



Information Structure and Scope Interactions: Disjunction Wide Scope Induced by Focus

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In this paper we investigate the scopal reading of disjunctions in French negative sentences with pre-schoolers. We posit that the French disjunctive “ou” does not fit the traditional disjunction PPI/non-PPI dichotomy according to which a wide scope is taken by a PPI disjunction and a narrow scope when the disjunction is not a PPI. We hypothesized that focus could be a successful scopal manipulator. Using Truth Value Judgment Tasks (TVJT), we tested French pre-schoolers’ scopal reading of negated disjunctions in a neutral prosody condition and with prosodic focus on the disjunctive in a between subject design. We found that as predicted, prosodic focus often induced participants to adopt a disjunction wide scope reading whereas a disjunction narrow scope reading was favored in the neutral prosody condition. This confirmed our hypothesis that focus can manipulate disjunction scope parameters. It also shows that, when the disjunction is focalised, children have access to the disjunction wide scope reading earlier than previously thought. Finally, we can conclude that the distinction between PPI-disjunctive vs. non-PPI disjunctive languages needs to be more fine-grained.

Keywords: information structure, focus, scope parameters, French disjunction, language acquisition, truth value judgment tasks, PPI

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INTRODUCTION

Disjunctions are logical expressions that introduce an alternative between at least two propositions. There are two possible readings of negated disjunctions: the disjunction narrow scope reading and the disjunction wide scope reading.

(1) I don’t like apples or pears

A sentence like (1) is judged true by adult English speakers if and only if it is both apples and pears that the “I” does not like. The disjunction creates a conjunctive entailment in negative sentences, namely both propositions must be true for the sentence to be true, see (6).

(2) $\neg_{\text{liking}} (\text{Apples} \vee \text{Pears}) \Leftrightarrow (\neg_{\text{liking}} \text{Apples}) \wedge (\neg_{\text{liking}} \text{Pears})$

In (1) and (2), the negation scopes over the disjunction meaning that it encompasses the whole disjunction.

However, not all languages seem to allow the negation to scope over the disjunctive. The Japanese sentence (3) would not be interpreted by native Japanese speakers as “it is the carrot and the pepper that the pig did not eat” (Goro and Akiba, 2004).

- (3) Butasan-wa ninjin ka piiman-wo tabe-nakat-ta
pig-TOP carrot or pepper-ACC eat-neg-Past
The pig did not eat the carrot or the pepper.

Transcribed in logical terms, we obtain (4), with the disjunctive taking wide scope over the negation.

- (4) $\neg^{\text{eating}} \text{Carrot} \vee \text{Pepper} \Leftrightarrow (\neg^{\text{eating}} \text{Carrot})$
 $\vee (\neg^{\text{eating}} \text{Pepper})$

In languages like Japanese, and also Russian, Hungarian, or Mandarin Chinese, it has been claimed that the disjunctive is a Positive Polarity Item, which must escape the scope of negation (Szabolcsi, 2002; Crain, 2012). Thus, in these languages the only possible reading is the disjunction wide scope reading. So, according to Szabolcsi (2002) and Crain (2012), the scope of the disjunction (narrow or wide) relative to the negation, depends on the polarity of the disjunctive. If the disjunctive is a positive polarity item (PPI), it can only appear in positive contexts which means that when a disjunction is introduced in a simple negative sentence, it remains unaffected by the negation that can only act around it (on the two propositions on each side) but not on the disjunction itself. While in English, the disjunctive is not PPI and tolerates being negated as a whole thus creating conjunctive entailments and following De Morgan's law, thus giving rise to a disjunction narrow scope reading.

It is widely reported in the literature that pre-school children assign narrow scope to the disjunction and wide scope to the negator in simple negative sentences regardless of the preferred adult-reading in their language (Gualmini et al., 2000; Goro and Akiba, 2004; Verbuk, 2007; Crain, 2008, 2012; Geçkin et al., 2018). Goro and Akiba (2004) found that only four Japanese-speaking children (six or under) out of 30 adopted a disjunction wide scope reading where it was the adult preferred reading. Using a similar experiment, Crain (2008) also found over 90% of preference for disjunction narrow scope readings in both English and Japanese speaking children. Crain (2008, 2012), explains this initial converging preference in scope readings with the Semantic Subset Principle according to which children first assume the meaning of a sentence to be the one that is true in the most restrictive contexts (subset) and will only start considering superset readings (i.e., readings that are true in more contexts) after having gathered counter evidence against the subset from adult language. So, only when they are more competent speakers of their native language. Specifically, the disjunction narrow scope reading is true in only one context out of the four possible options, namely, it is true only if both propositions are false. In contrast, the disjunction wide scope reading is true, strictly semantically speaking, in three contexts out of four, namely if one or the other or both of the propositions are false¹. Since the PPI-hood of the disjunction forces the less restrictive reading, the acquisition of this property only appears in experienced speakers, after about Age 6.

