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Logical Integrity*

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Abstract Building on previous literature, in particular Percus 2006 and Spector & Sudo 2017, I argue that the principle *Maximize Presupposition!* as standardly conceived is too permissive in that it sanctions certain utterances that are intuitively infelicitous. I propose, as an alternative to MP, a novel principle called *Logical Integrity* and I show that while LI makes the same prediction as MP for the "core" examples it is restrictive enough to account for the two problematic cases discussed. Furthermore, I argue that LI without further ado make interesting predictions for a novel type of example (dubbed generalized Percus cases), the examples discussed in Magri 2009a, and, potentially, Hurford's Constraint.

Keywords: *Maximize Presupposition!*, contextual entailment, contextual equivalence, presupposed ignorance, mismatching implicatures

1 Introduction: *Maximize Presupposition!* and its problems

Maximize Presupposition! (henceforth MP) is a principle of language use, rooted in Heim 1991, according to which of two competing sentences that are equally informative one must use the one which has a stronger presupposition, unless this presupposition is not assumed to be true (see Percus 2006; Sauerland 2008; Singh 2011 and Schlenker 2012, a.o.).[1]

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1 There is convincing evidence that MP (or any other principle that aims at capturing the same paradigm) cannot simply compare sentences *at root*, but at least in some cases it needs to compare smaller constituents. See Singh 2011 in particular for the relevant data (which originate in Percus 2006) and discussion. Due to space considerations in this paper I will not engage with this particular issue. See Anvari 2018 for extensive discussion.

(1) ***Maximize Presupposition!*** Let S be a sentence and S^+ be an alternative of S which has a stronger presupposition. S should not be used in context C if the following two conditions hold:

a. The presupposition of S^+ is satisfied in C, (Condition SAT)

b. S and S^+ are contextually equivalent in C. (Condition EQU)

As formulated in (1), the principle MP can derive the contrast in (2).

(2) *Context: John has two students.*
John invited {#all, both} his students.

Assume the two sentences S = [*John broke all his students*] and S^+ = [*John broke both his students*] are alternatives.[2] The presupposition triggered by S^+ (that John has exactly two students) is stronger than S. As this presupposition is assumed to be true in the context of (2) the condition SAT, i.e., (1a), is satisfied (so, ✓SAT). Furthermore, S and S^+ are equally informative in that context in the sense that at every world compatible with the background assumptions in (2) either both sentences are true (John invited two of his two students) or both are false (John invited fewer than two of his two students). Therefore the condition EQU, i.e., (1b), is satisfied at well (so, ✓EQU). Since both conditions of MP are satisfied, it correctly predicts S to be blocked by S^+ in (2).

The two conditions on which MP relies, SAT and EQU, are jointly too strong and, consequently, MP is too permissive in that it sanctions certain utterances that are intuitively infelicitous. At least two types of examples witness this claim.

First, Percus (2010) has observed that in some cases when two competitors are equally informative S is infelicitous even though the presupposition of S^+ is *not* assumed to be true.[3]

(3) *Context: As a rule, John takes two students on at a time. We do not know whether John currently has students or not.*
John invited {#all, both} of his students.

2 An entirely standard theory of alternatives according to which sentential alternatives are derived by replacing certain lexical items with their alternative lexical items will do for the purposes of this paper, minus two exceptions. In subsections 2.2 and 2.4 I will assume that each disjunction has its individual disjuncts as its alternatives. This is a standard assumption with which different theories deal differently (e.g., Katzir 2007 and Sauerland 2004). In section 3 I will discuss a particular constraint on alternatives due to Fox (2007).

3 Here and throughout the notation S/S^+ is *always* used on the assumption that S and S^+ are alternatives such that the presupposition of S^+ is stronger than S. The identity of S/S^+ either will not matter or can be deduced from the surrounding text.

