Simple disjunction PPIs: a case for obligatory epistemic inferences

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1 Data of interest

⋆ In certain languages, disjunctions exhibit PPI behavior (cf. Szabolcsi (2002)):

- English *or* and German *oder* are not PPIs
- French *ou* and Hungarian *vagy* are PPIs

⋆ Main properties of PPIs

- anti-licensing – they cannot be interpreted in the scope of a clausemate negation (only a wide scope interpretation is available) (1),
- rescuing – they are acceptable in the scope of an even number of negative operators (2), and
- locality of anti-licensing – they are acceptable in the scope of an extra-clausal negation (3).[1]

(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*

(2) a. Il est peu probable que Paul n'ait pas invité Pierre ou Julie à dîner.
'It is not unlikely that Paul invited either Pierre or Julie for dinner.'
   b. Si Paul n'avait pas invité Pierre ou Julie à dîner, cela aurait été impoli.
'If Paul hadn't invited Pierre or Julie for dinner, that would have been rude.'

(3) 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.

⋆ **Goal**: account for this behavior using tools already available elsewhere in the grammar.

⋆ This talk focuses solely on simple disjunction PPI (see Spector (2014) for an account of the positive polarity behavior of complex disjunctions such as French *soit soit*).

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[1] Although this is not the case for complex disjunctions like French *soit soit* 'either or'.

2 The grammatical approach to implicature calculation

⋆ Implicatures are derived in the grammar via a mechanism of exhaustification.

- Scalar elements activate alternatives and the grammar integrates these alternatives in a systematic way within the meaning of the utterance.

⋆ Scalar implicatures are the result of a syntactic ambiguity resolution in favor of an LF which contains an exhaustivity operator $\mathcal{E}xh$ (Chierchia, Fox, and Spector, 2012).[2]

(4) $\mathcal{E}xh(p) = p \wedge \forall q \in \mathbf{IE}(p, \mathscr{A}lt(p))[p \not\subseteq q \rightarrow \neg q]$
where: $\mathbf{IE}(p, \mathscr{A}lt(p)) = \lambda q.\neg\exists r \in \mathscr{A}lt(p)$ s.t. $(p \wedge \neg r) \rightarrow q$.
(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.)

⋆ Consider the example below:

(5) John talked to Mary or Bill.
   a. $\mathcal{A}lt$(John talked to Mary or Bill) = {John talked to Mary and Bill}
   b. $\mathcal{E}xh$[John talked to Mary or Bill] =
   John talked to Mary or Bill but not both.

⋆ A sentence like (5), however, does not always have the enriched meaning in (5b).

⋆ The optionality of the SI can be encoded as an optionality of exhaustification.

(6) John talked to Mary or Bill.
   a. John talked to Mary or Bill *inclusive*
   b. $\mathcal{E}xh$[John talked to Mary or Bill] *exclusive*

⋆ Scalar items are also endowed with sub-domain alternatives (cf. Sauerland (2004) and Fox (2007), a.m.o.).

(7) John talked to Mary or Bill.
   a. $\mathcal{A}lt_S$ = {John talked to Mary and Bill.}
   b. $\mathcal{A}lt_D$ = {John talked to Mary, John talked to Bill.}

⋆ Additional assumption: the domain and the scalar alternatives can be exhaustified independently.

⋆ This can be implemented by invoking a different exhaustifier for each set of alternatives: $\mathcal{E}xh_D$ and $\mathcal{E}xh_S$.

[2] I adopt a version of exhaustification which takes into account innocently excludable alternatives: a non-weaker alternative gets negated if and only if negating it is consistent with negating any other non-weaker alternative. This implementation of exhaustification is also referred to as contradiction-free exhaustification.

3 Obligatory epistemic inferences and restriction to UE contexts

⋆ I assume, following Meyer, that ignorance/epistemic implicatures "I don't know which" can also be derived in the grammar, similarly to scalar implicatures.

- Assertively used sentences contain a covert doxastic operator which is adjoined at the matrix level at LF (cf. Chierchia (2006); Alonso-Ovalle and Menéndez-Benito (2010)), which I represent as a necessity modal from now on.

⋆ Exhaustification proceeds with respect to the alternatives in (8a), delivering the enriched meaning in (8b) which amounts to "The speaker doesn't know which of the disjuncts is true.": [3]

(8) $\Box[p \vee q]$
   a. $\mathscr{A}lt_D(\Box[p \vee q]) = \{\Box p, \Box q\}$
   b. $\mathscr{E}xh_D[\Box[p \vee q]] = \Box[p \vee q] \wedge \neg\Box p \wedge \neg\Box q$

⋆ Note that in the scope of negation, this inference disappears; exhaustification is vacuous since the alternatives are entailed by (hence weaker than) the assertion.