¹Adult native speaker's and pragmatically competent children capable of drawing scalar implicatures would still reject a sentence with disjunction wide scope over negation in a context where both propositions are false. We will come back to this later.

After English and Japanese-type languages, it is important to consider that there are languages, like French, that seem to display a mixed behavior. The French disjunction "ou," equivalent to "or" in English, has been described as a PPI which simply cannot occur in the local context of negation, see (5b), (Spector, 2014; Nicolae, 2017).

- a. Marie a invité Léa ou Jean à dîner.
"Marie invited Lea or Jean for dinner."
(5) b.?? Marie n'a pas invité Léa ou Jean à dîner.
(Under a narrow-scope interpretation for disjunction)
"[Marie]² did not invite Léa or Jean for dinner."
[(Spector, 2014): 6, ex. (6)]

As (6) shows such sentences are rescuable if the negation is non-local, as in (6) or when the negation itself is also in a downward entailing context, as in (7).

- (6) Je ne pense pas que Marie ait invité Pierre ou Julie à dîner.
"I don't think that Marie invited Pierre or Julie for dinner."
(understood as I don't believe Pierre invited either one) [(Spector, 2014): 6, ex. (7)]

- a. Si Paul n'avait pas invité Pierre ou Julie à dîner,
cela aurait été impoli.
"If Paul had not invited Pierre or Julie for dinner,
that would have been rude."
(7) b. Il est peu probable que Paul n'ait pas invité Pierre
ou Julie à dîner.
"It is unlikely that Paul did not invite Pierre or
Julie for dinner."
(understood as It is likely that Paul invited either Pierre
or Julie for dinner). [(Spector, 2014): 6, ex. (8)]

One of the native speaker authors of this paper agrees with the above judgments but finds acceptable a structurally similar sentence with a semantic link between the propositions of the disjunction, for instance if they refer to two items on the same menu, as in (8). In such a sentence, the negation wide scope reading naturally shines through, meaning that Paul did not order either one of the two dishes.

- (8) Paul n'a pas commandé le poisson ou le poulet.
Paul did not order the chicken or the fish.

In sum, the fact that sentences with negation and "ou" are not straightforwardly interpreted with a disjunction wide scope reading shows that French "ou" does not behave like the Japanese "ka" illustrated earlier. Rather, an English-style disjunction narrow scope reading that can be coerced at least in some contexts as already suggested by Notley et al. (2011).

Moreover, in an experimental study with adult native speakers, Lungu et al. (2019) found that both scope readings of the disjunction, narrow or wide, are accessible to speakers in simple negative sentences. As Lungu et al. also point out, these facts cast doubt on the analysis of negated disjunctions along the classical PPI: disjunction wide scope, non-PPI: disjunction

²Paul in the original.

narrow scope representation dichotomy. Regardless of whether or not we consider the French disjunction to be a PPI, the very fact that both scopes are accessible is enough to argue that the PPI-hood of the disjunction cannot fully account for its scope parameters. Notley et al. (2011) indeed suggest a more flexible approach according to which both readings are always accessible even though one is preferred by adult speakers. As far as French is concerned, it is however unclear what that preferred reading is.

If a more fine-grained analysis is called for, it seems important to consider what factors may be relevant for obtaining a disjunction wide scope interpretation. Han and Romero (2004) have suggested that focus shifts disjunction scope parameters in English sentences thus allowing what they call a disjunction-as-alternative reading in negative sentences as opposed to the conjunctive reading dictated by De Morgan's laws. Moreover, it seems that focus is also closely related to the positive polarity of disjunction in Romanian and Hungarian (Szabolcsi, 2002). Szabolcsi even goes on to explain that, in Hungarian, prosodic stress on the negative in denial reading of negative sentences cause a disjunction narrow scope reading while the default reading is a disjunction wide scope, the disjunction thus appearing to be PPI, as shown in (9a) and (9b) [(Szabolcsi, 2002): 6, ex (14)]

- a. Te becsukt-ad az ajtó-t vagy az ablak-ot!
youin-closed-2sg the door-acc or the window-acc
(9) "You closed the door or the window!" [i.e., one of the two]
- b. Nem igaz! NEM csukt-am be az ajtó-t vagy az ablak-ot!
not true not closed-1sg in the door-acc or the window-acc
"Not true! I DIDN't close the door or the window"
[i.e., neither]

If focus can cause a wide scope reading of the negation, it can be expected to have the same effect on the disjunction when focused as well. Specifically, as Glanzberg (2009) argued, focusing the disjunct has the effect that the negation itself is presupposed, giving rise to a disjunct wide scope reading. Along these lines, we hypothesize that in a mixed language, like French, focus may be one of the determining factors for the wide or narrow scope of disjunction relative to the negation.