The presupposition of the *both*-sentence in (3) is not satisfied in that context. In (3) it is merely taken for granted that, at present, either John does not have any students or he has exactly two. The presupposition of *both* (that John, at present, has exactly two students) is, therefore, *not* part of the background assumptions, according to which it very well may be the case that at present John doesn't have any students (so, ✗SAT). On the other hand, the two alternatives *are* contextually equivalent. To see this, note that any world compatible with the background assumptions of (3) is either a world in which John does not have any students or a world in which John has exactly two students. In the former case both alternatives are undefined because both sentences presuppose that John has students (due to the plural definite embedded in the restrictors). In the latter case the situation is identical with (2). Therefore, neither sentence can be true without the sentence sentence being true as well (so, ✓EQU). Because SAT is not satisfied, MP does not predict any contrast to arise in (3), contrary to fact.

Second, Spector & Sudo (2017) have observed that in some cases when the presupposition of S^+ is assumed to be true S is infelicitous even though the two competitors are *not* equally informative.

(4) *Context: all students smoke.*
John is unaware that {#some, all} students smoke.

The two alternatives in (4) are not equally informative.[4] To see this, suppose w is a world in which all students smoke and, therefore, neither alternative in (4) yields a presupposition failure at w. Suppose further that in w John is certain that some students smoke but is not sure as to whether all students do. In w, S = [*John is unaware that some students smoke*] is false (since John does believe that some students smoke) while S^+ = [*John is unaware that all students smoke*] is true (since John is indeed ignorant as to whether all student smoke). Since worlds like w are not contextually ruled out in (4), the two alternatives in (4) are not equally informative (so, ✗EQU). On the other hand the presupposition of S^+ (that all students smoke) is satisfied in the context of (4) (so, ✓SAT). Because EQU is not satisfied, MP does not predict any contrast to arise in (4) contrary to fact.

The goal of this paper is to argue for an alternative to MP, a principle labeled Logical Integrity (henceforth LI), which maintains the good predictions of MP but is restrictive enough to account for (3) and (4) while making a host of other predictions

4 It is standard to analyze [*x is unaware that* ϕ] as presupposing that ϕ is true and asserting that x is either ignorant about ϕ or believes ϕ to be false:

$$[\![\, x \text{ is unaware that } \phi \,]\!] = \lambda w : [\![\phi]\!](w) = 1.\ \neg\forall w' \in \textsc{dox}_x^w : [\![\phi]\!](w') = 1.$$

on the side.

(5) ***Logical Integrity.*** Let S be a sentence and S′ be one of its alternatives. S is infelicitous in context C if the following two conditions hold.

a. S does not logically entail S′,

b. S contextually entails S′ in C.

The next two sections are organized as follows. Section 2 is divided in four parts. In subsection 2.1 I will demonstrate that once an appropriate definition of logical entailment is fed into LI it can account for the classic *Maximize Presupposition!* effects such as (2) (i.e., the cases where ✓SAT : ✓EQU) as well as the two problematic cases (3) (more generally, the cases where ✗SAT : ✓EQU) and (4) (more generally, cases where ✓SAT : ✗EQU). In subsection 2.2 I will show that LI is just about restrictive enough to accound for a novel type of example, one in which neither of the two conditions of MP are satisfied (i.e., a case where ✗SAT : ✗EQU). In subsection 2.3 I will briefly point out that LI also yields correct predictions for a class of data (discussed in detail by Magri (2009a) and subsequent publications) that are categorically outside of MP's purview as they involve alternatives that differ in their *assertive* force while having identical presuppositions. Finally, in subsection 2.4 I will explore the possibility of deriving Hurford's Constraint (Hurford 1974) from LI. In section 3 I will briefly discuss and defuse a potential counter-example to LI.

2 Logical Integrity

2.1 LI and MP

Let us go back to the example we began with, repeated below.

(6) *Context: John has two students.*
#John invited all his students.
ALT = {John invited both his students}

In the previous section I showed how MP can account for (6). I would now like to argue that this contrast can also be derived by LI, which is repeated below, *but only under a particular definition of logical entailment*.

