Epistemic Narrowing from Maximize Presupposition*

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1. Introduction

The principle of *Maximize Presupposition!* (MP), first proposed by Heim (1991), has been prominent in recent research, with linguists seeking to explain the complex ways in which speakers of a language use presuppositions and hearers interpret these uses (Percus 2006, Sauerland 2008, Chemla 2008, Schlenker 2012, Leahy 2016). Here we discuss what theory of alternatives supports the competition, or lack thereof, between presuppositonally weaker and stronger utterances. While a scale-based approach to alternatives similar to that first proposed for Scalar Implicature (Horn 1972; Gazdar 1979) has been employed for MP (Percus 2006), we will argue for a complexity-based approach modelled on Katzir (2007). This leads us into a phenomenon we call *Epistemic Narrowing*, whereby the inference drawn from the weaker of two competing alternatives concerns not common belief, as is predicted by MP, but rather the speaker's own beliefs. To explain *Epistemic Narrowing*, we will refer to what Chemla (2008) calls the *Authority Assumption*, an assumption made by hearers which licenses speakers to force accommodation upon them. We will show this notion to be too weak as it stands, and propose to strengthen it by limiting the instances under which a speaker is licensed to force accommodation upon her hearer. These more stringent conditions for presupposition accomodation are those where the accommodated presupposition is either easy for the hearer, or efficient for the speaker. The notion of efficiency, as shall be discussed, stems directly from the application of Katzir's (2007) complexity-based approach to alternatives.

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2. Antipresuppositions

MP as a pragmatic principle governing the use of presuppositions was first proposed by Heim (1991), in an attempt to capture the distribution of definite and indefinite descriptions in conversation. The principle bans use of an utterance S if there exists a presuppositionally stronger S′ whose presupposition is already known to be satisfied. We state MP as in (1).

(1) *Maximize Presupposition!*
A speaker s addressing hearer h will not use S if there is an S′ such that:

i. Strength condition: $p(S') \subset p(S) \wedge a(S') = a(S)$
The presupposition of S′ strictly entails that of S, while the asserted content a of S′ is the same as that of S

ii. Pragmatic condition: $cb_{s,h}(p(S'))$
The presupposition of S′ is common belief shared between the speaker s and the hearer h: $bel_s(p(S')) \wedge bel_h(p(S')) \wedge bel_s(bel_h(p(S'))) \wedge bel_h(bel_s(p(S'))) \ldots$

MP captures the infelicity of the utterances in (2a)-(4a). Given that the presuppositions of (2b)-(4b) are guaranteed by world knowledge, and given that the only difference between (2b)-(4b) and (2a)-(4a) is the addition of that presuppositional content, using (2a)-(4a) rather than their presuppositionally stronger alternatives is in violation of MP.

(2) a. #An independence of the United States is celebrated on July 4.
b. The independence of the United States is celebrated on July 4.
presupposes that there is exactly one independence of the United States

(3) a. #Mary believes that Paris is in France.
b. Mary knows that Paris is in France.
presupposes that Paris is in France

(4) a. #Jerry shaved all his legs.
b. Jerry shaved both his legs.
presupposes that Jerry has exactly two legs

MP also predicts that hearers, when presented with an utterance for which there is a presuppositionally stronger alternative, will draw as an inference that the pragmatic condition for this stronger alternative was not met. Hence it will be assumed that the presupposition of the stronger alternative is not common belief. We will use Percus's (2006) term *Antipresuppositions* (AP) for such inferences. To illustrate, the utterance in (5a) is predicted to carry the inference that (5b)'s presupposition is not common belief. As discussed in more detail in Section 5, this seems consistent with how (5a) is used and understood.

(5) a. A German student in my seminar brought cannoli.
AP: $\neg cb_{s,h}$(that there is exactly one German student in the speaker's seminar)

b. The German student in my seminar brought cannoli.
presupposes that there is exactly one German student in the speaker's seminar

3. Alternatives

MP as outlined in (1) covers much empirical ground, but it requires elaboration. For cases like (6a), an AP may be expected under MP as stated, but is not actually attested.

