$

-By (12), we can infer from (37) and (39) applied at moment t+2 that (40) holds:

(40) $w \models^{t+2} C^{c \leq p}(c \leq p)$

(iv) At time t+3, the speech act participants check that $(c \leq p)$ is common belief. By (iii), this is indeed the case - which justifies the speaker's belief mentioned in (i).

This analysis can be applied to Percus's example to derive the deviance of (41):

(41) #[Everyone with exactly two students]$_i$ **t_i assigned the same exercise to all of his students**.

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the strongest conjunctive restriction that can be added in a given syntactic position without affecting the truth conditions of the resulting sentence.

There is always risk that the addressee might forget that the local context c of the expression in bold entails that t_i *has exactly two students*. In such an event, different outcomes are produced depending on whether one selects *all* or its lexical alternative *both*: the former leaves this belief unchanged; the latter forces the addressee to check his beliefs about the local context, and to realize that it should in fact entail that t_i *has exactly two students*. By the mechanism outlined above, it the common belief that the local context does entail this is re-established. Thus *both* must be selected over *all*.

3.3 Objections

3.3.1 Magri's Objection: when the presupposition is entailed by the assertive component

Giorgio Magri (p.c.) notes that our analysis encounters a problem when the assertive component of a clause entails its presupposition.

(42) a. ? All Italians come from a beautiful country.
b. Italians come from a beautiful country.

In Magri's own analysis (Magri 2009, 2010), (42)b triggers a 'homogeneity presupposition' of the form: *Either all Italians come from a warm country, or no Italians come from a warm country*. He accounts for the deviance of (42)a in roughly the same way that Percus (2006) would. Following Magri 2009 (fn. 10), let us assume that (42)b involves a covert generic-like operator *Op* which is, among others, responsible for the presupposition. Both sentences in (42) have the same assertive component, but *Op* triggers a stronger presupposition, hence the sentence with *Op* should be preferred.

Now Magri notes that the assertive component of (42)a entails the presupposition of (42)b. So how any more information be produced by (42)b than by (42)a? Let us look at the objection more closely. Following the reasoning we developed in Section 3.1 ((23)-(27)), let us call *p* Magri's homogeneity presupposition, and let us assume that the context C has been affected by information loss about *p*. We now try to reason as follows:

(i) At time t, it is common belief relative to the initial context, *but not relative to the addressee's weakened belief state, nor to the weakened context,* that p.

(43) a. $w \models^t C\ p$
b. $w \not\models^t B_2^p\ p$
c. $w \not\models^t C^p\ p$

(ii) At time t+1, the speaker utters (42)a (= *All Italians come from a warm country*). In so doing, he shows (i.e. makes it common belief, even relative to the weakened common ground) that he believes (at t+1, and at all subsequent moments) that this sentence, and hence also its consequence *p*.

(iii) At time t+2, the speech act participants update their beliefs to take into account what happened at time t+1.
-Because of what happened at t+1, it is common belief at t+2 that the speaker believes at t+2 that it is common belief at t+2 that *p*:

(44) $w \models^{t+2} C^p\ B_1\ p$, and hence in particular $w \models^{t+2} B_2^p\ B_1\ p$

By assumption, *p* follows from the 'official' (unweakened) context ((43)a), hence also from the addressee's unweakened belief state:

(45) $w \models^{t+2} B_2\ p$

Instead of using Recoverability, which doesn't apply as stated in (21), let us posit a stronger principle:

(46) Strengthened Recoverability
Suppose that in the world of evaluation w, for any proposition *p*, for any time t and for any time t' ≥ t ,
if
(i) $w \models^{t'} B^{p} B_1 p$
(ii) $w \models^{t} B_2 p$
then
(iii) $w \models^{t'} B_2^{p} p$

(Note that assumption (46)(i) is weaker than assumption (21)(i), and thus (46) as a whole is *stronger* than (21).)
We can infer from (44), (45) and (46) that (47) holds:

(47) $w \models^{t+2} B_2^{p} p$

But this is precisely the inference that is obtained if the *presuppositional* alternative is used – as was shown in (26). So how can we argue that using the presuppositional information produces any more information than the non-presuppositional one in this case?

There are two possible replies.

