Simple disjunction PPIs – a case for obligatory epistemic inferences*

Andreea C. Nicolae

ZAS, Berlin

1. Introduction and data of interest

The goal of this paper is to offer a new analysis of the positive polarity behavior of simple disjunctions. This analysis is couched within the grammatical approach to implicature calculation as laid out in the work of Chierchia, Fox & Spector (2012), an approach which has subsequently been employed in the works of Chierchia (2013), Crnič (2014), and Fălăuş (2014), among many others, to account for the polarity behavior of indefinites across different languages.

It has been noted that disjunction exhibits polarity sensitivity in some languages but not in others (Szabolcsi 2002). For example, while English *or* and German *oder* are not PPIs, French *ou* and Hungarian *vagy* are. For the remainder of the paper I will use English and French examples to illustrate the difference between PPI and non-PPI disjunctions. One of the diagnostics for identifying a PPI is the inability of the indefinite to take narrow scope with respect to negation, a property which has been dubbed the "anti-licensing" condition, (1). Another properties, discussed at large in Szabolcsi 2004, is the ability of the positive polarity item to receive a narrow scope interpretation in the scope of a non-local negation, as shown in (2).

(1) Marie n'a pas invité Léa ou Jean à dîner.
'Marie has not invited Lea or Jean for dinner.'

a. Marie didn't invite Lea or she didn't invite Jean for dinner. *or>not*
b. *Neither Lea not Jean were invited to dinner by Marie. *not>or*

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(2) Paul ne pense pas que Marie ait invité Pierre ou Julie à dîner.
'Paul doesn't think that Marie invited Pierre or Julie for dinner.'

a. Paul doesn't think that M invited P or he doesn't think that M invited J.
b. Paul doesn't think that M invited P and he doesn't think that M invited J.

In this paper I offer an account of these distributional properties of PPI disjunctions using tools already employed elsewhere in the grammar.[1] While the focus of this paper is solely on simple disjunction PPIs, i.e., the counterparts of English *or*, I refer the interested reader to Spector 2014 for an account of the PPI behavior of complex disjunctions, i.e., the counterparts of English *either or*. The paper is organized as follows: Section 2 introduces the grammatical approach to scalar implicatures, setting up the necessary background for the analysis. Section 3 outlines the proposal in Spector 2014 for dealing with complex disjunction PPIs, which Section 4 subsequently builds upon in order to derive an account of simple disjunction PPIs as elements that obligatorily trigger epistemic inferences. Section 5 offers a proposal for how PPIs under non-local negation can receive a narrow-scope interpretation and finally Section 6 discusses cases where PPI disjunctions are felicitous even in the absence of epistemic inferences. Section 7 concludes.

2. The grammatical approach to scalar implicatures

Chierchia et al. (2012) argue that implicatures are derived in the grammar via a mechanism of alternative exhaustification, building on previous work in Krifka 1995, Chierchia 2004, Spector 2006, Fox 2007. The idea is that scalar elements activate alternatives and the grammar integrates these alternatives in a systematic way within the meaning of the utterance. Scalar implicatures (henceforth) SIs can thus be seen as the result of a syntactic ambiguity resolution in favor of an LF which contains a covert exhaustivity operator $\mathscr{E}\mathsf{xh}$. This operator has basically the same contribution as *only* in that it negates alternatives. One difference between overt *only* and $\mathscr{E}\mathsf{xh}$ is the way the alternatives which are to be negated are chosen. Crucially, the exhaustification happens with respect to a subset of the alternative set, namely that set which contains only *innocently excludable* alternatives. An alternative is innocently excludable if its negation can be added to the assertion without resulting in a meaning that entails another alternative.

(3) $\mathscr{E}\mathsf{xh}(\mathsf{p}) = \mathsf{p} \wedge \forall \mathsf{q} \in \mathbf{IE}(\mathsf{p}, \mathscr{A}\mathsf{lt}(\mathsf{p}))[\mathsf{p} \not\subseteq \mathsf{q} \rightarrow \neg \mathsf{q}]$
where: $\mathbf{IE}(\mathsf{p}, \mathscr{A}\mathsf{lt}(\mathsf{p})) = \lambda \mathsf{q}.\neg\exists \mathsf{r} \in \mathscr{A}\mathsf{lt}(\mathsf{p})$ s.t. $(\mathsf{p} \wedge \neg \mathsf{r}) \rightarrow \mathsf{q}$.
(p is true and any alternative q not entailed by p is false, as long as negating q is consistent with negating any other non-weaker alternative.)