(6) a. The guests left.
b. The two guests left.
presupposes that there are exactly two guests

Sentence (6b) meets the strength condition of MP, as it is equivalent to (6a) save for its stronger presupposition. Hence, in situations where (6b)'s presupposition is met, (6a) is expected to be infelicitous. However, intuitions are very clear regarding the fact that (6a) is felicitous regardless of whether or not it is common belief that there are exactly two guests. So the definition of MP in (1) predicts unattested APs. What is required to weaken the principle's effect is a theory of "alternatives", which lets (5a) and (5b) compete, but not (6a) and (6b). This leads us to the revised definition in (7), where the formal condition serves for the moment as a place-holder for whichever theory of alternatives will be chosen.

(7) *Maximize Presupposition!*
A speaker s addressing hearer h will not use S if there is an S' such that:
i. Formal condition: alt(S', S)
S' is an alternative to S
ii. Strength condition: $p(S') \subset p(S) \wedge a(S') = a(S)$
iii. Pragmatic condition: $cb_{s,h}(p(S'))$

Alternatives for MP have been specified in terms of scales (Percus 2006), much like alternatives for *Scalar Implicature* (Horn 1972; Gazdar 1979). In essence, a scale is a set such as {a, the}, and alternatives are derived by substitution of one scale mate for another. Additional scales would therefore be the sets {believe, know} and {all, both}. In order to capture the fact that (6b) does not compete with (6a), one could state that there is no scale {the, the two}, and thus that these utterances are not alternatives.

However, scales that are simply stipulated have no explanatory value. In the domain of Scalar Implicature, Katzir (2007) proposed to replace scales with a notion of structurally-defined alternatives. On this view, a parse tree S' will be a member of the set of alternatives of S if and only if it is at most as complex as S, meaning that S' can be derived from S through a finite series of (a) substitutions (substituting an element in S with an element of the same lexical category) or (b) deletions (removing edges and nodes from S).

Since Katzir's complexity-based approach to alternatives was designed for Scalar Implicatures, its application to MP remains to be investigated. Three predictions must be met. Assuming that MP's strength condition is met for an utterance S' with respect to S, it is

predicted that (i) if S′ is structurally equivalent, S will antipresuppose the presupposition p of S′, (ii) if S′ is structurally more complex, S will not antipresuppose p and (ii) if S′ is structurally simpler, obtained from S through deletion, S will antipresuppose p.

The first of these predictions is the simplest to confirm. Indeed, in all cases of MP presented thus far, alternatives can be thought of as given by scales such as {a, the}, {believe, know} and {all, both}, where one lexical item was substituted for another. Those alternatives are straightforwardly recovered under Katzir's account, where any substitution of a lexical item for an item of the same category yields an alternative. Crucially, the strength condition of MP plays an important role in determining whether or not an utterance and one of its alternatives will enter in competition, as illustrated in (8).

(8) a. Mary waved goodbye to all of her children.
AP: $\neg cb_{s,h}$(that Mary has exactly 2 children)

b. Mary waved goodbye to both of her children.
presupposes that Mary has exactly two children

c. Mary waved goodbye to some of her children.
presupposes that Mary has children

While (8c) is effectively an alternative to (8a), it does not compete with (8a) given that it is weaker. This is in contrast to the observed competition between (8a) and (8b), where the presupposition of the latter is stronger than that of the former.

With regard to the second prediction, we observe that Katzir's complexity based approach to alternatives correctly predicts the lack of competition between the utterances in (6). As noted, (6b) meets the strength condition for MP. We can explain the lack of competition between both utterances by the fact that (6b) is structurally more complex than (6a).