(i) First, we could accept Recoverability (= (21)) while rejecting Strengthened Recoverability (= (46)). A possible motivation could be that the addressee will check whether he believes that *p* if *p* is presented by the speaker as being common belief, but not if *p* is just part of the speaker's assertion. However, in the absence of further arguments, this solution is not appealing: it would seem that if *p* was part of the unweakened context, the addressee should at least take the speaker to be an authority on the matter in the weakened context.

(ii) Alternatively, we could make use of the fact that when the presuppositional alternative is picked, we obtain a stronger result: we don't just derive (47), but also (48), as was shown by the reasoning that lead to (27):

(48) $w \models^{t+2} C^{p} p$

Now it is clear that in general (48) entails (47), but not conversely. In fact, given the definition of common belief, we can infer from (48) both (49)a and (49)b:

(49) a. $w \models^{t+2} B_2^{p} p$
b. $w \models^{t+2} B_2^{p} C^{p} p$

But as Emmanuel Chemla (p.c.) observes, arguing on the basis of higher-order beliefs ('the addressee believes that it is common belief that *p*') leads down a slippery slope. To see the problem, suppose the speaker had decided to pick the non-presuppositional alternative, which would *not* have yielded the inference in (48) – hence (50)a and, plausibly, (50)b:

(50) a. $w \not\models^{t+2} C^{p} p$
b. $w \models^{t+2} B_2^{p}$ not $C^{p} p$

While (49)b yields a belief that the addressee will acquire if the presuppositional but not if the non-presuppositional alternative is picked, the situation is symmetric: (50)b corresponds to a belief that the addressee will have if the *non*-presuppositional rather than the presuppositional alternative is chosen. In other words, for the solution we sketched to be fully acceptable, we would need to develop a more general account of informational strength

for higher-order beliefs, one that somehow 'breaks the symmetry' between (49)b and (50)b. This is a topic we leave for future research.[29]

3.3.2 Logically true presuppositions[30]

Consider the contrasts in (51):

(51) a. #John believes that two plus two is four.
b. John knows that two plus two is four.

We have a special case of Magri's problem: the presupposition of (51)b is entailed by the assertive component, for the simple reason that the presupposition is a universally true proposition (the same point could have been made by replacing *two plus two is four* with a tautology rather than a mathematical statement). But the strategies we outlined to address Magri's problem won't be applicable here: arbitrarily weakening the context won't change anything to the situation, since in *no context whatsoever* could the presupposition of (51)b turn out to be informative.[31]

This is a problem, but arguably one for intensional semantics rather than from our particular treatment of *Maximize Presupposition*. Importantly, the considerations that show that the presupposition of (51)b couldn't be informative also lead to the conclusion that (52) couldn't possibly be informative (and also that (51)b should be vacuously true!).

(52) Two plus two is four.

Now it could be that some tautologies (e.g. *It will rain or it won't rain*) have a better claim to uninformativeness than (52); but it doubtful that even they are uninformative *in all conceivable contexts*.

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[29] The same problem arises with garden-variety belief operators which satisfy conditions of introspection: if a belief state B for which (i) $w \not\models^{t} B\ p$ is updated with a proposition *p*, we will have: (ii) $w \models^{t+1} B\ p$. But if *B* satisfies: (not B p) ⇒ B not B p ('negative introspection'), we also have: (iii) $w \models^{t} B\ \text{not}\ B\ p$. By (positive) introspection, (ii) leads to: (iii) $w \models^{t+1} B\ B\ p$. If the agent's beliefs are consistent, we also have: (iv) $w \not\models^{t+1} B\ \text{not}\ B\ p$. In other words, the agent has a belief at t+1 that he lacks at t (namely: the belief that *p*); but he also has at t a belief that he lacks at t+1 (namely: the belief that *not B p*).

This problem can be avoided if we assume that the Gricean maxim of Quantity is stated with respect to propositions that do not themselves contain these epistemic operators – let us call these 'non-epistemic propositions'. The condition could be stated as in (i). The difficulty is that the argumentation of Section 3.3.1 requires that Quantity *should* take into account higher-order beliefs, and hence epistemic propositions.

(i) Quantity
If a sentence *S* is an alternative to *S'*, and the intersection of the non-epistemic true propositions that the utterance of *S* leads the addressee to believe is a proper superset of the intersection the non-epistemic true propositions that the utterance of *S'* leads the addressee to believe, then *S* should be preferred to *S'*.

[30] Thanks to E. Chemla for discussion of this issue.