[1]Two other landmark properties of PPI-hood are their ability to be "rescued" by a second negation, and "shielding", their ability to receive narrow scope interpretation with respect to negation whenever a universal quantifier intervenes between the indefinite and the negation. I will not discuss such cases here for reasons of space, but see Nicolae 2016 for the details of the analysis.

Following Zimmermann (2000), Sauerland (2004), Alonso-Ovalle (2006), Spector (2006) and Fox (2007), among many others, I argue that a disjunctive sentence such as (4a) is associated with the alternative set in (4b) which contains not only the conjunctive alternative, but also the individual disjuncts.

(4) a. Mary invited John or Bill.
    b. $\mathscr{A}\mathtt{lt}$ = {Mary invited John and Bill, Mary invited John, Mary invited Bill}

The question now is what happens when $\mathscr{E}\mathtt{xh}$ is applied to (4a). The first step is figuring out what the set of IE alternatives is. Note that neither domain alternative is innocently excludable since the exclusion of one results in a meaning that entails the other and vice versa. Since neither domain alternative is innocently excludable, the exhaustification proceeds with respect to a subset of the alternative set, namely the set containing only the conjunctive alternative. The result of applying $\mathscr{E}\mathtt{xh}$ will produce the same enriched meaning as if we had not considered domain alternatives, provided in (5):

(5) $\mathscr{E}\mathtt{xh}$ [Mary invited John or Bill] = Mary invited John or Bill & Mary didn't invite John and Bill

A sentence like (4a), however, does not always have the enriched meaning obtained in (5)—depending on the context, the implicature 'Mary didn't invite John and Bill' may or may not be present. I will assume, going forward, that we can encode the optionality of the SI as an optionality of exhaustification. In other words, a sentence like (4) can be thought of as ambiguous between the two LFs in (6a-b).

(6) Mary invited John or Bill.
    a. Mary invited John or Bill *inclusive*
    b. $\mathscr{E}\mathtt{xh}$[Mary invited John or Bill] *exclusive*

3. Complex disjunctions and the source of positive polarity

Most languages have more than one way of conveying disjunction. For example, in English we find *or* and *either or*, in French *ou*, *ou ou* and *soit soit*, in Romanian *sau*, *ori*, *ori ori*, *fie fie*, in Hungarian *vagy*, *vagy vagy* and *akár akár* and in German we encounter *oder* and *entweder oder*. One of the main differences between these ways of conveying disjunction within a language boils down to whether the disjunction is interpreted inclusively or exclusively in positive contexts; namely, whether the SI is present or not. So while (7a) can be continued with 'possibly both', (7b) cannot, at least not as easily (cf. Nicolae & Sauerland 2016 for experimental evidence to this effect).

(7) a. Mary will visit John or Bill. …*possibly both*
    b. Mary will visit either John or Bill. …#*possibly both*

Spector (2014) argues for an analysis of this difference as follows: unlike simple disjunction, which is ambiguous between the two LFs in (8), the complex disjunction is unambiguously interpreted with an $\mathscr{E}\mathtt{xh}$ operator; that is, only the LF in (8b) is available with complex disjunctions.

(8) a. $[\mathrm{p} \vee \mathrm{q}]$ ✓*ou*, ✗*soit soit*
b. $\mathscr{E}\mathtt{xh}[\mathrm{p} \vee \mathrm{q}]$ ✓*ou*, ✓*soit soit*

Interestingly, Spector notes, complex disjunctions also exhibit PPI-like behavior cross-linguistically.[2] For example, French *soit soit* cannot receive a narrow scope interpretation with respect to a c-commanding negation, (9), but it can if the negation is further embedded under a downward-entailing operator, (10).[3]

(9) Pierre ne parle pas soit allemand soit anglais.
'Pierre doesn't speak soit German soit English.'
a. Pierre doesn't speak German, or he doesn't speak English. *or*>not
b. *Pierre doesn't speak either German or English. *not>or*

(10) Je n'emmène jamais Marie au cinéma sans qu'elle ait demandé la permission soit à son pére soit à sa mére.
'I never bring Marie to the movies without her having asked permission from both her father and mother.'

