

# A cross-linguistic investigation of the positive polarity status of disjunction

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## Abstract

We discuss experimental findings on the interpretation of simple disjunction in negative contexts in four languages: Italian, French, English, Romanian. We provide evidence that both the narrow scope and the wide scope readings for disjunction with anti-additive operators are available in all four languages, a result that (i) refines existing generalizations on the polarity sensitivity of simple disjunction and, more generally, (ii) casts doubt on the robustness of the distinction between PPI disjunction languages and non-PPI disjunction languages, which turns out to be less clear-cut than assumed in the theoretical (e.g., Szabolcsi 2002, Spector 2014, Nicolae 2017) or experimental literature (e.g., Crain 2012, Guasti *et al* 2017).

## 1 Introduction

Sentences like (1), with the simple disjunction *or* in the immediate scope of negation, are typically ambiguous between a *narrow scope* interpretation of disjunction (1a), where none of the disjuncts<sup>1</sup> is true, and a *wide scope* one (1b), where one of the disjuncts may be true:

- (1) Mary didn't invite John **or** Suzi to the party.
- It is not the case that Mary invited John and it is not the case that Mary invited Suzi to the party. NEG >> OR
  - It is either John or Suzi that Mary didn't invite to the party. OR >> NEG

Languages have been claimed to differ with respect to the availability of these two readings (e.g., Szabolcsi 2002, 2004). Certain languages

(Type A), e.g., English, Greek, Korean, allow both readings. Other languages (Type B), e.g., Hungarian, Japanese, Russian, only allow the wide scope reading. This has led to the claim that simple disjunction in Type B languages is a Positive Polarity Item (PPI). PPIs do not form a uniform class cross-linguistically (see van der Wouden 1997, Israel 2011, a.o.), but according to a standard characterization, an item exhibits PPI-behavior if it cannot take immediate scope below a clause-mate anti-additive (AA) operator (Szabolcsi 2002, 2004), e.g., negation, *without*. It can, however, scope below extra-clausal negation or merely downward entailing (DE) operators like *few* or *at most 4* (but see e.g., Spector 2014 for issues with this characterization).

Various language acquisition studies have provided experimental evidence that seems to substantiate the existence of a distinction between languages allowing both readings and languages allowing only the wide scope reading, a distinction often referred to as a PPI-disjunction parameter (e.g., Goro and Akiba 2004, Crain 2012, Guasti *et al* 2017). However, as far as adult language data is concerned, to date, the only experimental evidence for wide-scope-only behavior of simple disjunction comes from data from the adult control groups used in these acquisition studies. Not only is this kind of data insufficient, but it is also controversial, as there is evidence clearly attesting the narrow scope reading of disjunction in Type B languages, e.g., French (see the corpus example in (2)):

- (2) La crise de croissance de la science n'est **pas** une maladie **ou** une mort.  
'The growing pains that science has do not constitute illness or death.'

This evidence suggests that it may be wrong to consider Type B languages as strictly

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<sup>1</sup> By disjuncts in these examples we mean the affirmative propositions *Mary invited John to the party* and *Mary invited Suzi to the party*.

excluding the narrow scope reading of disjunction and calls for a more thorough examination of the behavior of disjunction in DE contexts across adult grammars. The goal of this paper is to substantiate and, if necessary, refine existing generalizations about the PPI-hood of disjunction across languages. This will inform current theoretical approaches to polarity sensitivity, but at this stage of our investigation, we do not seek to account for the possible PPI-behavior of disjunction or the extent of cross-linguistic or speaker variation in this area.<sup>2</sup>

## 2 Experiment

The goal of this experiment is to assess whether languages differ with respect to the behavior of disjunction in DE contexts. More specifically, we want to determine whether it is really the case that simple disjunction behaves as a PPI in some languages but not in others. In order to address this question, we set up an experiment testing the interpretation of disjunction in negative contexts in four languages: two allegedly Type A languages—English, Romanian (Szabolcsi 2002, 2004)—and two allegedly Type B languages—Italian, French (Spector 2014, Nicolae 2017, Guasti *et al* 2017).

### 2.1 Procedure, materials and design

A total of 124 adults participated in the experiment: 25 French native speakers, 25 Romanian native speakers, 43 Italian native speakers and 31 English speakers. Participants were instructed to perform a Likert-scale acceptability judgment task on IboxFarm (Drummond 2013) where they had to evaluate continuations of potentially ambiguous sentences with simple disjunction and various DE operators based on their naturalness, using a scale from 1 (very unnatural) to 7 (very natural). The continuations were compatible with either the narrow scope (3a) or the wide scope reading (3b) of disjunction. Participants

saw only one of the two continuations for each sentence in a randomized order.