The final prediction to check is whether or not structurally simpler alternatives, *i.e.* alternatives derived through deletion, will in fact compete with the utterances from which they are derived. For an example to be valid, it must not only be the case that the asserted contents of both utterances be identical, but moreover, that the presuppositional content of the structurally simpler alternative be stronger than that of its more complex counterpart.

We present two cases where such alternatives can be obtained. In the first, the deleted element is found within the scope of the presupposition trigger. In the particular case of (9), the element being deleted is one of two disjuncts scoped under the definite article.

(9) a. The two or three points John scored impressed Mary.
APs: $\neg cb_{s,h}$(that John scored exactly 2 points), $\neg cb_{s,h}$(that John scored exactly 3 points)

b. The two points John scored impressed Mary.
presupposes that John scored exactly 2 points

c. The three points John scored impressed Mary.
presupposes that John scored exactly 3 points

The examples in (9b) and (9c) both meet the formal and strength conditions with respect to (9a). Both have been obtained through deletion and furthermore, (9a) is equivalent to both (9b) and (9c) modulo presuppositional content: (9b) and (9c) presuppose that the number of points John scored is two and three, respectively, while (9a) merely presupposes that that number is two or three. Thus, a speaker's utterance of (9a) will be predicted to lead a given hearer to infer that the pragmatic conditions for (9b) and (9c) are not met, resulting in the APs stated in (9a). This prediction is in fact borne out. However, it is borne out in a way that requires comment. The clear inferences one draws from (9a) is not merely that it is not *common* belief whether John scored exactly two or three points, but rather that the *speaker* is herself unaware of whether John scored exactly two or three points. The predicted APs are attested in virtue of these latter attested inferences strictly entailing the former: if the presuppositions of (9b) and (9c) are not part of the set of the speaker's beliefs, then they cannot be members of the set of common beliefs of the speaker and his hearer.

A similar phenomenon occurs in the second type of deletion case we found. This second type of case relies on the notion of presuppositional filtering (Karttunen 1973), where a presupposition can be filtered by neighboring content that entails it. The presupposition of (10b) below is filtered in (10a) by a conjunct preceding the trigger *his*.[1]

(10) a. No boy has a bike and lost his bike.
AP: $\neg cb_{s,h}$(that all boys have bikes)

b. No boy lost his bike.
presupposes that all boys have bikes

Once again, the utterance in (10b) meets both MP's formal and strength conditions with respect to (10a). Not only is it obtained from the latter through deletion, but it asserts the same content as (10a) with the added presupposition that (10a) filters out. Much like in the example in (9a), an utterance of (10a) does not merely lead hearers to infer that (10b)'s presupposition is not *common* belief, for intuitions are very crisp regarding the fact that such an utterance leads one to infer that the *speaker* does not believe that all boys have bikes. This in turn entails that (10b)'s presupposition is not common belief, but through the same type of reasoning described for (9a).

In (11) and (12), it is explicitly stated how the predicted APs of (9a) and (10a) relate to the attested inferences, where $\neg bel_S(p)$ signifies that the speaker s does not believe p.

(11) The two or three points John scored impressed Mary.
$\neg bel_S$(that John scored exactly 2/3 points) $\models \neg cb_{s,h}$(that John scored exactly 2/3 points)

(12) No boys have bikes and lost their bikes.
$\neg bel_S$(that all boys have bikes) $\models \neg cb_{s,h}$(that all boys have bikes)

[1]We thank Raj Singh for the suggestion that alternatives for MP could be obtained through deletion of a presupposition filter.

In this paper, the phenomenon whereby a predicted AP concerns the speaker's beliefs rather than the common belief shared between speaker and hearer will be understood to be not an inference separate from an AP, but rather as the strengthening of an AP. This strengthening process, here dubbed *Epistemic Narrowing* (EN), operates in such a way that the set of beliefs on which an AP is focused is no longer the intersection of the beliefs of a speaker s and a hearer h, but rather the set of beliefs of s. In this sense, the epistemic scope of the inference is "narrowed" from the common belief to the beliefs of the speaker.