[31] The pair in (i) raises the same issue:

(i) a. #All members of this couple have children from a previous relationship.
b. Both members of this couple have children from a previous relationship.

On the assumption that the couple in question exists, it would seem that the presupposition that it contains exactly two members is automatically satisfied – which means that the presupposition of (ib) should never be informative.

A possible line of investigation would be to expand the set of contexts (i.e. of information states) to include ones that encompass *impossible* worlds in addition to possible worlds – with the assumption that logical truths may fail to hold in impossible worlds. Developing such an approach would of course require an entirely different discussion (see for instance Fagin et al. 1995 for a survey of existing frameworks). Our point is just that when such a move is made, the approach to presupposition maximization explored here might be tenable in the end.

4 Extension: Blind Implicatures as Misleading Implicatures

In this section, we suggest that our assumptions about Fallibility (and local contexts) can be used to reinterpret data that Magri (2009, 2010) took to argue for the existence of what he calls 'blind implicatures'.

4.1 Magri's Blind Implicatures

Magri starts from examples such as (53):

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

Intuitively, one would like to say that (53) is deviant because it triggers an implicature that *not all Italians come from a warm country*. The problem is that such a reasoning cannot be made if the comparison between *some Italians come from a warm country* and its alternative *all Italians come from a warm country* is effected relative to the context set. This is because relative to any reasonable context, the two sentences are equivalent: *some* Italians come from a warm country is true just in case *all* Italians do. As a result, there is no reason one should infer from the first sentence the negation of the second. Magri proposes that implicatures are *not* computed relative to the context set after all; rather, they are computed 'blindly', i.e. without access to the context set, and oddness ensues if the resulting inference contradicts information which is in fact taken for granted in the context (Magri 2009, 2010).

In the most recent version of his work, Magri (2010) makes the following assumptions.

(54) Exhaustivity operator

a. Scalar implicatures are brought about by a covert operator akin to overt 'only', called the exhaustivity operator and written *EXH*.

b. The domain of this exhaustivity operator is restricted by a contextually assigned relevance predicate *R*; the exhaustivity operator with its restriction is written EXH_R.

c. Its semantics is given by: for any clause *F*,

$EXH_R(F) = F \wedge \bigwedge_{F' \in R \text{ and } F' \text{ is stronger than } F} \neg F'$

F is called the *prejacent* and the *F'* that are negated are called the *excludable alternative*.

d. EXH is present at all sites in which it can be inserted, but its semantic contribution may be trivialized due to *R*.

(55) Strength

Excludable alternatives are those alternatives that are *logically* stronger than the prejacent.

(56) Relevance
The relevance predicate *R* is assigned by context. But its denotation must satisfy two requirements:
a. The prejacent of the exhaustivity operator is relevant.
b. If two propositions are contextually equivalent, then they pattern alike with respect to Relevance, namely they are either both relevant or else both irrelevant.

Without trying to do justice to Magri's subtle discussion, let us sketch his analysis of (53).
-By (54)d, the sentence must include an exhaustivity operator, as in (57).

(57) EXH_R Some Italians come from a warm country.

-By (56)a, the denotation of *R* must include at least the prejacent, i.e. *Some Italians come from a warm country*.
-In any reasonable context the latter sentence is equivalent to *All Italians come from a warm country*, so by (56)b this sentence too must belong to the denotation of *R*.
-Relative to a null context, *All Italians come from a warm country* is excludable (i.e. adding its negation to *Some Italians come from a warm country* does not yield a *logical* contradiction); hence (by (55) and (54)c) (57) will entail that *not all Italians come from a warm country*.
-Relative to any reasonable context, this contradicts the prejacent, and hence the sentence is felt to be odd.

4.2 Problems

Magri's analysis encounters two difficulties whose source is that it is insufficiently context-sensitive.
-First, although Magri's theory is a localist theory because it allows for the insertion of exhaustivity operators in embedded positions, it does not take into account the local context in which these operators are inserted; but this information turns out to be necessary for a proper definition of Relevance as defined in (56).
-Second, and more importantly, Magri's context-insensitive definition of Strength fails to account for some blind implicatures which arise in case some contextual information is crucially needed to provide the required asymmetric entailment among members of a scale; we will propose to solve this problem by appealing to Fallibility.