Spector claims that these two distributional restrictions observed with complex disjunctions: (i) obligatory scalar implicature and (ii) restriction to upward entailing environments, should be seen as the result of the same underlying mechanism, namely that complex disjunctions should be analyzed as scalar elements that obligatorily trigger SIs by virtue of the fact that they obligatorily trigger exhaustification. In order to account for the PPI behavior of complex disjunctions, Spector has to furthermore assume that the application of $\mathscr{E}\mathtt{xh}$ is constrained by a pragmatic economy condition which dictates that the contribution of $\mathscr{E}\mathtt{xh}$ must give rise to strengthening (cf. Fox & Spector to appear).

(11) An occurrence of $\mathscr{E}\mathtt{xh}$ in a given sentence *S* is not licensed if eliminating this occurrence leads to a sentence *S'* such that *S'* entails or is equivalent to *S*.
An occurrence of $\mathscr{E}\mathtt{xh}$ *is licensed if it leads to strengthening.*

[2] An exception to this generalization is the English complex disjunction *either or* is not a PPI, as pointed out by Spector himself. I leave this as an open problem.
(i) Mary didn't invite either Lucy or John for dinner.
a. Mary didn't invite Lucy or she didn't invite John for dinner. *or>not*
b. Neither Lucy not John were invited to dinner by Mary. *not>or*

[3] Interestingly, complex disjunctions are anti-licensed by negation regardless of its locality. See Section 5 for a discussion of this difference between simple and complex disjunction PPIs.

If *soit soit* is analyzed as a disjunction which triggers obligatory exhaustification, the PPI-like behavior of this element comes out straightforwardly. Since disjunction is weaker than conjunction only in upward entailing environments, only in these environments does the contribution of $\mathscr{E}\mathtt{xh}$ lead to strengthening, hence the restriction of *soit soit* to upward entailing environments.

4. Simple disjunction PPIs and obligatory epistemic inferences

The analysis presented above works well for complex disjunctions, but it leaves wide open the question of how to analyze simple disjunction PPIs, i.e., disjunctions like French *ou*. The problem is that when we turn to simple disjunctions, their PPI status can no longer be seen as the result of obligatory scalar inferences, as these elements are only optionally associated with such an SI. If we want to maintain, with Spector, that positive polarity has its source in obligatory exhaustification, we must conclude that when it comes to exhaustification of sentences containing simple disjunctions, the scalar alternative must be ignored. To this end, I will follow previous authors (cf. Fox & Katzir (2011), Crnič, Chemla & Fox (2015)) who have argued that alternatives can be pruned, namely that exhaustification can proceed with respect to a subset of the set of alternatives. I will adopt this assumption and propose the following generalization:

(12) Simple disjunction may prune the scalar alternative from its alternative set, whereas complex disjunction may not.

In other words, a simple disjunction can associate with either of the alternative sets in (13), whereas a complex disjunction is restricted to the full alternative set in (13a). From here on out I will annotate these different alternative sets as $\mathscr{A}\mathtt{lt}_S$ and $\mathscr{A}\mathtt{lt}_D$ respectively. I will furthermore subscript the exhaustification operator with S or D to indicate which alternative set the operator associates with.

(13) a. $\mathscr{A}\mathtt{lt}_S(p \vee q) = \{p, q, p \wedge q\}$
b. $\mathscr{A}\mathtt{lt}_D(p \vee q) = \{p, q\}$

The goal going forward is to argue that, more generally, PPIs are elements which are lexically marked as triggering obligatory exhaustification, and that the difference among the different types of PPIs has its source in the alternatives that enter into the calculation.[4] I claim that simple disjunction PPIs (French *ou*), like complex disjunction PPIs (French *soit soit*), and unlike simple disjunction non-PPIs (English *or*) trigger obligatory exhaustification, an operation which is governed by the economy condition ruling out vacuous instances of $\mathscr{E}\mathtt{xh}$, cf. (11). The difference between the two types of disjunction PPIs is that simple disjunction PPIs trigger exhaustification with respect to a (possibly) different set of alternatives, namely the one in (13b).

[4] I follow Chierchia (2013) who encodes obligatory exhaustification as a lexical requirement in his analysis of NPIs.

The solution, however, is not as simple as saying that simple disjunction PPIs involve exhaustification with respect to (13b). Since these alternatives, repeated in (14a), are not innocently excludable, i.e., the exclusion of one results in the automatic inclusion of the other, the exhaustification of the assertion with respect to this set will be vacuous, as in (14b). As is, this account would predict that *ou* should be ruled out in UE cases given that the result of exhaustification is vacuous, contrary to the requirement imposed by $\mathscr{E}\mathsf{xh}$, (11).