(9) $\Box\neg[p \vee q]$ $\quad\quad \Box\neg[p \vee q] = \Box\neg p \wedge \Box\neg q$
   a. $\mathcal{A}lt_D(\Box\neg[p \vee q]) = \{\Box\neg p, \Box\neg q\}$ $\quad\quad [\Box\neg p \wedge \Box\neg q] \rightarrow \Box\neg p$
   b. $\mathcal{E}xh_D[\Box\neg[p \vee q]] = \Box\neg[p \vee q]$ $\quad\quad [\Box\neg p \wedge \Box\neg q] \rightarrow \Box\neg q$

⋆ I argue that PPI disjunctions are disjunctive elements that require obligatory domain exhaustification.[4]

- French *ou* – exhibits PPI behavior because it requires obligatory association with a domain exhaustifier (only (10b) is possible).
- English *or* – does not exhibit PPI behavior since it doesn't require obligatory association with a domain exhaustifier (both (10a) and (10b) are possible).

(10) a. $[p \vee q]$ $\quad\quad$ ✓*or*, ✗*ou*
   b. $\mathcal{E}xh_D[p \vee q]$ $\quad\quad$ ✓*or*, ✓*ou*

⋆ An economy condition governs the distribution of exhaustification operators:

(11) An occurrence of $\mathcal{E}xh$ 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 $\mathcal{E}xh$ is licensed if it leads to strengthening.

[3] Scalar exhaustification is also an option, and depending on where it takes place (below or above the modal), different inferences may be obtained: (i) $\mathscr{E}xh_S > \Box$ weak inference that it's possible that neither, or (ii) $\Box > \mathscr{E}xh_S$ strong inference that necessarily neither

[4] This is inspired by the account provided in Spector (2014) where it's argued that complex disjunction like French *soit soit* exhibit positive polarity behavior because they require obligatory **scalar** exhaustification.

⋆ If a disjunctive element requires obligatory association with a domain exhaustifier, the economy condition derives the restriction of these elements to UE environments:

- ◦ In UE contexts the exhaustification of disjunction gives rise to an epistemic inference, (8), hence it leads to strengthening.
- ◦ In DE contexts the exhaustification is vacuous, i.e. the application of the obligatory exhaustifier doesn't result in strengthening, hence the unavailability of a narrow scope interpretation for PPI-disjunctions.

Rescuing by a second negation

⋆ If we further embed a sentence such as (12) in a DE context as in (13), the PPI is rescued, i.e. can be interpreted in the scope of negation.

(12) Paul n'a pas invité Pierre ou Julie à dîner.
'Paul didn't invite Pierre or he didn't invite Julie for dinner'

(13) a. Si Paul n'avait pas invité Pierre ou Julie à dîner, cela aurait été impoli.
'If Paul hadn't invited Pierre or Julie for dinner, it would've been rude.'
b. Il est peu probable que Paul n'ait pas invité Pierre ou Julie à dîner.
'It is not unlikely that Paul invited either Pierre or Julie for dinner.'

⋆ Both *peu probable* 'not likely' and the antecedent of a conditional constitute DE environments, as evidenced by the fact that NPIs are acceptable in these environments.

(14) a. Il est peu probable que Jean ait critiqué quoi que ce soit.
'It is unlikely that Jean criticized anything.'
b. Si Paul avait dit quoi que ce soit, ça aurait été impoli.
'If Paul had said anything, it would've been rude.'

⋆ Being embedded under two DE operators is equivalent to being in a positive environment for the purposes of exhaustification: (i) the alternatives are stronger than the assertion, and (ii) the domain exhaustification leads to strengthening.

(15) $\mathcal{E}xh_D[\Box\neg\neg[p \vee q]]$
a. $\mathcal{A}lt_D(\Box\neg\neg[p \vee q]) = \{\Box\neg\neg p, \Box\neg\neg q\} = \{\Box p, \Box q\}$
b. $\mathcal{E}xh_D[\Box\neg\neg[p \vee q]] = \Box(p \vee q) \wedge \neg\Box p \wedge \neg\Box q$

4 PPIs without an ignorance inference

⋆ There are cases where the epistemic/ignorance implicature is absent and yet the PPI is still acceptable; e.g. the French dialogue in (16a), translated in English in (16b), seems to show just that.

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

⋆ The continuation 'in fact both', which amounts to (17a), is incompatible with the enriched meaning we derived in (17b).