4. Epistemic Narrowing

The phenomenon here labelled EN has been previously described in the literature. Chemla (2008) has described occurrences of APs in which the focus of the inference is not on common belief, but rather on the speaker's beliefs. Interestingly, Chemla's example shown in (13) differs from those in (9) and (10) insofar as its presuppositionally stronger alternative, rather than being structurally simpler, is structurally equivalent to it.

(13) a. John believes that I have a sister.
predicted AP: $\neg cb_{s,h}$(that the speaker has a sister)
actual AP: $\neg bel_s$(that s has a sister)

b. John knows that I have a sister.
presupposes that the speaker has a sister

MP as stated in (7) predicts the inference from an utterance of (13a) that it is not *common* belief that the speaker has a sister. But (13a) carries a rather stronger inference, *viz.* that the *speaker* does not believe she has a sister. To explain this, Chemla turns to a modern Stalnakerian view of presuppositions and common ground (Stalnaker 1998, 2002; von Fintel 2008; Schlenker 2012) and by proposing that the context surrounding an utterance is essential in determining the types of inferences drawn from it. According to him, context is responsible for determining whether an *Authority Assumption* (AA) about the speaker is made on the part of the hearer. This assumption will prove crucial to the strengthening of the AP in (13a) and, perhaps, those of (9a) and (10a).

Under the modern Stalnakerian view adopted by Chemla, a proposition p becomes common belief just in case (i) a speaker s believes p to be true, (ii) she presupposes p within an utterance S and (iii) her presupposing p has the effect of causing a hearer h to accommodate and believe p. Chemla refers to the third of these points as *Authority*. For s to be an authority on p signifies that if s were to presuppose p in a given utterance, her hearer would accommodate and believe p. As a result of this understanding of common belief, the general constraints on the use of presuppositions will be those illustrated in (14).

(14) Constraints on the use of presuppositional sentences: A sentence S with presupposition p can be felicitously uttered by a speaker s iff:

i. s believes that p is true
ii. s is an authority on p

It follows from these constraints on the use of presuppositional sentences that the predicted inference drawn from MP will differ significantly from how APs have been described so far in this paper. Assuming that $\text{bel}_s(\text{auth}_{s,h}(p(S')))$ signifies that the speaker s believes that she is an authority with respect to the hearer h on the presupposition of S', the predicted pragmatic condition which must be met in order for s to utter a sentence S' will be that of (15a), leading to the characterization of APs in (15b).

(15) a. Pragmatic Condition: $\text{bel}_s(p(S')) \wedge \text{bel}_s(\text{auth}_{s,h}(p(S')))$
b. Antipresupposition: $\neg\text{bel}_s(p(S')) \vee \neg\text{bel}_s(\text{auth}_{s,h}(p(S')))$

This new pragmatic condition for MP differs in an interesting way from its previously stated incarnation, *i.e.* $\text{cb}_{s,h}(p(S'))$. Recall that underlying this previous description of the pragmatic condition was an infinite chain of conjuncts, *viz.* $\text{bel}_s(p(S')) \wedge \text{bel}_h(p(S')) \wedge \text{bel}_s(\text{bel}_h(p(S'))) \wedge \text{bel}_h(\text{bel}_s(p(S'))) \ldots$, whereby the negation of a single of these was enough for the pragmatic condition to not be met. Under Chemla's version of the pragmatic condition, the conditions under which it can be negated are drastically reduced. Thus, it will never be the case that an utterance will prove infelicitous on account of the negation of some arbitrary conjunct in this series, *e.g.* $\neg\text{bel}_h(\text{bel}_s(\text{bel}_h(p(S'))))$. With this new formal condition, MP can be restated as the principle in (16).