(14) $\mathscr{E}\mathsf{xh}_D[p \vee q]$

a. $\mathscr{A}\mathsf{lt}_D(p \vee q) = \{p, q\}$

b. $\mathscr{E}\mathsf{xh}_D(p \vee q) = p \vee q$

This is obviously a wrong prediction and I argue that we can get around this problem by adopting the proposal in Meyer 2013 which takes uncertainty/epistemic implicatures, such as the one in (15), normally thought of as arising via pragmatic principles (e.g., via Grice's Cooperative Principle), to also be derived in the grammar, similarly to scalar implicatures.

(15) Mary invited John or Paul. $\rightsquigarrow$ *But I don't know which.*

Meyer's claim is that assertively used sentences contain a covert doxastic operator which is adjoined at the matrix level at LF (cf. also Kratzer & Shimoyama 2002, Chierchia 2006 and Alonso-Ovalle & Menéndez-Benito 2010 for similarly minded proposals). She calls this operator K (following Gazdar (1979) and gives it the semantics in (16). I represent this operator as a necessity modal throughout the remainder of the text.

(16) $[\![\Box_x\, p]\!] = \lambda w.\forall w' \in \mathrm{Dox}(x)(w) : p(w')$
$w' \in Dox(x)(w)$ *iff given the beliefs of x in w, w' could be the actual world.*

By bringing this operator into the grammar we can derive the epistemic implicature of disjunction similarly to how we derive its scalar implicature, via the application of an exhaustification operator. This implicature is obtained by having the exhaustifier take scope over the modal, as in (17):

(17) $\mathscr{E}\mathsf{xh}_D \Box(p \vee q)$

a. $\mathscr{A}\mathsf{lt}_D(\Box(p \vee q)) = \{\Box p, \Box q\}$

b. $\mathscr{E}\mathsf{xh}_D[\Box(p \vee q)] = \Box(p \vee q) \wedge \neg\Box p \wedge \neg\Box q = \Box(p \vee q) \wedge \Diamond\neg p \wedge \Diamond\neg q$

Exhaustifying with respect to this set of alternatives will deliver uncertainty implicatures about the two domain alternatives. For a sentence such as 'Mary visited John or Bill', the enriched meaning in (17b) will amount to 'Mary definitely visited one of the two, but it's possible she didn't visit John and it's possible she didn't visit Bill', hence the uncertainty with respect to the status of the individual disjuncts.

Adopting this way of deriving epistemic implicatures allows for a uniform approach to implicatures, both scalar and uncertainty. Most importantly for our purposes, however, it straightforwardly derives the acceptability of elements triggering obligatory exhaustification in UE cases. Notice that the enriched meaning in (17b) is stronger than the non-enriched meaning. In other words, the exhaustification is no longer vacuous, satisfying the condition in (11), and thus rendering the PPI disjunction *ou* acceptable in UE contexts.

Before concluding this section it is worth checking that in DE contexts the presence of the doxastic operator does not lead to any (undesired) strengthening. There are three possible LFs we need to check this for, provided in (18).

(18) a. $\Box[\neg[\mathscr{E}xh_D[p \vee q]]] = \Box[\neg[p \vee q]]$
b. $\Box[\mathscr{E}xh_D[\neg[p \vee q]]] = \Box[\neg[p \vee q]]$
c. $\mathscr{E}xh_D[\Box[\neg[p \vee q]]] = \Box[\neg[p \vee q]]$

The exhaustification in (18a) will be vacuous given that the domain alternatives are not innocently excludable. The vacuity of $\mathscr{E}xh_D$ in (18b) is due to the fact that the alternatives of a negated disjunction are weaker than the sister of $\mathscr{E}xh_D$, and the same is true of (18c).

At this point we have successfully shown why simple disjunction PPIs are unacceptable in DE but acceptable in UE environments once we analyze them as elements that trigger obligatory exhaustification and allow pruning of their scalar alternative.

5. PPIs under non-local negation

In this section we turn our attention to the second property of simple disjunction PPIs discussed in the introduction, their ability to take narrow scope with respect to an extra-clausal negation. While the simple disjunction *ou* cannot receive a narrow scope interpretation with respect to a local negation, (19), it can easily receive such an interpretation in the presence of a non-local negation, as shown in (20).