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

⋆ The problem: what allowed a PPI disjunction to survive in UE cases (under the analysis pursued here), namely the ignorance implicature $\Diamond\neg p \wedge \Diamond\neg q$, is in contradiction with the continuation.

⋆ The goal: derive a strengthened meaning that is compatible with the continuation.

⋆ Invoking recursive exhaustification of the domain alternatives, as in (18), will yield a meaning compatible with a situation in which both are true.

(18) $\mathscr{E}xh_{D,2}[\Box[\mathscr{E}xh_{D,1}[p \vee q]]]$
a. $\mathscr{A}lt_{D,1}(p \vee q) = \{p, q\}$
b. $\mathscr{E}xh_{D,1}[p \vee q] = p \vee q$
c. $\mathscr{A}lt_{D,2}([\Box[\mathscr{E}xh_{D,1}[p \vee q]]) = \{\Box[\mathscr{E}xh_{D,1}(p)], \Box[\mathscr{E}xh_{D,1}(q)]\}$
$= \{\Box(p \wedge \neg q), \Box(q \wedge \neg p)\}$
$= \{\Box p \wedge \Box\neg q, \Box q \wedge \Box\neg p\}$
d. $\mathscr{E}xh_{D,2}[\Box[\mathscr{E}xh_{D,1}[p \vee q]]] = \Box(p \vee q) \wedge \neg(\Box p \wedge \Box\neg q) \wedge \neg(\Box q \wedge \Box\neg p)$
$= \Box(p \vee q) \wedge (\neg\Box p \vee \Diamond q) \wedge (\neg\Box q \vee \Diamond p)$
$= \Box(p \vee q) \wedge (\Box p \rightarrow \Diamond q) \wedge (\Box q \rightarrow \Diamond p)$

⋆ A natural paraphrase: 'My belief that p does not rule out the possibility that q, and vice versa.' In other words, it's possible p and it's possible q.

⋆ This recursively enriched meaning is now compatible with a situation in which both p and q must be true, i.e. $\Box(p \wedge q)$.

⋆ Note that we need to restate the economy condition on exhaustification so that it applies only to the topmost occurrence of $\mathcal{E}xh$ within a given sentence.

(19) The topmost occurrence of $\mathcal{E}xh$ in a given sentence S is not licensed if eliminating this occurrence leads to S' such that S' entails or is equivalent to S.

5 PPIs under non-local negation

⋆ *Ou* cannot receive a narrow scope interpretation with respect to a local negation (20), but it can with a non-local negation (21).

(20) 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.
b. *Neither Lea not Jean were invited to dinner by Mary.

(21) 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.

⋆ How can we explain why the PPI can survive in the scope of a non-local negation?

- On the one hand we need to argue that there is domain exhaustification, which furthermore leads to strengthening, so as to account for the PPI's acceptability,
- On the other hand we want to derive a meaning that is equivalent to the meaning corresponding to the non-exhaustified LF: $\Box(\neg(p \vee q))$.
- Furthermore, whatever analysis we provide for (21) must not be an option for PPIs under clause-mate negation, (20).

⋆ The only way to achieve both strengthening and a meaning equivalent to the non-exhaustified sentence is by invoking two levels of recursive exhaustification, one in the embedded clause and another in the matrix clause, as in (22):

(22) $\Box[\mathcal{E}xh_{D,4}[\mathcal{E}xh_{D,3}[\neg[_{\text{CP}}\ \mathcal{E}xh_{D,2}[\mathcal{E}xh_{D,1}[p \vee q]]]]]]$

⋆ For presentational purposes I will simplify (22) as in (23):

(23) $\Box[\mathcal{E}xh_{RD,2}[\neg[_{\text{CP}}\ \mathcal{E}xh_{RD,1}[p \vee q]]]]$

⋆ Recursively exhaustifying a disjunction gives rise to a conjunctive meaning, as in (24d).

(24) $\mathcal{E}xh_{RD,1}[p \vee q]$
a. $\mathscr{A}lt_{RD,1}(p \vee q) = \{p \wedge \neg q, q \wedge \neg p\}$
b. $\mathscr{E}xh_{RD,1}[p \vee q] = (p \vee q) \wedge \neg(p \wedge \neg q) \wedge \neg(q \wedge \neg p)$
$= p \wedge q$

⋆ Observe that the result of this recursive exhaustification gives rise to a globally weaker meaning since a conjunction in the scope of negation gives rise to a weaker meaning than disjunction in the scope of negation.