(7) ***Logical Integrity.*** Let S be a sentence and S′ be one of its alternatives. S is infelicitous in context C if the following two conditions hold.

a. S does not logically entail S′,

b. S contextually entails S′ in C.

To begin with, we already know the second condition of LI, i.e., (7b), holds. As argued in the previous section, the two alternatives are contextually *equivalent* in the context of (6), from which it follows that the *all*-sentence contextually entails its *both*-variant; i.e., any world w compatible with background assumption assumptions of (6) is such that if the *all*-sentence is true in w then so if the *both*-sentence. So all we need to do is to make sure that the *all*-sentence does not logically entail its *both*-variant and LI will predict the oddness of (6).

As it happens, the desideratum that the *all*-sentence in (6) should not logically entail the *both*-sentence puts a non-trivial constraint on the definition of logical entailment in trivalent semantics. To see this, consider the following two salient definitions of logical entailment in a trivalent setting, where the possible truth-values are $\{1,0,\#\}$ and presupposition failure is marked by the third truth-value.[5]

(8) a. S strictly entails S′ iff for any world w, if S is true in w then S′ is true in w as well.

$$\mathrm{S} \vDash_{\text{strict}} \mathrm{S}' \text{ iff } \forall w : [\![\mathrm{S}]\!](w) = 1 \Rightarrow [\![\mathrm{S}']\!](w) = 1$$

b. S strawson entails S′ iff for any world w, if S is true in w then S′ is not false in w.

$$\mathrm{S} \vDash_{\text{strawson}} \mathrm{S}' \text{ iff } \forall w : [\![\mathrm{S}]\!](w) = 1 \Rightarrow \underbrace{[\![\mathrm{S}']\!](w) \neq 0}_{[\![\mathrm{S}']\!](w) \in \{1,\#\}}$$

In a bivalent setting with two truth-values, not being false is the same as being true. Hence the two definitions in (8) collapse in the bivalent case. In a trivalent setting, however, not being false means being *either* true *or* undefined. Hence $\vDash_{\text{strawson}}$ is in fact weaker than $\vDash_{\text{strict}}$ in a trivalent setting. I will now show that LI cannot account for (6) if (7a) is fed $\vDash_{\text{strawson}}$ but it can account for (6) if (7a) is fed $\vDash_{\text{strict}}$.

LI cannot predict the oddness of (6) if the notion of entailment that its condition (7a) relies on is taken to be strawson entailment. The reason is that S = [*John invited all his students*] strawson entails S^+ = [*John invited both his students*] (in fact, the two sentences are strawson equivalent). To see this, let w be a world in which S is true. If S is true in w then in w John has a certain number of students n and he

5 See Chemla, Égré & Spector 2017 for a general discussion of different ways to define logical entailment in trivalent semantics. The definition of strawson entailment is due to von Fintel (1999).

invited n out of his n students. There are two possibilities regarding n, either $n = 2$ or $n \neq 2$. If $n = 2$ then S^+ is also true in w. If $n \neq 2$ then S^+ is undefined in w due to presupposition failure. In other words, it is impossible for S to be true and S^+ to be *false*, which is to say that S strawson entails S^+.

LI can predict the oddness of (6) if the notion of entailment that it its condition replies on is taken to be strict entailment. That is to say, S in fact does not strictly entail S^+. To see this fairly obvious point, note that strict entailment means guarantee of truth: S strictly entails S' iff the truth of S guarantees that S' is *true* as well. Now, let w be a world in which John has four students and he invited all of them. In this world, S is certainly true but S^+ is undefined, i.e., it is not true. Therefore S does not strictly entail S^+. So the first condition of LI is now satisfied. Furthermore, we showed above that in the context of (6) S contextually entails S^+. Therefore the second condition of LI is satisfied as well, and LI predicts S to be infelicitous in (6). I will now proceed on the assumption that the notion of entailment that LI relies on is strict entailment which I will sometimes refer to as logical entailment *simpliciter*.[6]

Let me now move on to Percus's observation. The example (3) used in the previous section involved competition between *all* and *both*. Here is another example involving the articles which makes the same point.