❑ *Local contexts and Relevance*

Let us first consider the pair in (58), originally suggested by E. Chemla (p.c.):[32]

(58) a. #[Every professor who assigned the same grade to each of his students]$_i$ **t_i assigned the best possible grade to some of his students**.
b. [Every professor who assigned the same grade to each of his students]$_i$ t_i assigned the best possible grade to all of his students.

[32] Chemla's original examples was closer to (i):

(i) #[Every professor who gave the same grade to each of his students]$_i$ t_i gave an A to some of them.

We have replaced *an A* with *the best possible grade* to ensure that world knowledge isn't necessary to derive the equivalence between (58)a and (58)b.

There are two sites at which an exhaustivity operator could be attached, so by (54)d we have the representation in (59) (we write EXH_R and $EXH_{R'}$ because the domain restrictions of different exhaustivity operators must clearly be allowed to be different).

(59) EXH_R [Every professor who assigned the same grade to each of his students]$_i$ $EXH_{R'}$ **t_i assigned the best possible grade to some of his students**.

Could we account for the deviance of the sentence by assuming that the embedded operator plays no role, i.e. that its domain restriction makes it trivial? Probably not. For although Magri's definition of Relevance ensures that both (58)a and (58)b are part of the denotation of *R*, the two sentences are *logically* equivalent, and hence (58)b does not count as 'excludable' (because it is not logically stronger than the prejacent of the matrix exhaustivity operator in (59)).[33] So the embedded exhaustivity operator must be appealed to in order to derive the desired result. But this raises a new question: how can we guarantee that the domain restriction *R'* of the embedded exhaustivity operator $EXH_{R'}$ does not make it vacuous? We know by (56)a that the denotation of *R'* must at least include the prejacent, which appears in bold in (59). But we *cannot* appeal to (56)b to guarantee that the alternative *t_i gave the best possible grade to some of his students* is also included. The reason is that *relative to the global context* these clauses are not equivalent: it is the linguistic material that precedes $EXH_{R'}$ which is responsible for the equivalence of these expressions.

Within Magri's system, there is a simple fix, which is to take 'contextual equivalence' to be computed relative to the *local* context of the prejacent, rather than with respect to the global context of the conversation. In the theories of Heim 1983 or Schlenker 2009, 2010, the local context of the prejacent will in essence only include pairs of the form <world w, assignment function s>, where for each such pair, s(i) is in w a professor who assigned the same grade to each of his students.[34] The necessary amendment is stated in (60).

(60) Amendment to Magri's theory
Contextual equivalence in the definition of Relevance (in (56)b) is computed relative to the local context of the prejacent.

- *Fallibility and contextual entailment*[35]

We will now argue that Magri's theory encounters difficulties because in some cases access to the context is necessary to ensure that one member of a scale asymmetrically entails the other (in some of these cases, it could be that the scale itself is contextually determined, i.e.

[33] To make this point rigorous, we would need to define explicitly which parts of the language count as 'logical', and hence have a constant meaning in all possible contexts. Here we assume that the sentence has the logical skeleton in (i), where symbols in capital letters correspond to lexical material while all other words are logical constants.

(i) [Every P who A the same G to each of S] A the B-st G to some of S

Now it is plausible that in all possible contexts (i) is indeed equivalent to (ii) (we say 'plausible' rather than 'obvious' because a derivation of this result would require a fully explicit semantics for all the non-capitalized words).

(ii) [Every P who A the same G to each of S] A the B-st G to all of S

[34] Since the prejacent includes a bound variable, we must appeal to an extension of the theory of Schlenker 2009, 2010, which in its original version is developed for a variable-free fragment. This extension is discussed in Appendix D of Schlenker 2009.

[35] Thanks to B. Spector for discussion of these issues.

that it is only in some contexts that the members of the scale are considered as alternatives to each other; but we will not focus on this point).

Consider the following examples:

(61) a. In my company, everyone who has any degree at all has a Ph.D. #? Bill works in my company, and **he has a high school degree**.[36]
b. In my company, everyone who has any degree at all has a Ph.D. # Bill works in my company, and he only has a high school degree.
c. In my company, everyone who has any degree at all has a Ph.D. Bill works in my company, and he has a Ph.D.