(25) $\Box[\neg[p \vee q]] \rightarrow \Box[\neg[\mathcal{E}xh_{RD}[p \vee q]]] \quad \sim \quad \Box[\neg[p \vee q]] \rightarrow \Box[\neg[p \wedge q]]$

⋆ The occurrence of $\mathcal{E}xh_{RD,1}$ in $\Box[\neg[\mathcal{E}xh_{RD,1}[p \vee q]]]$ does not conform to the economy condition on $\mathcal{E}xh$.

⋆ The only way to avoid this while maintaining obligatory exhaustification is through a second level of recursive exhaustification, as in (26).[5]

[5] I assume that the embedded exhaustifiers are ignored when calculating the alternatives with respect to which the higher exhaustification is calculated.

(26) $\mathcal{E}xh_{RD,2}[\neg[_{\text{CP}}\ \mathcal{E}xh_{RD,1}[p \vee q]]]$

a. $\mathscr{A}lt_{RD,2} = \{p \wedge \neg q, q \wedge \neg p\}$

b. $\mathcal{E}xh_{RD,2}[\neg[_{\text{CP}}\ \mathcal{E}xh_{RD,1}[p \vee q]]] = \neg(p \wedge q) \wedge \neg(p \wedge \neg q) \wedge \neg(p \wedge \neg q)$
$= \neg p \wedge \neg q$

⋆ Essentially, we have recursive exhaustification of the disjunction of two negated constituent ($\mathcal{E}xh_{RD}[\neg p \vee \neg q]$), which results in the conjunction of these constituents.

⋆ Note that the topmost occurrence of $\mathcal{E}xh$, namely $\mathcal{E}xh_{RD,2}$ leads to strengthening, satisfying the economy condition on $\mathcal{E}xh$, repeated below.

(27) The topmost occurrence of $\mathcal{E}xh$ in a given sentence S is not licensed if eliminating this occurrence leads to S' such that S' entails or is equivalent to S.

⋆ Putting it all together, we see that the final result will be the same as if no exhaustification had occurred.[6]

(28) $\Box[\mathcal{E}xh_{RD,2}[\neg[_{\text{CP}}\ \mathcal{E}xh_{RD,1}[p \vee q]]]] = \Box(\neg(p \vee q)) = \Box(\neg p \wedge \neg q)$

⋆ Why is this not an option for disjunction under a local negation?

⋆ Since we have an embedded CP in one case but not the other, the contribution of the topmost $\mathcal{E}xh$ is checked with respect to different S's.

- For disjunction under non-local negation, $S' = \neg[\mathcal{E}xh_{RD,1}[p \vee q]] = \neg(p \wedge q)$; and as shown above, $\mathcal{E}xh(S') \rightarrow S'$, satisfying (27).
- For disjunction under a local negation, $S' = \neg[p \vee q]$, since no embedded CP means no "time" to compute the embedded exhaustification separately; since $\mathcal{E}xh(S') = S'$ the condition in (27) is not satisfied.

⋆ One leftover concern: we need to restrict recursive exhaustification so as not to derive conjunctive meanings for disjunction all over the place.

(29) An occurrence of $\mathcal{E}xh_{RD}$ in a given sentence S is not licensed if eliminating this occurrence leads to a sentence S' such that S' can be obtained from S via lexical replacement.

⋆ In other words, the result of recursive exhaustification should not give rise to a meaning that could have been expressed by an alternative obtained via lexical replacement.

[6] Possible evidence for the presence of embedded recursive exhaustification is provided by cases such as *John doesn't think that Mary invited Suzy or Julie, but Bill does*, where the elided constituent can be interpreted as *Bill think that Mary invited both Suzy and Julie*.

6 Summary

- ⋆ I argued that the PPI behavior of plain disjunction can be thought of as the interplay between a semantic requirement for obligatory exhaustification and an economy condition which prevents vacuous exhaustification.
  - ◦ This approach can predict the restriction of such PPIs to (locally) upward entailing environments.
  - ◦ It also predicts the ability of a PPI disjunction to survive in the absence of ignorance inferences.
  - ◦ Not discussed today: certain PPIs are also acceptable in the scope of Strawson-DE environments, something that this account can handle without a problem.
- ⋆ This analysis should easily be carried over to account for the distribution of existential quantifiers like *some* in English which also exhibit PPI behavior.
- ⋆ Ultimately, one should attempt to unify the distribution of PPIs and NPIs within a single framework.
  - ◦ Presently, the proposal offered here to account for the positive polarity aspect of disjunction is not immediately compatible with the proposal offered in Chierchia (2013) to account for the distribution of NPIs.
  - ◦ One may consider instead adopting the account in Crnič (2014) to deal with NPIs.

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