(19) Marie n'a pas invité Léa ou Jean à dîner.
'Marie has not invited Lea or Jean for dinner.'
a. Mary didn't invite Lucy or she didn't invite John for dinner.
b. ??Neither Lucy not John were invited to dinner by Mary.

(20) Paul ne pense pas que Marie ait invité Pierre ou Julie à dîner.
'Paul doesn't think that Marie invited Pierre or Julie for dinner.'
a. Paul doesn't think that Mary invite Pierre or he doesn't think that Mary invited Julie.
b. Paul doesn't think that Mary invite Pierre and he doesn't think that Mary invited Julie.

This is prima facie problematic since we showed earlier that exhaustification cannot lead to strengthening when disjunction occurs in the scope of a negation, and intuitively so since the meaning that results from interpreting disjunction under negation is stronger than any other conceivable alternative. It appears then that we have reached an impasse. On the one hand we need to argue that there is exhaustification which furthermore leads to strengthening so as to account for the PPI's acceptability, while on the other hand we want to derive a meaning that is equivalent to the meaning corresponding to the non-exhaustified LF. Furthermore, whatever analysis we put forward to account for the acceptability of the reading in (20b) must not be an option for PPIs under clause-mate negation, (19b).

Within this system, the only way to achieve both strengthening and a meaning equivalent to the non-exhaustified LF is via the LF in (21) which consists of recursive exhaustification in the embedded clause, followed by a second level of recursive exhaustification above the negation in the matrix clause.[5] Crucially, all instances of exhaustification occur with respect to the pruned alternative set consisting only of the domain alternatives. For presentational purposes I represent recursive exhaustification via a single operator $\mathsf{Exh}_{\mathsf{RD}}$.

(21) $\Box[\mathscr{E}\mathsf{xh}_{\mathsf{RD}}[\neg[_{\mathsf{CP}}\,\mathscr{E}\mathsf{xh}_{\mathsf{RD}}[p \vee q]]]]$

In the following I will walk the interested reader through each step in detail.[6] After the first level of recursive exhaustification an enriched meaning is obtained. Recursively exhaustifying a disjunction amounts to exhaustification with respect to the pre-exhaustified alternatives in (22a), which in turn results in a conjunctive meaning, (22b).

(22) $\mathscr{E}\mathsf{xh}_{\mathsf{RD}}[p \vee q]$

a. $\mathscr{A}\mathsf{lt}_{\mathsf{RD}}(p \vee q) = \{\mathscr{E}\mathsf{xh}_{\mathsf{D}}(p), \mathscr{E}\mathsf{xh}_{\mathsf{D}}(q)\}$
$= \{p \wedge \neg q, q \wedge \neg p\}$

b. $\mathscr{E}\mathsf{xh}_{\mathsf{RD}}[p \vee q] = (p \vee q) \wedge \neg(p \wedge \neg q) \wedge \neg(q \wedge \neg p)$
$\equiv p \wedge q$

If we take the result of exhaustification to be evaluated globally (cf. Fox & Spector to appear), we observe that the result of recursive exhaustification gives rise to a globally weaker meaning since a conjunction in the scope of negation amounts to a weaker meaning than disjunction in the scope of negation.

(23) $\Box[\neg[p \vee q]] \rightarrow \Box[\neg[\mathscr{E}\mathsf{xh}_{\mathsf{RD}}[p \vee q]]] \quad \sim \quad \Box[\neg[p \vee q]] \rightarrow \Box[\neg[p \wedge q]]$

Given the economy condition on $\mathscr{E}\mathsf{xh}$, namely the ban on non-strengthening exhaustification, this won't do. The only way to avoid this while maintaining obligatory exhaustification is through another level of recursive exhaustification, as in (24). I assume that the embedded exhaustifiers are ignored when calculating the alternatives with respect to which the higher exhaustification is calculated, as in (24a):

[5]The initial impulse might have been to deal with these cases by claiming that the doxastic modal can be adjoined at the embedded level, below the negation. For reasons that I do not have space to discuss here, this operator must be restricted to occurring only at the matrix level.

[6]For those who want to skip these details, however, it suffices to note that the result of recursive exhaustification at the embedded level is a conjunction, which upon negation becomes equivalent to the disjunction of two negations, which subsequently gets recursively exhaustificatied, resulting in the conjunction of two negations, which is precisely the same result as if no exhaustification had occurred.