(61)a is somewhat odd because the second sentence implies that Bill *only* has a high school degree – or in other words, that the *highest* academic degree he obtained was a high school degree. A similar effect is obtained when an explicit *only* is added, as in (61)b. This is intuitively a blind implicature in Magri's sense: given the first sentence, the second sentence of (61)a should be equivalent to *Bill works in my company and he has a PhD* – hence standard Gricean reasoning cannot explain why there is an implicature that the latter alternative is excluded. Magri must posit that the expression in bold in (61)a is in the scope of an exhaustivity operator EXH_R. Furthermore, he can observe that the prejacent must belong to the denotation of *R*; and that *he has a Ph.D*, which is contextually equivalent to the prejacent, must also belong to this denotation. But how can this alternative be excluded? It is only relative to contextual knowledge that *Bill has a Ph.D* asymmetrically entails *Bill has a high school degree*; neither sentence *logically* entails the other (i.e. entails it relative all conceivable contexts; it is perfectly coherent to assume that someone has a Ph.D without having a high school degree – and it is only because of standard regulations at universities that this case rarely arises).

While Magri could tweak his definition of the semantics of the exhaustivity operator in (54)b to guarantee that *non-weaker alternatives* rather than *stronger alternatives* are excluded (a point to which we return below), this would fail to account for the asymmetry between (61)a and (61)c: the former does trigger an inference that *Bill doesn't have a Ph.D*, but the latter definitely does not trigger an inference that *Bill doesn't have a high school degree*. This symmetry problem cannot be solved without access to contextual knowledge – which seems to contradict the essence of Magri's idea of blind implicatures. Interestingly, this is the same kind of problem we discussed with respect to *believe* vs. *know* in Percus's framework: there contextual knowledge was necessary to ensure that the two verbs had in fact the same assertive component; *Maximize Presupposition* and blind implicatures both seem to depend on fine-grained contextual knowledge.

Upon closer inspection, the same problem arises with some garden-variety scalar implicatures. The crucial observation is that recourse to contextual knowledge is necessary to have the desired pattern of asymmetric entailment in the pair <some, every>. When the restrictor *P* is empty, *[Every P] Q* does not entail *[Some P] Q*. A standard response is that the restrictor is *presupposed* to be non-empty – and this presuppositional information that could easily be accessible to Magri's 'blind' mechanism. But the difficulty is that there are examples in which *[Every P] Q* does not carry an implication, let alone a presupposition, that there are *P*-individuals (I believe the same facts hold with when *every* is replaced with *all*):

(62) *Context*: A professor who is renowned for the difficulty of his tests announces to his students:

[36] The data should be investigated more rigorously, perhaps with experimental means. An anonymous referee writes that s/he finds (61)a "a little awkward perhaps but not as complete a failure as Magri's example".

a. I'll give a bottle of Champagne to every student who gets a perfect score on the next test.
b. I'll give a bottle of Champagne to some/at least one student who gets a perfect score on the next test.

The same point can be made by considering the patterns of projection that are predicted when presupposition triggers are embedded under other operators. It is uncontroversial that operators with universal force give rise to patterns of universal presupposition projection; thus in (63) we get an inference that *each year, at least one applicant who already had a published paper got in*.

(63) *Context*: I have been on the admissions committee for the last 20 years. Talking about this period, I say:
Each year, I knew that at least one applicant who already had a published paper would get in.
=> Each year, at least one applicant who already had a published paper got in.

But the facts are different in (64): we need not get an inference that *each year, there was at least one applicant who already had a published paper*; but this is what would be predicted if the non-emptiness requirement was a presupposition of the clause *every applicant who already had a published paper got in*.

(64) *Context*: I have been on the admissions committee for the last 20 years. Talking about this period, I say:
Each year, every applicant/all applicants who already had a published paper got in.
≠> Each year, there was at least one applicant who already had a published paper.

For standard accounts of implicatures, this observation need not pose a serious difficulty; they may simply posit that contextual knowledge can be accessed when checking that the pair <[Some P] Q, [Every P] Q> stands in the appropriate relation of asymmetric entailment. But Magri's theory is again faced with a symmetry problem: in the absence of contextual knowledge, he cannot predict that *some student* is interpreted as *some but not every student* without also predicting that *every student* is interpreted as *every but not some student*; but the latter is equivalent to *no student* – and clearly this interpretation is not available in these cases.

In sum, the problem is Magri's account is in a way 'too' blind: it has insufficient access to contextual knowledge when the latter is needed to ensure that the appropriate asymmetric entailment holds among the members of a scale. As a result, even Magri's most basic case does not quite work as desired: he cannot account for the blind implicature in (65), since the alternative with *all* does not *logically* entail this sentence.