There were four versions of the experiment (a French, an Italian, a Romanian and an English version, respectively). Below, we illustrate our experimental stimuli with an English example involving disjunction and negation:

- (3) If I remember correctly, Mary didn't invite John or Suzi to her birthday party.
- a. **narrow scope** continuation: She's upset with both of them and doesn't want to see them.
  - b. **wide scope** continuation: I don't know which of them.

Previous experimental studies (Crain 2012, a.o.) typically use one AA operator—negation—to test the PPI-behavior of disjunction. In our study, we included two AA operators—negation and *without*, anti-additivity being the key factor in the anti-licensing behavior of PPIs. In addition, we included three merely DE operators (*few*, *doubt*, *rarely*). The experiment used scope (*wide*, *narrow*) and DE operator (*negation*, *without*, *otherDE*) as factors, which gave rise to 6 experimental conditions:

Scope DE operator	Narrow	Wide
negation	negation-narrow	negation-wide
without	without-narrow	without-wide
otherDE	otherDE-narrow	otherDE-wide

Table 1: Experimental conditions

There were 18 experimental items (3 per condition), 2 practice items and 34 fillers randomly interspersed among the experimental items.

Our study targets what we can call the “PPI Parameter Hypothesis” for simple disjunction. According to this hypothesis, languages differ with respect to whether disjunction behaves as a PPI. Specifically, it has been claimed that disjunction is a PPI—an item ‘anti-licensed’ in the direct scope of local additive operators—in French and Italian but not in English and Romanian (see e.g., Szabolcsi 2002, Crain 2012). If this claim is correct, then we expect this cross-linguistic difference to be reflected in acceptability judgments as follows: assuming that otherDE operators provide the baseline for the

<sup>2</sup> For discussion of these issues, see e.g., Szabolcsi (2002) and Spector (2014), as well as Liu & Iordăchioaia (2018) for a recent overview on positive polarity.

acceptability of the narrow and wide scope continuations, then the PPI Parameter Hypothesis predicts that AA operators will change this baseline. In other words, we expect there to be an interaction between DE Operator (AA vs. otherDE) and Scope (narrow vs. wide) in French and Italian, but not in English and Romanian. More precisely, in languages with a PPI-disjunction such as French and Italian, we expect that the acceptability of wide scope continuations relative to narrow scope continuations should be higher with AA operators than with otherDE operators. In English and Romanian on the other hand, the relative acceptability of narrow scope and wide scope continuations should not be affected by the anti-additivity of the operator *per se*.

## 2.2 Results and discussion

Figure 1 below reports, for each language, the score means for the narrow scope (red bars) and the wide scope (blue bars) continuations with AA operators (*negation, without*) and otherDE operators (*few, rarely, doubt*).

We fitted a Cumulative Link Mixed Model to the Likert-scale responses with the *clmm()* function from the ordinal package (Christensen, 2019) in R (R Core Team, 2019) to assess the relation between DE operator and scope and check whether this relation is modulated by language. As fixed effects we included *Scope* (narrow vs. wide), *DE operator* (AA vs. otherDE) and *Language* (French vs. Italian vs. Romanian vs. English), as well as their interaction into the model. As random effects, we had intercepts for subjects and items, by-subject random slopes for the effect of DE operator and scope, as well as a by-item random slope for the effect of scope. As reference levels, we used ‘French’ as the reference level for Language, ‘narrow’ as the reference level for Scope and ‘otherDE’ as the reference level for DE operator.

The results of the analysis reported in Table 2 below revealed a significant effect of DE operator and a significant effect of scope: narrow scope with AA operators received lower scores than narrow scope with otherDE operators; wide scope with otherDE operators received lower scores than narrow scope. They also revealed a significant DE operator-by-Scope interaction: moving from otherDE operators to AA operators results in higher scores for the wide scope continuations and lower scores for the narrow scope

continuations. This confirms the prediction of the PPI Parameter Hypothesis, which states that French *ou* is a PPI-disjunction; as such, the anti-additivity of the operator should affect speakers’ judgments for narrow scope and wide scope continuations.