(24) $\mathscr{E}\mathsf{xh}_{\mathsf{RD}}[\neg[\mathscr{E}\mathsf{xh}_{\mathsf{RD}}[p \vee q]]]$

a. $\mathscr{A}\mathsf{lt}_{\mathsf{RD}}(\neg[\mathscr{E}\mathsf{xh}_{\mathsf{RD}}[p \vee q]]) = \mathscr{A}\mathsf{lt}_{\mathsf{RD}}(\neg(p \vee q))$
$= \{\mathscr{E}\mathsf{xh}_{\mathsf{D}}(\neg p), \mathscr{E}\mathsf{xh}_{\mathsf{D}}(\neg q)\}$
$= \{p \wedge \neg q, q \wedge \neg p\}$[7]

b. $\mathscr{E}\mathsf{xh}_{\mathsf{RD}}[\neg[\mathscr{E}\mathsf{xh}_{\mathsf{RD}}[p \vee q]]] = \neg(\mathscr{E}\mathsf{xh}_{\mathsf{RD}}(p \vee q)) \wedge \neg(p \wedge \neg q) \wedge \neg(q \wedge \neg p)$
$= \neg(p \wedge q) \wedge \neg(p \wedge \neg q) \wedge \neg(q \wedge \neg p)$
$\equiv \neg p \wedge \neg q$

We can see that the final result will be the same as if no exhaustification had occurred.[8]

(25) $\Box[\mathscr{E}\mathsf{xh}_{\mathsf{RD}}[\neg[_{\mathrm{CP}}\, \mathscr{E}\mathsf{xh}_{\mathsf{RD}}[p \vee q]]]] = \Box(\neg p \wedge \neg q) = \Box\neg p \wedge \Box\neg q$

Recall that PPI disjunctions can take narrow scope with respect to negation only if that negation is extraclausal, (19) versus (20). The task at this point is to understand why the syntactic position of negation should matter. Recall the economy condition on $\mathscr{E}\mathsf{xh}$:

(26) An occurrence of $\mathscr{E}\mathsf{xh}$ in a given sentence *S* is not licensed if eliminating this occurrence leads to a sentence S' such that S' entails or is equivalent to *S*.

The fact that we are dealing with an additional CP level below the negation will be the clue to answering this question. Since we have an embedded CP in (20) but not in (19), the contribution of the higher $\mathscr{E}\mathsf{xh}_{\mathsf{RD}}$ is checked with respect to different S's. For disjunction under non-local negation, the contribution of $\mathscr{E}\mathsf{xh}_{\mathsf{RD}}$ is evaluated with respect to the S' which corresponds to the LF in (27a). Since the entailment in (27b) holds, the condition in (26) is satisfied, rendering $\mathscr{E}\mathsf{xh}$ felicitous, which in turn guarantees that the PPI disjunction will receive a narrow scope interpretation with respect to the non-local negation.

(27) $S = \Box[\mathscr{E}\mathsf{xh}_{\mathsf{RD}}[\neg[_{\mathrm{CP}}\, \mathscr{E}\mathsf{xh}_{\mathsf{RD}}[p \vee q]]]]$

a. $S' = \neg[\mathscr{E}\mathsf{xh}_{\mathsf{RD}}[p \vee q]] = \neg(p \wedge q)$

b. $\mathscr{E}\mathsf{xh}_{\mathsf{RD}}(S') \rightarrow S'$

On the other hand, in the case of disjunction under local negation, i.e., (19), the contribution of $\mathscr{E}\mathsf{xh}$ will be evaluated with respect to a different S', which corresponds to the LF in (28a). The lack of an embedded CP boundary means that there is no "time/space" during which the embedded exhaustification could be calculated separately, meaning that the

[7] Note that $\mathscr{E}\mathsf{xh}_{\mathsf{D}}[\neg p] = \mathscr{E}\mathsf{xh}_{\mathsf{D}}[q]$ and vice versa.