(9) *Context: there are two possible outcomes in chess, checkmate (one winner) or draw (no winners).*
I just saw two people playing chess. {#A, the} winner was Iranian.

In (9) as well as (3) the context is not rich enough to guarantee that the presupposition of $S^+ =$ [*the winner was Iranian*] (that there was exactly one winner) is true, as it allows for the possibility of the game having ended in a draw. In (9) as well as (3) the alternatives are in fact contextually equivalent. To see this, let w be some world compatible with the background assumptions in (9). If S^+ is true in w then, automatically, S is true in w as well. Put differently, since S^+ strictly entails S, it contextually entails S *in any context*. So let us show that S contextually entails S^+ in (9). Suppose S is true in w. This means that in w there was at least one winner who was Iranian. But since w is compatible with the background assumptions of (9) there must have been exactly one winner, who also happened to be Iranian. Therefore, S^+ must be true in w as well.

6 A reviewer opines that the present inquiry "stands on very shaky feet" due to limited empirical scope. One point that the reviewer makes is that LI "should imply" that both [*John broke all of his arms*] and [*John broke each of his arms*] are equally infelicitous while in fact the latter is relatively less degraded if not entirely felicitous. I think this is a very interesting *puzzle* for LI and, indeed, every other extant analysis of the phenomena discussed in this paper (that I know of). One salient possibility, of course, is to deny that *each* competes with *both* in the first place. But deriving this stipulation from independently motivated considerations is not trivial.

Now, MP cannot account for (9) for exactly the same reason that it couldn't account for (3), because the presupposition of S^+ is not satisfied in both examples. LI, on the other hand, immediately predicts (9). First, note that S does not strictly entail S^+. In an imaginary world in which the rules of chess allow for both players winning, if both players in fact win the game and one of them is Iranian, S is true but S^+ is undefined (hence not true). Second, S does contextually entail S^+ in (9) as we just argued in the previous paragraph. Therefore LI predicts S to be infelicitous in (9) (the exact same reasoning applies to (3)).[7]

Next, let us consider Spector & Sudo's (2017) observation, repeated below.

(10) *Context: all students smoke.*
#John is unaware that some students smoke.
ALT = {John is unaware that all students smoke}

Recall the problem here was that even though the presupposition of S^+ = [*John is unaware that all students smoke*] is satisfied, the two alternatives are not contextually equivalent. Note, however, that LI does not rely on contextually equivalence, rather contextual entailment. Let's check the two conditions of LI. First, S does not strictly entail S^+. In a world in which only some students smoke, S may be true (depending on John's belief state) but S^+ is certainly not true due to presupposition failure. Second, the S does contextually entail S^+ despite the fact that the two are not contextually equivalent. To see this, note that any world *w* compatible with the background assumptions of (10) is one in which all students smoke, therefore both sentences are defined at *w*. Suppose S is true in *w*. This means that in *w* John does not believe that some students smoke which entails that John does not believe that all students smoke either. Therefore the S^+ must be true in *w* as well. Since both conditions of LI are satisfied for (10), it predicts the oddness of the *some*-variant in (10).

What we showed in this subsection is that once an appropriate notion of logical entailment is fed into LI, the resulting principle can capture classic MP effects as well as the two puzzles raised by Percus (2010) and Spector & Sudo (2017). In the next three subsections I will show three further advantages that LI might have over MP.

7 Even though the presupposition of S^+ is not satisfied in (9) (or (3)) the sentence can nevertheless be uttered felicitously, presumably by relying on the process of accommodation. One might be tempted to argue, on the basis of this observation, that in both (3) and (9), S is infelicitous simply because S^+ can be felicitously uttered regardless of the fact that its presupposition is not satisfied. See Anvari 2018 for some arguments against this approach.