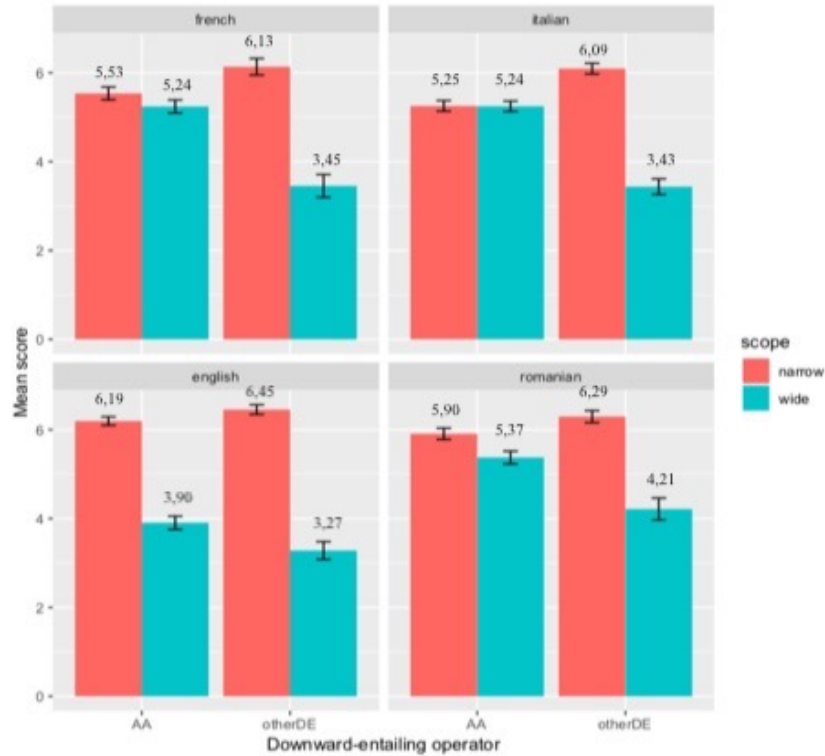
The difference between AA and otherDE operators is further modulated by language, as shown by the three-way DE operator-by-Scope-by-Language interaction. As noted above, the difference in acceptability between narrow scope and wide scope continuations varies with the context (AA vs. otherDE). What we find is that this variation is smaller in English/Romanian than in French. Italian, on the other hand, behaves just like French.

The model with Italian as reference level for ‘Language’ is essentially the same as the one with French as reference level. This confirms that Italian *o* is a PPI-disjunction, just like French *ou*. The models with Romanian and English as reference levels for ‘Language’ were basically the same as the ones for French and Italian, with one exception: these models did not reveal any effect of DE operator: the difference between narrow scope with otherDE operators and narrow scope with AA operators was not significant. Importantly, however, these models, just like the ones for French and Italian, showed a significant DE operator-by-Scope interaction. The two-way interaction observed in English and Romanian is not predicted by the PPI Parameter Hypothesis, according to which the anti-additivity of the operator should not affect the relative acceptability of the narrow scope and the wide scope continuations in these languages, where simple disjunction is assumed not to exhibit PPI-behavior.

Summing up, the DE operator-by-Scope interaction observed in all four languages indicates a “PPI effect” in the behavior of disjunction across all languages: narrow scope gets worse and wide scope gets better as one goes from an otherDE context to an AA context. Under the PPI-disjunction parameter hypothesis, this effect is expected in French and Italian, described as PPI-disjunction languages, but unexpected in English and Romanian, described as non-PPI-disjunction languages. In these latter languages, going from otherDE contexts to AA contexts should not affect the difference in acceptability between the narrow scope and wide scope continuations, contrary to fact. Our results do

show that there is a difference between English/Romanian, on the one hand, and French/Italian, on the other hand: the three-way interaction DE operator-by-Scope-by-Language indicates that the PPI effect (i.e., the relative acceptability of narrow scope and wide scope continuations in AA vs. otherDE contexts), even if present in all languages, is

larger in French/Italian than in English/Romanian. However, this difference should not be described in terms of a PPI parameter, whereby only French/Italian would display such an effect. Rather, it should be described in terms of strength of the PPI effect. This effect is much stronger in French and Italian than in English and Romanian.



**Figure 1:** Score means for the narrow scope (red bars) and the wide scope (blue bars) continuations for French, Italian, English and Romanian. Error bars correspond to standard error of the mean.

<i>Predictor</i>	<i>Estimate</i>	<i>SE</i>	<i>Z-value</i>	<i>P-value</i>
DE operator-AA	-1.15	0.37	-3.05	0.002
Scope-Wide	-3.62	0.52	-6.95	<0.001
Language-English	0.33	0.44	0.75	0.45
Language-Italian	-0.42	0.40	-1.05	0.29
Language-Romanian	-0.02	0.45	-0.05	0.95
DE operator-AA by Scope-Wide	3.11	0.52	5.90	<0.001
DE operator-AA by Language-English	0.66	0.41	1.61	0.10
DE operator-AA by Language-Italian	0.00	0.36	0.01	0.98
DE operator-AA by Language-Romanian	0.59	0.42	1.40	0.16
Scope-Wide by Language- English	-0.53	0.59	-0.90	0.36
Scope-Wide by Language-Italian	0.44	0.54	0.82	0.40
Scope-Wide by Language-Romanian	0.91	0.61	1.47	0.13
DE operator-AA by Scope-Wide by Language-English	-1.83	0.54	-3.36	<0.001
DE operator-AA by Scope-Wide by Language-Italian	0.01	0.49	0.02	0.97
DE operator-AA by Scope-Wide by Language-Romanian	-1.32	0.56	-2.33	<0.05

Summary of the fixed effects in the logit model (N = 2232; log-likelihood = -3383.22)

**Table 2:** Output of the Cumulative Link Mixed effects model with ‘French’ as reference level for *Language*, ‘otherDE’ as reference level for *DE operator* and ‘narrow’ as reference level for *Scope*.