(16) *Maximize Presupposition!*
A speaker s addressing hearer h will not use S if there is an S' such that:
i. Formal condition: $\text{alt}(S', S)$
ii. Strength condition: $p(S') \subset p(S) \wedge a(S') = a(S)$
iii. Pragmatic condition: $\text{bel}_s(p(S')) \wedge \text{bel}_s(\text{auth}_{s,h}(p(S')))$
The presupposition of S' is believed by the speaker s and s believes that she is an authority with respect to the hearer h on the presupposition of S'

This revision alone, however, is insufficient to account for the actual inference drawn in (13a). The additional premise needed is an assumption on the part of the hearer, *viz.* the *Authority Assumption* (AA). AA refers to the hearer's assumption that the speaker believes that in presupposing $p(S')$, she will cause the hearer to accommodate and believe $p(S')$.

(17) Authority Assumption: $\text{bel}_s(\text{auth}_{s,h}(p(S')))$

With the revised pragmatic condition and the AA in hand, we can explain why the strengthened inference in (13a) is drawn. Given that (13a) is weaker than (13b), its utterance leads the hearer to infer the negation of the pragmatic condition, *i.e* $\neg\text{bel}_s$(that the speaker has a sister) $\vee \neg\ \text{bel}_s(\text{auth}_{s,h}$(that the speaker has a sister)). But because the speaker could have uttered (13b), in which case the addressee would have accommodated its presupposed content, and because the speaker is aware of this, the hearer makes the AA $\text{bel}_s(\text{auth}_{s,h}$(that s has a sister)). The epistemically narrowed inference $\neg\text{bel}_s$(that s has a sister) can then be drawn straightforwardly by way of disjunction elimination, as recorded in (18).

(18) $\neg bel_S$(that s has a sister) $\vee$ $\neg bel_S(auth_{s,h}$(that s has a sister)) AP
$bel_S(auth_{s,h}$(that s has a sister)) AA

$\neg bel_S$(that s has a sister)

So, Chemla's account of AP based inferences correctly predict the epistemically narrowed inference in (13). Because (13a) was used rather than (13b), and because the AA is made on the part of the hearer, the AP will be epistemically narrowed and focus on the speaker's beliefs rather than common belief. This very same type of reasoning can be employed to derive EN from the utterance in (19a) and its alternative (19b).[2]

(19) a. A bathroom in my apartment is flooded.
AP : $\neg bel_S$(that there is exactly one bathroom in s's apartment)

b. The bathroom in my apartment is flooded.
presupposes that there is exactly one bathroom in s's apartment

5. Srengthening Authority

While we take Chemla's (2008) account to be on the right track, we suggest that it requires refinement. Let us first consider Chemla's own example in (20a). Because the speaker asserts in (20a) that she believes Mary is pregnant, *i.e.* bel_S(that Mary is pregnant), her uttering this weaker alternative instead of (20b) will result in the inference that $\neg bel_S(auth_{s,h}($ that Mary is pregnant)), once again obtained through disjunction elimination over $\neg bel_S$(that Mary is pregnant) $\vee$ $\neg bel_S(auth_{s,h}$(that Mary is pregnant)).

(20) a. I believe that Mary is pregnant.
AP: $\neg bel_S(auth_{s,h}$(that Mary is pregnant))

b. I know that Mary is pregnant.
presupposes that Mary is pregnant

The first thing to note is that Chemla's account predicts that the utterance in (20a) will not be epistemically narrowed, which is consistent with speaker intuitions on the matter. However, we suggest that the predicted inference $\neg bel_S(auth_{s,h}$(that Mary is pregnant)) is contrary to intuitions. Chemla describes (20a) as leading to the inference *that the speaker is not an authority about Mary being pregnant*, presumably referencing the common usage of the word *authority*, whereby she is not in a position to ascertain this fact. This is not, however, the technical meaning of *Authority* presented by Chemla. In discussing APs, the word has a very specific usage, *viz.* that a speaker uttering a sentence presupposing p will cause her hearer to accommodate and believe p. Yet it is quite clear that, under the assumption that there are no previous disagreements on whether Mary is pregnant or not, if a speaker were to utter (20b) while its presupposition was not previously believed by the hearer, the

[2]We thank Michael Wagner for the example in (19a).

hearer would simply accommodate and come to believe it. Thus, it appears as though the inference $\neg bel_S(auth_{S,h}$(that Mary is pregnant)) is in fact contrary to our intuitions.