[8] Observe that I abstracted away from the semantic contribution of "think", suggesting that this mechanism should apply blindly, regardless of the embedding verb. The results of a small-scale survey (4 French speakers) indicate that 3 out of 4 people accept narrow scope readings of disjunction under non-local negation regardless of the embedding verb. Of the six predicates tested, 2 were neg-raising and 4 not neg-raising. The informant that disallowed narrow-scope interpretations did so with 3 of the non neg-raising verbs. This is quite striking as we would expect the opposite judgments if in fact it turned out that the neg-raising properties of a verb were to have an effect. Future work should look at this issue in more detail to understand why certain speaker might reject narrow-scope readings for non neg-raising verbs but not for neg-raising verbs.

contribution of the higher $\mathscr{E}\mathsf{xh}$ is calculated with respect to an LF that contains no other exhaustifier.[9] Since S' includes no $\mathscr{E}\mathsf{xh}$, the equivalence in (28b) renders the occurrence of the higher $\mathscr{E}\mathsf{xh}$ in (28) vacuous.

(28) $S = \Box[\mathscr{E}\mathsf{xh}_{RD}[\neg[\mathscr{E}\mathsf{xh}_{RD}[p \vee q]]]]$

a. $S' = \neg[p \vee q]$

b. $\mathscr{E}\mathsf{xh}_{RD}(S') = S'$

One might wonder why recursive exhaustification with respect to a pruned set of alternatives, i.e., only the domain alternatives, is allowed in this case but not in the case of unembedded disjunction. Recursive domain exhaustification is ruled out for unembedded disjunction because the final result is equivalent to one of the pruned alternatives, namely the conjunctive one. In the case at hand, however, the result of recursive exhaustification does not give rise to a meaning equivalent to one of the pruned alternatives. As already discussed in Fox & Katzir 2011 and Ivlieva 2012, pruning of the sort employed here must be constrained so as not to derive a conjunctive meaning for disjunction. I will adopt a constraint on pruning which requires the result of exhaustification with respect to a pruned set of alternatives to give rise to a meaning that could not have been expressed by a (stronger) alternative obtained via lexical replacement.

Before concluding this section I want to point out one last difference between simple and complex disjunctions with respect to their PPI behavior. Spector (2014) shows that unlike simple disjunction PPIs, complex disjunctions like *soit soit* are global PPIs in that they cannot receive a narrow-scope interpretation even with respect to an extra-clausal negation, as shown by the lack of contrast between (29b) and (30b).

(29) Pierre ne parle pas soit allemand soit anglais.
'Pierre doesn't speak either German or English.'

a. Pierre doesn't speak German, or he doesn't speak English.

b. *Pierre doesn't speak either German or English.

(30) Marie ne pense pas que Jacques ait invité soit Anne soit Paul à dîner.
'Marie doesn't think that Jacques invited either Anne or Paul.'

a. Marie doesn't think that J invited A, or she doesn't think that J invited P.

b. *Marie doesn't think that Jacques invited either Anne or Paul.

The task we are faced with right now is to understand why complex disjunctions should behave differently than simple disjunctions in these constructions. Recall that complex disjunction triggers obligatorily exhaustification and that it disallows pruning of its scalar alternative. I argue that this second property of complex disjunctions, namely their inability to prune the scalar alternative, is what precludes a narrow scope interpretation of complex

[9] This distinction between the acceptability of a narrow-scope interpretation of disjunction in (20) versus (19) could be seen as evidence for the role of phases in the interpretation of $\mathscr{E}\mathsf{xh}$, further reinforcing the claim that $\mathscr{E}\mathsf{xh}$ is a grammatical operation.

disjunction regardless of the locality of a c-commanding negation. The idea is that as soon as the scalar alternative enters the calculation, there is no way to apply $\mathscr{E}\mathsf{xh}$ and retrieve a meaning congruent to that of an LF without $\mathscr{E}\mathsf{xh}$; recall that recursive exhaustification leads to a conjunctive meaning only if the scalar alternative is pruned. In other words, no combination of $\mathscr{E}\mathsf{xh}$s will derive a narrow scope reading of complex disjunction, hence the inability of complex disjunction to receive a narrow scope interpretation with respect to negation, regardless of its locality. I differ from Spector (2014) in this respect: whereas he argues that complex disjunctions are global PPIs because $\mathscr{E}\mathsf{xh}$ must apply at the matrix level, my account derives this global PPI behavior without this additional stipulation about the adjunction site of $\mathscr{E}\mathsf{xh}$.

6. PPIs without epistemic inferences

We saw above that exhaustification with respect to the domain alternatives will give rise to a strengthened meaning only in the presence of a speaker-oriented doxastic operator. By relying on the presence of this operator to derive a strengthened meaning upon exhaustification, we make the prediction that a simple disjunction PPI will only ever be able to survive in an UE context if it gives rise to an epistemic inference. The French dialogue in (31) illustrates that there are cases where the epistemic inference is absent and yet the PPI is still acceptable.