(65) #Some Italians come from a beautiful country.

4.3 Misleading Implicatures

We will now explore a restatement of Magri's ideas within a framework in which Fallibility can arbitrarily weaken any global or local context. The basic idea is that if any weakening of a (global or local) context gives rise to an implicature - whether global or embedded - which contradicts the assertive component of the clause that triggers it, we obtain a misleading implicature, and the sentence is deviant.

- *Framework*

For ease of comparison with Magri's system, we follow him (and the literature summarized in Chierchia et al., to appear) in taking implicatures to be triggered by syntactically represented exhaustivity operators. Unlike Magri, we do not take this operator to be systematically present, but we take as primitive the fact that different contexts make the presence of such an operator more or less likely (how this is determined is left open by the present analysis).

(66) Implicature generation
a. Implicatures are triggered by the *optional* presence of the operator *EXH* defined in (54).
b. The notion of strength in (54)c is defined by entailment relative to the local context of the prejacent of *EXH*.

(67) Misleading implicatures
If any weakening (obtained by Fallibility) of the context set favors the insertion of an exhaustivity operator *EXH* which triggers an implicature that contradicts the assertive component of the prejacent of *EXH* relative to the actual (unweakened) value of its local context, then *S* favors the generation of a misleading implicature and is for this reason deviant.

- *Simple cases*

Among all the weakenings that we consider, one is the total weakening of the (global or local) context: no information at all remains in the context; we henceforth call this the 'null context'. This derives as a special case the situation that Magri considers to generate his blind implicatures. While we will also consider many partial weakenings, the total weakening guarantees that we can rule out the cases that are excluded by Magri's theory. To make the reasoning concrete, let us consider the examples in (68).

(68) a. Obama and Palin live in a powerful country.
b. Obama or Palin live(s) in a powerful country.

Clearly, (68)b asymmetrically entails (68)a. Relative to the null context, (68)a implicates the negation of (68)b; but this contradicts the meaning of (68)a relative to the unweakened context. In other words, there is a weakening of this context (namely the total weakening) which favors the appearance of an implicature which is misleading, since it contradicts the meaning of the sentence relative to the intended (= unweakened) context.

Since Fallibility can affect a local context just as well as the global one, we can also account for (69):

(69) #[Every professor who assigned the same grade to each of his students]$_i$ **t$_i$ assigned the best possible grade to some of his students**.

Recall that for Magri the problem was to explain why the implicature could not be made vacuous by excluding the *all* alternative from the domain restriction of the exhaustivity operator. In the original version of his theory, it was only in case an alternative was contextually equivalent to the prejacent of the exhaustivity operator *relative to the global context* that it could not be ignored (our amendment in (60) was designed to circumvent the problem). The difficulty does not arise in our framework. Let c be the local context of the expression in bold (within Heim's framework (Heim 1983), this will be a set of <world,

assignment function> pairs). Writing *a* for the proposition *t_i gave an A to some of his students ⇔ t_i gave an A to all of his students,* we consider a weakening of the addressee's beliefs, and hence also of context set, which guarantees that:

(70) a. w $|\neq^t C^a$ [c ≤ (t_i gave an A to some of his students ⇔ t_i gave an A to all of his students)]
b. w $|=^t C^a$ [c ≤ each professor has students]

An embedded implicature could in principle be triggered by inserting an exhaustivity operator as in (71):

(71) [Every professor who gave the same grade to each of his students]$_i$ **EXH_R t_i gave an A to some of them**.

With respect to the unweakened global context, the presence of this operator would be known not to change anything, since relative to the local context c, *t_i assigned the best possible grade to some of his students* is equivalent to *t_i assigned the best possible grade to all of his students* – and hence the latter alternative is not excludable. But it *is* an excludable alternative when some of the information about c is lost, as in (70)a. In such an event, a misleading embedded implicature will be triggered.