In fact, aside from cases where the speaker and hearer disagree with respect to the presupposition of a stronger alternative, it becomes hard to imagine cases where the hearer's AA will not be made. This is problematic, as cases where no EN is observed will be predicted to yield the strengthened AP, as in the example first shown in (5), repeated in (21).

(21) a. A German student in my seminar brought cannoli.
Predicted inference: $\neg bel_S$(that there is exactly 1 German student in my seminar)

b. The German student in my seminar brought cannoli.
presupposes that that there is exactly 1 German student in my seminar

Because a speaker's utterance of (21b) would surely lead the hearer to accommodate and believe its presupposition, the authority assumption is met with respect to (21a), which predicts the epistemically narrowed AP in (21a). However, this is not an inference which can be obtained from (21a), a fact which can be established by thinking about the conditions under which it will be felicitous. It is clear that a speaker can utter (21a) felicitously despite believing (21b)'s presupposition to be true, which will be justified by her assumption that the hearer lacks this knowledge. Given an utterance of (21a), a hearer would accordingly be incapable of determining whether the speaker was herself unaware that there is exactly one German in her seminar, whether she believed there were many such students, or whether she simply assumed the hearer to be ignorant of the exact number of such students. There are thus too many conditions under which this utterance is felicitous for it to yield an epistemically narrowed inference. In fact, this perceived lack of EN in (21a) can be made perspicuous by performing a test in which speaker A utters (21a) while speaker B responds with a question indicating that no narrowed inference has been drawn, as in (22).

(22) A: A German student in my seminar brought cannoli.
B: Not good! Are there any other Germans in your seminar? There should be at least one German dessert.

What B's question indicates is that A's utterance does not convey the information that she does not believe there is exactly one German student in her seminar. Comparing the results of this test to a similar test performed on an utterance of (19a), where EN was observed, we can see that in the latter B's response is odd.

(23) A: A bathroom in my apartment is flooded.
B: #Not good! Are there other bathrooms in your apartment?

The oddness of B's response in (23) can be accounted for by the narrowed inference drawn form A's utterance. Similarly, we can show that the utterance in (24a) differs from Chemla's (2008) (13a) above insofar as unlike the latter, no EN inference can be drawn from it. If we

once again perform the same test we performed in (22), as in (25) and (26), the contrast between the inferences drawn from each utterance becomes clear.

(24) a. John believes that Mary has a sister.
Unattested: $\neg \text{bel}_S$(that Mary has a sister)

b. John knows that Mary has a sister.
Presupposes that Mary has a sister

(25) A: John believes that Mary has a sister.
B: What do you think? Does she have a sister?

(26) A: John believes that I have a sister.
B: #What do you think? Do you have a sister?

B's answer in (26), unlike his answer in (25), is very odd. Once again, this can be explained by the fact that the inference drawn from (13a), as opposed to the inference drawn from (24a), is epistemically narrowed. Yet, once again, Chemla's notion of *Authority* predicts that (24a) should lead to an EN inference as much as (13a) does.

It becomes apparent that Chemla's *Authority* is too weak, as it fails to arbitrate between APs where EN occurs and those where it does not. The notion of *Authority* must therefore be strengthened so as to make more stringent the conditions under which the AA can be made. We propose the formulation in (27).

(27) *Authority*
$\text{auth}_{s,h}(p(S'))$ iff h's accommodation of $p(S')$ following s's utterance of S' is easy

The concept of *Ease of Accommodation* that (27) appeals to is vague and surely requires fleshing out. Here we content ourselves with the preliminary characterization in (28), hoping that the ideas are intuitive enough to be understood and expanded upon in future work.