2.2 Further application I: generalised Percus cases

Consider the following utterance.

(11) *Context: we know that Mary was born somewhere in France, but we do not know which city.*
#John is unaware that Mary was born in Paris or London.

One way to account for the oddness of the sentence S = [*John is unaware that Mary was born in Paris or London*] in (11) is to say that it is a typical MP effect due to the competition of S with its alternative S^+ = [*John is unaware that Mary was in Paris*] on the basis of the fact that the presupposition of S^+ (that Mary was born in Paris) is stronger than the presupposition of S (that Mary was born in Paris or London). However, MP is categorically incapable of accounting for the oddness of S in (11), for two reasons.

First, like Percus's (2010) example discussed earlier, the presupposition of S^+ is in fact not satisfied in the context of (11) as it is merely common ground that Mary was born somewhere or other in France, the context is not strong enough to determine which city in France she was born in (so, ✗SAT).

Second, like Spector & Sudo's (2017) example discussed earlier, S and S^+ are *not* contextually equivalent in the context of (11). Take *w* to be a world in which Mary was indeed born in Paris but John mistakenly believes that Mary was born in London. In *w*, S is false (because John does believe that Mary was born in London) however S^+ is true (because it is indeed correct that John does not believe that Mary was born in Paris). Since a world like *w* is not contextually ruled out in (11), S and S^+ are not contextually equivalent in that context (so, ✗EQU).[8]

The urgent question now is whether LI can account for (11). To see that it can, first note that S does not logically entail S^+. In a world in which Mary was born in London S may be true (depending on John's belief state) but S^+ is certainly not true as it suffers from presupposition failure. Next, let us verify that in the context of (11) S indeed contextually entails S^+. As the reasoning is relatively dense, I have broken it down in (12).

(12) a. Assumption: *w* is some world (i) compatible with the background assumptions in (11) in which (ii) S is true.

b. Since (i), in *w* Mary was born somewhere in France.

c. Since (ii), S is defined in *w*.

8 As this passage makes clear, example (11) may as well be called a "generalized Spector-and-Sudo case".

d. Since (12c), the presupposition of S is verified by *w*; i.e., in *w* Mary was born either in Paris or in London.

e. Since (12b) and (12d), in *w* Mary was born in Paris.[9]

f. Since (ii), *w* is a world in which John does not believe that Mary was born in Paris or London; that is, as far as John is concerned Mary may have been born in a city other than Paris and London.

g. Since (12f), *w* is a world in which John does not believe that Mary was born in Paris; that is, as far as John is concerned Mary may have been born in a city other than Paris.

h. Since (12e) and (12g), S^+ is true in *w*.

I have shown that for any world compatible with the background assumptions of (11), if S is true in that world then S^+ is true in that world as well. So S contextually entails S^+ in the context of (11). Since we also showed earlier that S does not strictly entail S^+, S is predicted to be infelicitous by LI in the context of (11).[10]

2.3 Further application 2: the Magri cases

The goal of this subsection is to briefly point out that some of the data discussed in Magri 2009a,b can be immediately accounted for by LI. In fact LI can account for the full paradigm that Magri lays out, however to show that I will need to equip LI with a suitable "projection recipe" in order to deal with data points that involve competition, not between root clauses, but smaller constituents in embedded positions. As I mentioned in footnote 1, I have left the problem of projection out of this paper. For extensive discussion the reader can consult Anvari 2018.

Consider the following utterance.

(13) *Context: John always gives the same grade to his students.*
This semester, John gave {#some, all} of his students an A.

The first thing to note is that in this example the alternatives trigger the same presupposition, namely that John has students. MP, as a principle that marks a preference

9 Tacit assumption: since *w* is compatible with the background assumptions in (12d), in *w* Paris is a city in France while London is not.