(31) Marie a parlé à Jean ou Paul. En fait, elle a parlé aux deux.
‘Mary talked with John or Paul. In fact she talked with both.’

At first sight, the system appears to wrongly predict that unlike non-PPI disjunctions, PPI disjunctions should be infelicitous with a continuation like the one above. That is because the continuation ‘in fact both’, $\Box(p \wedge q)$ is incompatible with the uncertainty implicature obtained by application of $\mathscr{E}\mathsf{xh}_D$, namely $\Diamond\neg p \wedge \Diamond\neg q$. So we see here that what gets us into trouble with the continuation is precisely what allowed a PPI disjunction to survive in UE cases (under the analysis pursued here), namely the strengthening via the epistemic implicature in (17b). What we need then is to derive a strengthened meaning of the disjunction that will be compatible with the continuation in (31). I argue that invoking both embedded and matrix exhaustification with respect to the domain alternatives will yield a meaning compatible with a situation in which both are true.

(32) $\mathscr{E}\mathsf{xh}_D[\Box[\mathscr{E}\mathsf{xh}_D[p \vee q]]]$

a. $\mathscr{A}\mathsf{lt}_D(p \vee q) = \{p, q\}$
b. $\mathscr{E}\mathsf{xh}_D[p \vee q] = p \vee q$
c. $\mathscr{A}\mathsf{lt}_D(\Box[\mathscr{E}\mathsf{xh}_D[p \vee q]]) = \{\Box\mathscr{E}\mathsf{xh}_D\, p, \Box\mathscr{E}\mathsf{xh}_D\, q\}$
$= \{\Box(p \wedge \neg q), \Box(q \wedge \neg p)\}$
d. $\mathscr{E}\mathsf{xh}_D[\Box[\mathscr{E}\mathsf{xh}_D[p \vee q]]] = \Box(p \vee q) \wedge \neg\Box(p \wedge \neg q) \wedge \neg\Box(q \wedge \neg p)$
$\equiv \Diamond p \wedge \Diamond q$

The equivalence in (32d) holds because if it's true that Mary necessarily talked with John or Paul but that she didn't necessarily talk only with John, then it follows that it's possible that she talked with Paul, and vice versa. This recursively enriched meaning is now compatible with a situation in which both *p* and *q* must be true.[10]

In summary, we can now understand how it is possible for an unembedded simple disjunction that exhibits PPI behavior to lack both a scalar and an uncertainty implicature, and yet still count as strengthened for the purposes of satisfying the economy condition on non-vacuous exhaustification. Whereas in the case of English *or* we might have dealt with the acceptability of this continuation by simply stating that the exhaustification is not obligatory, in the case of the French *ou*, a PPI, such an approach is not possible since the disjunction triggers obligatory exhaustification. Suspending exhaustification in this case should not be an option for then we would expect exhaustification to also be suspendable in DE contexts, therefore no longer deriving the unacceptability of disjunction in such contexts.

7. Overview and outlook

In this paper I argued that the PPI behavior of simple disjunction should be analyzed as an interplay between a semantic requirement for obligatory exhaustification and an economy condition which prevents vacuous exhaustification, building on the analysis provided by Spector (2014) to account for the PPI behavior of complex disjunctions cross-linguistically. I showed that once this system is adopted, coupled with a condition on alternative pruning and the claim that exhaustification can take scope over a covert doxastic operator, we can straightforwardly derive the restricted distribution of simple disjunction PPIs. Specifically, I argued that simple, but not complex, disjunction allows the pruning of its conjunctive alternative, using as evidence the contrast between these two types of disjunction when it comes to the optionality of their scalar implicature. This analysis was shown to derive the interpretation of PPI disjunctions in the scope of a local as well as a non-local negation, as well as the fact that simple disjunction PPIs can survive in the absence of uncertainty implicatures.

Andreea C. Nicolae
andreea.nicolae@gmail.com

[10]This approach is independently adopted by Crnič, Chemla & Fox (2015) to account for the observation that sentences with disjunction in the scope of a universal quantifier, *Every A is P or Q*, tend to give rise to distributive inferences that each of the disjuncts holds of at least one individual in the domain of the quantifier, *Some A is P* & *Some A is Q* in the absence of simple negated inferences, *Not every A is P* & *Not every A is Q*.

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