- *Context-dependent implicatures*

Our approach makes it possible to derive further instances of misleading implicatures. In fact, even for (65) something additional needs to be said: as we argued above, it is only in the presence of some additional assumptions that the restrictor of *every/all* can be guaranteed to be non-empty; without such assumptions, the alternative with *all* does not entail (65), and there is no reason to expect that the latter should give rise to a blind implicature. For Magri, the problem can be summarized as follows: a standard context licenses both of the inferences in (72):

(72) a. w $|=^t$ C if some Italians come from a beautiful country, all Italians come from a beautiful country
b. w $|=^t$ C there are Italians

Now the problem is that Magri's implicature generation algorithm must have access to (72)b (in order to ensure that an implicature can be generated) without having access to (72)a. But his notion of 'blindness' is too coarse-grained to do the job: both assumptions are equally unavailable to a blind computational procedure.

The situation is different in the present framework. Since the context can be weakened in all sorts of ways, there will be one weakening which preserves the inference in (72)b but not that in (72)a; it is obtained by 'forgetting' *i*, which is short for the proposition: *if some Italians come from a beautiful country, all Italians come from a beautiful country*:

(73) a. w $|\neq^t C^i$ if some Italians come from a beautiful country, all Italians come from a beautiful country
b. w $|=^t C^i$ there are Italians

Now it is clear that this weakened context should trigger the implicature that *not all Italians come from a beautiful country* – which is a misleading implicature.

Let us turn to our other problematic example, repeated in (74):

(74) In my company, everyone who has any degree at all has a Ph.D. #? Bill works in my company, and **he has a high school degree**.

The entailment relation between *he has a high school degree* and *he has a Ph.D* is computed relative to the local context of the expression in bold – call this context c. Among all the conceivable weakenings of the global context, there is one which satisfies (75) (we write *p* = *everyone working at my university who has any degree has a PhD*):

(75) a. w $|\neq^{t} C^{e \leq p}$ (c ≤ everyone working at my university who has any degree has a PhD)
b. w $|=^{t} C^{e \leq p}$ (c ≤ if Bill has a Ph.D, Bill has a high school degree)

Thanks to (75)b, the appropriate asymmetric entailment relation holds of the pair <high school degree, PhD>. Now relative to the weakened global context, a misleading local implicature will be triggered – namely that Bill has a high school degree *but no Ph.D*.

In sum, because Fallibility triggers all sorts of weakenings of the information available about various (global or local) contexts, we can capture both the 'blindness' of Magri's implicatures, and the fact that some of them are in fact context-dependent. And thanks to the assumption that implicatures are triggered (*via* exhaustivity operators) within a local context, we can also capture the fact that strength of entailment must be evaluated relative to a local context.

- *An open issue*

Let me end this section with an open issue. In recent accounts of scalar implicatures, it is not just stronger alternatives that get negated, but more generally *non-weaker* ones (see Chemla and Spector 2011 for a recent experimental and theoretical discussion, as well as references). This is for instance essential to derive from (76)a the intuitive inference in (76)b:

(76) a. *Target sentence:* Exactly one student solved some of the problems.
b. *Intuitive inference:* The student who solved some of the problems didn't solve all of the problems.
c. *Non-weaker alternative:* Exactly one student solved all of the problems.

(76)c does count as an alternative to (76)a, since it is obtained from it by replacing *some* with its lexical alternative *all*. But due to the non-monotonicity of *exactly one*, this is not a *stronger* alternative, although it is a *non-weaker* one. By negating it, we obtain the desired inference in (76)c (if exactly one student solved at least one of the problems, and it's not the case that exactly one student solved all of the problems, it must be that the student who solved at least some of the problems didn't also solve all of them).

Now Magri (p.c.) notes that when the exhaustivity operator is defined so as to negate non-weaker (rather than stronger) alternatives, his approach based on blind implicatures and our approach based on misleading implicatures become equivalent (see Magri 2012). In his terms, the two theories can be summarized as follows:

(77) A sentence *S* sounds odd (because of a blind/misleading implicature) relative to a context c iff:
a. *Blind implicatures:* $EXH^{\text{non-weaker}}{}_{R}{}^{c'}(S) \cap c = \emptyset$ for c' = W
b. *Misleading implicatures:* $EXH^{\text{non-weaker}}{}_{R}{}^{c'}(S) \cap c = \emptyset$ for some c' ⊇ c
where W is the set of all possible worlds, and $EXH^{non\text{-}weaker}{}_{R}{}^{c'}(S)$ negates the alternatives to *S* that are (i) relevant according to R, and (ii) non-weaker than *S relative to the context c'*.