10 For space limitations I have not said anything about the proposals that Percus (2010) and Spector & Sudo (2017) motivate on the basis of their insights. Although I don't expect the reader to simply take my word for this, let me simply assert here that neither Percus's solution to his own observation (which crucially relies on the condition that alternatives be contextually equivalent) nor the system that Spector and Sudo's eventually adopt (which crucially relies on the condition that the presupposition of alternatives be satisfied) can capture the oddness of (11). See Anvari 2018 for the relevant discussion.

for the alternative with the *stronger* presupposition, is, therefore, categorically irrelevant here. Magri himself uses data like (13) to motivate a theory of exhaustification according to which (i) *exh* is obligatorily attached to every possible scope site and (ii) the notion of entailment that *exh* relies on is *logical* rather than contextual. These assumptions, coupled with certain facts about relevance, guarantee that in the context of (13) the *some*-sentence denotes the proposition that John gave an A to some *but not all* of his students. Since this proposition directly contradicts the background assumptions the sentence is predicted to be infelicitous in that context.

It is not difficult to see that LI also accounts for (13). The *some*-sentence in (13) certainly does not logically entail it *all*-variant. But in the specified context, it does contextually entail it. To see this, note that the context in (13) effectively entails that if John gave an A to some of his students then he gave an A to all of his students. It follows by *modus ponens* that the *some*-sentence contextually entails its *all*-variant, so the oddness of the *some*-sentence in the context of (13) is indeed predicted by LI as well.

2.4 A potential further application: Hurford's Constraint

Hurford's (1974) constraint (henceforth HC) states that disjunctions where one disjunct contextually entails the other are infelicitous.

(14) #John was born in France or Paris.

Given our background assumptions, Paris is a city of France. Therefore S = [*John was born in Paris*] contextually entails S′ = [*John was born in France*]. Therefore the oddness of (14) follows from HC. Note that, crucially, HC must be stated relative to *contextual*, rather than logical, entailment. The reason is that it is not a logical truth that Paris is a city of France. For example, it is logically conceivable that Paris is an independent country geographically surrounded by France. If so, then S does not logically entail S′ and HC cannot predict the oddness of (14) if it relies on logical entailment.

Now, HC is merely a generalization. The prevailing intuition regarding a principled derivation of HC involves redundancy. The details vary significantly (see, e.g., Kaztir & Singh 2013 and Meyer 2014, a.o.), but the core idea is that the sentence [*John was born in France or Paris*] has as an alternative [*John was born in Paris*] which is simpler. Since the two alternatives are contextually equivalent given our background assumptions[11] the former is prohibited on the ground of prolixity.

11 Since [*John was born in Paris*] contextually entails [*John was born in France*] it immediately follows that [*John was born in France or Paris*] contextually entails [*John was born in France*]. Furthermore, elementary facts about disjunction guarantee that [*John was born in France*] logically entails [*John*

There is a well-known class of *prima facie* counterexamples to HC of which (15) is an example.

(15) John invited some or all of his students.

That the sentence in (15) is entirely felicitous is problematic for HC since it is a logical truth that [*John invited all of his students*] logically entails [*John invited some of his students*]. Since logical entailment guarantees contextual entailment in any context, HC predicts (15) to be infelicitous. Data points like (15) have been used to motivate the grammatical theory of exhaustification (Chierchia, Fox & Spector 2009 and subsequent work). In a nutshell, the argument is that if the grammar is equipped with a covert exhaustivity operator, EXH, then one possible logical form for (15) would be (16).

(16) [EXH John invited some of his students] or [John invited all of his students]

Since [EXH *John invited some of his students*] denotes the proposition that John invited some *but not all* of his students, the second disjunct no longer entails the first. Since the sentence in (15) has a parse which does not violate HC, the sentence is predicted to be judged felicitous.

At this point, let me point out that LI can capture the relevant data points without any recourse to grammatical exhaustification.