### 3 General discussion and outlook

The PPI-disjunction parameter hypothesis has inspired work on cross-linguistic variation in the semantics of connectives and has been used in language acquisition studies to address learnability issues across languages. However, the results of our cross-linguistic experimental study suggest that there is no qualitative difference between languages in this respect, calling into question the robustness of this parameter across languages. These findings fit with the fact that, when we look at corpora, narrow scope (as well as wide scope) readings is attested in all of the languages in our study.

The results reported here have implications for language acquisition. Previous work in this area (Guasti *et al* 2017) using a truth value judgment (TVJ) methodology found that Italian and French adults control consistently rejected sentences with simple disjunction under negation in a scenario where both disjuncts were false (“narrow scope” scenario). This has been taken to confirm the existence of languages where the narrow scope reading is unavailable/ungrammatical (see Crain 2012 for an overview). If we are right, then the reported performance on the TVJ task does not reveal unavailability/ungrammaticality of the narrow scope reading and has to be explained in some other way.

We think that the TVJ methodology brings out preferences and that the Likert-scale continuations task that we used is more effective in revealing what readings are available. The acceptability judgment task used in our study asked participants to evaluate a sentence (the continuation that disambiguates the readings) in the context of another sentence (i.e., a sentence containing disjunction and a DE operator). The hypothesis is that, when we read or hear two sentences together in a discourse, we try to make them coherent with each other. If the continuation is compatible with the preferred interpretation, it will be rated as natural. And if it corresponds to the dispreferred interpretation, the search for coherence would make (at least some of the) speakers revise their initial hypothesis, and access the other interpretation. With a TVJ task, on the other hand, there is arguably no such pressure to look for coherence. The TVJ task asks speakers to judge whether a potentially ambiguous sentence is true or false

in a context that makes only one reading true. If speakers have a preference for one reading over another, nothing would force them to change their initial hypothesis. This preference is similar to other language-dependent preferences for ambiguous constructions, such as those involving high or low attachment of relative clauses, e.g., *Someone shot the maid<sub>1</sub> of the actress<sub>2</sub> [that was standing on the balcony]<sub>1/2</sub>* (e.g., Grillo and Costa 2014).

This raises the question of what determines the preferences observed across languages. Recent experimental work on scopally ambiguous structures involving universal quantifiers and negation invokes several factors, such as processing limitations and prosody (Lohiniva and Panizza 2016; Syrett, Simon and Nisula 2014, a.o.). In the case of sentences with negated disjunction, prosody might play a role in determining speakers’ preference for one reading over the other. According to Jing (2008: 154), intonation can help disambiguate the two readings: neutral intonation on the disjunctive phrase has been claimed to favor a narrow scope interpretation, whereas focus stress on each of the disjuncts has been claimed to favor a wide scope reading. The judgments that speakers gave in our study might have been influenced by a prosody that they implicitly assigned to the sentences they read. However, given that the experiment did not control for prosody, the extent to which speakers may have relied on prosodic information in their responses is unclear. Further research is necessary to determine the way speakers recruit prosodic information for the interpretation of sentences with disjunction and negative operators.

The results reported in this paper are also relevant to current theories of PPIs, which typically rely on a strong form of ‘anti-licensing’, i.e., the assumption that languages with PPI-disjunction disallow (or strongly disfavor) narrow scope readings in the immediate scope of negation (and other AA operators). Our study reveals a more nuanced picture, with cross-linguistic differences less clear-cut than standardly assumed. More empirical investigation is needed to settle the existence of PPI-disjunction, assess the extent of cross-speaker and cross-linguistic variation, and ultimately develop a comprehensive explanation.

Our study calls for a better understanding of the factors that may affect the preferred

scope of disjunction and the influence of monotonicity on the preferred interpretation. Similarly complex patterns, which current theories are unable to fully capture, have been recently reported with respect to the positive polarity behavior of modified numerals (Mihoc and Davidson 2019), showing the need for further investigation in this area. The hope is to develop experimental paradigms and methods that can be fruitfully put to use to investigate various types of expressions that have been claimed to have a PPI-status (e.g., connectives, indefinites, modified numerals, modals).

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