(28) *Ease of Accommodation*

a. The *Ease of Accommodation* of $p(S')$ is positively correlated with the degree to which a speaker s is judged reliable with respect to $p(S')$

b. *The Ease of Accommodation* of $p(S')$ is negatively correlated with the amount of surprisal associated with $p(S')$

Clause (28a) may capture the difference between (13a) and (24a), as in the former, the degree of reliability of the speaker for the presupposition of its stronger alternative may be less than in the latter. Thus, while the inference drawn from (13a) will be epistemically narrowed, that of (24a) will not, as suggested by (29).

(29) a. John knows that Mary has a sister
s is less reliable: Mary has a sister

b. John knows that I have a sister
s is more reliable: s has a sister

The notion of reliability presented in (28a) should be intuitive. The reason why a hearer will draw an epistemically narrowed AP from the weaker alternative of (29b) is because he judges the speaker to be reliable on whether or not she has a sister. Given this reliability, the hearer would easily accommodate the presupposition that s has a sister if s were to presuppose it. Thus, the AA is made for (29b) when is uttered its weaker alternative, leading to the inference $\neg bel_S$(that s has a sister). The converse is true for (29a), where the speaker is not judged to be reliable on whether Mary has a sister. Thus, the AA will not be made following an utterance of the sentence's weaker alternative, leading to an AP which has not been narrowed, *viz.* $\neg bel_S$(that Mary has a sister) $\vee$ $\neg bel_S(auth_{S,h}$(that Mary has a sister)).

This notion of reliability may also reflect the intuitive impression one gathers from the utterances in (20), restated below.

(30) a. I believe that Mary is pregnant.
AP: $\neg bel_S(auth_{S,h}$(that Mary is pregnant))

b. I know that Mary is pregnant.
presupposes that Mary is pregnant

As previously mentioned, the inference predicted by Chemla's account for (30a) is $\neg bel_S($ $auth_{S,h}$(that Mary is pregnant)), as $\neg bel_S$(that Mary is pregnant) is eliminated from the AP given the speaker's assertion that she believes Mary is pregnant. It was argued that according to Chemla's characterization of *Authority*, this inference was contrary to speaker intuitions. This is not the case for the revised account of *Authority* proposed here. It seems quite natural to assume that this inference should be understood as meaning the speaker does not believe she is reliable concerning whether or not Mary is pregnant. This is in fact much closer to the common usage of authority Chemla employed to justify the inference his model predicted from (30a), where he stated that (30a) would lead one to infer that the speaker is not an authority about Mary being pregnant.

The notion of surprisal appealed to in (28b) is intended in the information theoretic sense (e.g., Cover & Thomas 2012). It refers to a probability-based measure of the amount of information associated with a proposition. We can informally describe an utterance as possessing more surprisal if more of its presupposed content is new information and less surprisal if less of it is.[3] This notion may be at work when considering the contrast in the inferences drawn from (21a) and (19a), whose stronger alternatives are restated in (31a) and (31b), respectively.

[3]The relevance of information theoretic surprisal was suggested to us by Mats Rooth.

(31) a. The German student in my seminar brought cannoli.
more surprisal: there is exactly one German student in s's seminar

b. The bathroom in my apartment is flooded.
less surprisal: there is exactly one bathroom in s's apartment.

The utterance in (31a) is likely to carry more surprisal than that of (31b), as the probability of the number of German students in the speaker's seminar being one is lower than the probability of the number of bathrooms in her apartment being one. These probabilities are crucially reliant on encyclopedic knowledge. While no exact model of this process is provided here, we propose that because the probability of the presupposition in (31b) is relatively high, an utterance of (19a) will trigger the AA in hearers, leading to its epistemically narrowed AP. The converse is true of (21a), as the relatively high amount of surprisal generated by (31a) will prevent the AA from being met, leading to a weak, disjunctive, AP.