(17) a. John was born in France or Paris = S
John was born in France = S′

b. John invited some or all of his students = S
John invited all some of his students = S′

As argued above, in both cases in (17) S contextually entails S′. The difference from the point of view of LI, then, has to be on the logical side. In (17b) the entailment goes through logically as well as contextually. As LI is by definition restricted to alternatives that are *not* logically entailed, LI does not predict S to be blocked by S′ in (17b). In (17a), on the other hand, the entailment does not go through logically. That is, logically, S = [*John was born in France or Paris*] does not entail S′ = [*John was born in France*] (as pointed out above). Therefore, LI predicts S to be blocked by S′ in (17a).[12]

was born in France or Paris] which, in turn, guarantees that the former contextually entails the latter in any context. It follows that [*John was born in France*] and [*John was born in France or Paris*] are contextually equivalent.

12 I am grateful to Raj Singh and Danny Fox for bringing this prediction of LI to my attention.

So LI seems to capture both cases of infelicity due to HC violation (as in (14)) and cases of felicity due to HC obviation (as in (15)). Furthermore, LI does this without any recourse to grammatical exhaustification. It follows that *if* LI is the correct account of HC, then HC cannot be used as a motivation for grammatical exhaustification. Unfortunately, HC type disjunctions have certain other properties that do not from LI. The most problematic property of this kind (due to Gajewski & Sharvit (2012) and discussed in detail with two other similar properties in Fox & Spector 2018), from the point of view of LI, is that HC disjunctions (that is disjunctions where one disjunct contextually entails the other) are *always* infelicitous when embedded under negation.

(18) a. #John was not born in France or Paris.

b. #John did not invite some or all of his students.

As the reader can easily verify, the predictions that LI makes for (18a) and (18b) are exactly the same as those it makes for (14) and (15). The problem, of course, is the oddness of (18b). As far as I can see there is no simple modification of LI that allows it to capture the oddness of (18b) while maintaining the felicity of (15). Of course, it could be that (18b) is infelicitous independently of LI-related considerations. But it is very difficult to imagine a reason for the oddness of (18b) that does not at the same time predict (15) to be infelicitous. I will have to leave this issue for future research.

3 A potential counterexample to LI

In this subsection I'd like to discuss a potential counterexample to LI which was brought to my attention by Maša Močnik and Ciyang Qing (p.c.).[13] Consider the following utterance.

(19) *Context: we know that every student solved at least some of the problems, but we don't know whether there are students who solved all of the problems.*
Some of the students solved all of the problems.

The felicity of the utterance in (19) is problematic for LI on the assumption that the sentence in (20), $\forall\exists$, is an alternative to the sentence in (19), $\exists\forall$.

(20) All of the students solved some of the problems.

13 I am grateful to Moshe Bar-Lev for helpful discussion.

To see why, note that $\exists\forall$ does not logically entail $\forall\exists$. In any world in which at least one student solved all of the problems and at least one student didn't solve any of the problem, $\exists\forall$ is true and $\forall\exists$ is false. On the other hand, in the context of (19) $\exists\forall$ contextually entails $\forall\exists$ for a rather trivial reason. In (19), $\forall\exists$ is *already assumed to be true* and it is a general fact about contextual entailment that for any context C and any propositions S and S′, if S′ is assumed to be true in C[14] then S contextually entails S′ in C. LI, therefore, seems to incorrectly predict that (19) is infelicitous.

For all I know the problem raised by (19) is lethal for LI. However, here I would like to explore two responses to this problem that rely on more or less independently motivated assumptions.[15]

One potential response is to deny the assumption that $\forall\exists$ is an alternative to $\exists\forall$ to begin with. This move is encouraged by at least two considerations. First, it appears that $\exists\forall$ can never trigger the implicature that $\neg\forall\exists$. More specifically, the claim that is there is no context in which an utterance of the string in (21) comes with the implicature indicated below it. One the assumption that any implicature-related alternative is also an LI-related alternative, this observation seems to support to the claim that $\forall\exists$ is not an alternative to $\exists\forall$.