In both cases, deviance is obtained relative to c if an implicature we derive relative to some set c' which is a superset of c turns out to be inconsistent with c. In (77)a, c' = W, the set of all possible worlds: Blindness is insensitive to contextual information. In (77)b, c' can be any superset of c whatsoever, since Fallibility considers all possible weakenings of c. It is immediate that (77)a entails (77)b. But as Magri 2012 shows, the converse also holds: if

(77)b holds, there are alternatives S_1, ..., S_n to S such that for some c' $\supseteq$ c, (i) {S, $\neg S_1$, ..., $\neg S_n$} is consistent relative to c', but (ii) {S, $\neg S_1$, ..., $\neg S_n$} is not consistent relative to c. It is immediate that (i) entails that {S, $\neg S_1$, ..., $\neg S_n$} is also consistent relative to W, hence that S_1, ..., S_n are also negated by $EXH^{non\text{-}weaker}{}_{R}{}^{c'}(S)$ for c' = W – and (77)a follows.

Magri's remark shows that the two theories might converge in the end. But crucially, the resulting synthesis would suffer from the same symmetry problem that Magri's original theory faced with respect to *some* vs. *every/all*: we want *Some Italians come from a beautiful country* to trigger the blind/misleading implicature that *not all Italians do*, but we don't want the sentence *All Italians come from a beautiful country* to yield the implicature that *it's not the case that some do*, i.e. that none do! But with (77)a, and hence also with (77)b, this problem *does* arise, as we noted in Section 4.2. So it remains to be seen how a mechanism of implicature computation based on the negation of non-weaker alternatives could be made compatible with *either* theory envisaged here.

5 Conclusion

Let us take stock. Following Stalnaker's ideas, we started by showing that in some cases marking a presupposition can both (i) convey new information to the addressee, and (ii) ensure that the presupposition is indeed satisfied. This provided a mechanism to derive *some* instances of *Maximize Presupposition* from Gricean reasoning. But this measure proved insufficient in two respects. First, *Maximize Presupposition* is active even when the presupposition being marked is already common belief among the speech act participants. Second, the principle is also active in cases in which the presupposition is licensed by the linguistic material that precedes the trigger (Percus's examples).

• To solve the first problem, we postulated that the addressee is subject to Fallibility: there is a always a slight chance that his beliefs may be weakened in arbitrary ways. When this risk is realized, we are back to the kind of situation to which Stalnaker's mechanism can be applied – and marking a presupposition *does* produce information in the end. A side benefit of this analysis is that the scales involved in *Maximize Presupposition* can be made sensitive to the context: it is only in contexts in which *x knows that p* and *x believes that p* have the same assertive component that the two expressions compete.

• To solve the second problem, we adopted Singh's idea that *Maximize Presupposition* is computed relative to local contexts – but with a Gricean twist: it is because the addressee's beliefs about local contexts are also subject to Fallibility that *Maximize Presupposition* can produce information in the end.

We then applied these two mechanisms (Fallibility and Locality) to the analysis of Magri's blind implicatures.

• The mere possibility that the context might be weakened justifies choosing the stronger of two members of a scale even when the two are contextually equivalent. This had an added benefit: since Fallibility could lead to arbitrary weakenings of the context (not just to the total weakening leading to Magri's context-insensitive case), we could handle cases in which contextual knowledge was needed to compute the appropriate entailment among members of a scale.

• We were also able to extend the analysis of blind implicatures to embedded cases thanks to the assumption that embedded exhausitivity operators are sensitive to the logical force of members of a scale *relative to their local context*; when the knowledge of the local context is weakened, some misleading implicatures can be triggered (i.e. implicatures which contradict the assertive contribution of the clause that triggers them relative to its local context).

The precise mechanisms (psychological and logical) by which Fallibility arises should be investigated in greater detail; and some of the problems left open in Sections 3.3 and 4.3

still need to be addressed. But we hope to have shown that *Maximize Presupposition* can plausibly be re-analyzed in a broadly Gricean fashion, and that the necessary adjustments to our pragmatic framework can yield benefits for the analysis of implicatures.

It is also noteworthy that our analysis does not rely on trivalence, despite our initial statement of *Maximize Presupposition*: our pragmatic derivation can be added to any theory of presupposition projection which countenances local contexts. The latter can themselves be reconstructed on the basis of a classical, non-dynamic semantics (Schlenker 2009, 2010) – and hence *Maximize Presupposition* is neutral with respect to debates on trivalence and also dynamic semantics.

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