6. Epistemic Narrowing and Complexity

Having defended and refined Chemla's account of APs, our final point will be on whether or not this account is sufficient to explain the EN observed in (9) and (10), repeated below.

(32) a. The two or three points John scored impressed Mary.
APs: $\neg bel_S$(that John scored exactly 2 points), $\neg bel_S$(that John scored exactly 3 points)

b. The two/three points John scored impressed Mary.
presupposes that John scored exactly 2/3 points

(33) a. No boy has a bike and lost his bike.
AP: $\neg bel_S$(that all boys have bikes)

b. No boy lost his bike.
presupposes that all boys have bikes

Given the occurrence of EN in the APs of both (32a) and (33a), we seem compelled to conclude that the presupposition of (32b) and (33b) are easy, as the AA seems to be made in those cases. For independent verification, we now embed these presuppositions under *believe* and and its factive partner *know*. If accommodation of the presuppositions carried by (32b) and (33b) were indeed easy, we would expect the same for (34b) and (35b) as well and hence would expect for the AA to hold. (34a) and (35a) would then be predicted to support epistemically narrowed APs, in parallel to Chemla's (2008) example (13a) above.

(34) a. Mary believes that John scored exactly two/three points.
unattested: $\neg bel_S$(that John scored exactly two/three points)

b. Mary knows that John scored exactly two/three points.
presupposes that John scored exactly two/three points

(35) a. Mary believes that all students lost their bikes.
unattested: $\neg bel_S$(that all students lost their bikes)

b. Mary knows that all students lost their bikes.
presupposes that all students lost their bikes

Interestingly, this prediction fails in either case. It thus appears as though in both cases, the presupposition's *Ease of Accommodation* is not responsible for the epistemic narrowing of the AP. In order to explain how it is that EN nevertheless occurs in both these utterances, it may be helpful to consider their common characteristic, *i.e.*, that both have as their presuppositionally stronger alternative a structurally simpler utterance. A possible first step towards explaining this EN will be to refer to Horn's (1984) *R principle*, stated in (36).

(36) The R principle: SAY NO MORE THAN YOU MUST

The principle pressures speakers into being as communicatively efficient as possible, suggesting that a speaker, in order to be more efficient, should not use the utterances in (32a) and (33a) if she believes the presupposition of a competing alternative to be true. Thus, if the hearer does not believe this presuppositional content to be true already, he will be forced to accommodate it following an utterance of the presuppositionally stronger alternatives. The EN occurring in (32a) and (33a) can be explained by the gain in communicative efficiency acquired by the speaker from uttering the structurally simpler alternatives, which causes hearers to make the AA for (32b) and (33b). If a speaker fails to utter the simpler alternatives, the resulting AP will be narrowed, calling for a revision of the notion of *Authority* which includes the notion of structural complexity.

(37) *Authority*
$auth_{s,h}(p(S'))$ iff h's accommodation of $p(S')$ following s's utterance of S' is either easy for h, or s using S' and forcing h to accommodate rather than using S is efficient for s.

The notion of communicative efficiency, it should be noted, is a direct consequence of the application of Katzir's complexity-based approach to alternatives on MP. This provides further support for this approach, as it offers an explanation for the narrowing observed in (32a) and (33a) where, as shown, *Ease of Accommodation* does not seem to play a role.

7. Conclusion

We argued for a theory of alternatives for *Maximize Presupposition!* that is based on Katzir's (2007) notion of structural complexity. This argument led us into an investigation of *Epistemic Narrowing*. To derive epistemically narrowed *Antipresuppositions*, we argued that Chemla's notion of *Authority* must be strengthened so as to make more stringent the conditions under which the *Authority Assumption* is made. Thus, for a speaker to be licensed to force accommodation upon her hearer, it must be the case that either this

accommodation is "easy" for the hearer or that this accommodation endows the speaker with a gain in "communicative efficiency".

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