(21) Some of the students solved all of the problems.
$\not\rightsquigarrow$ at least one student didn't solve any of the problems

Second, based on certain considertations pertaining to the embedding of disjuncts under universal quantifiers, Fox (2007) (see his fn. 35) has suggested a constraint on alternatives which guarantees that $\forall\exists$ is not an alternative to $\exists\forall$.

(22) **Fox's constraint.** For any sentence S, the set of alternatives associated to S, ALT(S), is the smallest set such that,

a. $S \in \text{ALT}(S)$, and

b. If $S' \in \text{ALT}(S)$ and S'' can be derived from S' by replacing one scalar item with an alternative such that S' does not entail S'' then $S'' \in \text{ALT}(S)$.

(22) has the effect of breaking down the derivation of alternatives into successive steps each consisting of a single replacement. As summarized in (23) there are two ways to derive $\forall\exists$ from $\exists\forall$ both of which violate Fox's constraint.

14 S′ is assumed to be true in C iff S′ is true in every world of C.

15 Note that an obvious, and completely stipulative, response would be to simply restrict LI to those alternatives that are not contextually trivial.

(23) a. $\exists\forall \longrightarrow \forall\forall \not\longrightarrow \forall\exists$

b. $\exists\forall \not\longrightarrow \exists\exists \longrightarrow \forall\exists$

$\therefore\ \forall\exists \notin \textsc{alt}(\exists\forall)$ (By Fox's constraint)

To my knowledge no independent evidence in favor of Fox's constraint has been discussed in the literature. Consequently it reasonable that one be suspicious of its application here. An alternative response to our original problem is to take into account the role of exhaustification. Note that no claim made in this paper is incompatible with the availability in principle of a grammatical mechanism of exhaustification. Now, one available parse for (19) is (24).

(24) Some of the students 1 [EXH all of the problems 2 [t_1 solved t_2]]

Of course, the exhaustivity operator in (24) is going to be semantically vacuous: the only scalar item in its scope is *all* which is at the top of its scale. However, suppose the alternative to (24) that it competes, as far as LI is concerned, with is (25).

(25) All of the students 1 [EXH some of the problems 2 [t_1 solved t_2]]

The LF in (25) is not contextually trivial; it denotes the proposition that all of the students solved some but not all of the problems, which is contextually informative. Furthermore, (25) is neither logically *nor contextually* entailed by (24) for the simple reason that (24) logically (and therefore also contextually) entails that (25) is false. Now, *if* the only alternative to (24) that is taken into consideration by LI is (25), the sentence (19) is predicted *not* to be blocked by LI (because the string has a parse does not violate LI). The problem, of course, is that it is very plausible that (25) is not the only relevant alternative; indeed, the LF in (26), derived by removing the exhaustivity operator in (25), appears to be an equally legitimate alternative.

(26) All of the students 1 [some of the problems 2 [t_1 solved t_2]]

For this line of reasoning to work, therefore, I need to stipulate that while (25) is an alternative to (24), (26) is not. One might want to derive this stipulation from the assumption that covert material cannot be deleted across alternatives, as argued by Meyer (2013). Indeed this same assumption is crucial for Magri (2009b) as well. I leave further investigation of this problem to future research.

4 Conclusion

Building on previous literature, in particular Percus (2006) and Spector & Sudo (2017), I have argued that the principle *Maximize Presupposition!* as standardly conceived is too permissive in that it sanctions certain utterances that are intuitively infelicitous. I proposed as an alternative to MP a novel principle called *Logical Integrity* and I showed that while LI makes the same prediction as MP for the "core" examples it is restrictive enough to account for the two problematic cases discussed. Furthermore, I argued that LI without further ado make interesting predictions for a novel type of example, the cases discussed in Magri (2009a), and Hurford's Constraint. Finally, I discussed and defused one potential counter-example to LI.

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