Before we can test experimentally whether a disjunction wide scope reading can indeed be triggered by prosodic focus on the disjunct, we need to establish that prosodic manipulation of focus is appropriate in this language. It is well-known that stress shift is not the preferred way to mark focus in French where clitic left dislocation is more widespread (Lambrecht, 1994; Hamlaoui, 2008). French speaking adults are nevertheless sensitive to prosodic focal manipulation as shown by Szendroi et al. (2018) who designed a correction task in which participants were expected to correct either the subject or object part of the test sentence depending on where the focus laid. They also tested French, German and English-speaking children aged 3–6 using the same experiment and found that children, as early as 3 years old, are able to take into account prosodically marked focus. Even though they did witness cross-linguistic differences to the effect that both French children and adults had a preference for neutral stress compared to English participants, Szendroi et al.'s (2018) work provides enough

ground to expect that our participants would react to prosodic focal manipulation.

In our study we tried to experimentally attest whether focus on the disjunction causes it to scope out of the negation in contexts where the negation would normally take a wide scope. This hypothesis was tested using prosodic stress on the disjunction as a way to mark focus. Following Goro and Akiba (2004), and adopting their methodology, we used truth value judgment tasks to test the interpretation that pre-schoolers gave to negative sentences containing a disjunction with and without focus. An adult control group was also tested in the neutral prosody condition to ensure that the test sentences that we used would be given, a negation wide scope reading by competent speakers as the default interpretation of French negated disjunctions is disputed [see Spector (2014), Lungu et al. (2019), discussed above]. Thus, our experiment aims to determine whether prosodic focus is one of the determining factors in scope assignment of the negated disjunction in French. If our hypothesis turns out to be correct, it would lead us to conclude that the disjunction scope parameter assignment is more fluid than previously thought [see also Lungu et al. (2019)] and can be influenced by prosodic focus and perhaps other pragmatic cues which remain to be explored.

THE EXPERIMENT

Adult Pre-test

In order to verify one of the present author's native speaker judgment regarding our test items, we tested a native-speaker adult control group. One participant was excluded as their results on the fillers were indistinguishable from a guess pattern (analyzed data: 14 participants, mean age 51, 19; range Age 23–74). The pre-test involved the same experimental material as those used with the children in the neutral intonation group in the main experiment (see below for experimental details). The adult procedure used animated videos instead of live acted out stories and the questions were recorded by the same native speaker that conducted the children's experiment. In every other respect the procedure was the same as that of the child experiment. Results of this pre-test showed that the control group gave answers consistent with a negation wide scope reading in 98.4% of cases. Overall, the pre-test confirmed that in neutral intonation the experiment material is normally interpreted with a disjunction narrow scope reading, in accordance with this author's native speaker judgments.³ This result seems to go against experimental findings from Pagliarini et al. (2017) who reported an 83.4% rejection rate of the conjunctive entailment triggered by a disjunction narrow scope reading in a similar TVJT. Our test stories however, featured a third item, additionally to the two disjuncts, which was always true thereby motivating the use of a simple negation while a negative concord (ni [...] ni) would have been preferred to induce a conjunctive reading in the absence of such a contrastive

³Note also that the negation wide scope reading is also the reading that is consistent with the Semantic Subset Principle (Crain, 2008), so children are in any case expected to entertain this reading, even in languages where adults do not.

element [as pointed out by Pagliarini et al. (2017)]. In French, sentences of the type “NOT A OR B” do not seem to be felicitous in the absence of the contrastive element. This is why our test sentences were of the form “X BUT NOT A OR B” and why our adult participants derived a conjunctive entailment.

Main Experiment

The design of the experiment was closely following the methodology of Goro, Akiba and Crain’s previous works (Goro and Akiba, 2004; Crain, 2012) using truth value judgment tasks to study disjunction scope parameters acquisition among English and Chinese speakers for Crain and Japanese speaking children for Goro and Akiba, 2004.

Participants

Fifty-three monolingual French-speaking pre-schoolers participated in the study. The participants were recruited and tested in their respective pre-school. Both pre-schools are located in the region of Champagne in the north-east of France where standard French is spoken. The answers of three of the participants were excluded from the analysis, two of them because the test could not be completed for lack of attention span and one because the child gave the same answer to all the questions. The results of 50 participants are thus reported here.

The participants were randomly assigned to one of the two conditions: Neutral Intonation condition where the participants received the version of the test containing neutral intonation on the disjunction ($n = 21$, mean age = 5;1, age range 4;3–6;3), and Prosodic Stress condition where the participants received the version of the test containing prosodic stress on the disjunction ($n = 29$, mean age = 5;3, age range 4;0–6;0).

Materials

Following Goro and Akiba’s (2004) experimental design, participants watched stories unfolding in front of them involving a dinosaur. In each story, a different toy dinosaur was presented with three items to eat namely, a candy, an apple and an orange. The dinosaur always ate the candy.⁴ At the end of each story, the participants were asked to award a coin to the dinosaur based on its performance. The stories had three possible outcomes, as shown in (10).

- (10) a. *Red medal story*: The dinosaur ate the candy only and received a red coin.
 b. *Yellow medal story*: The dinosaur ate the candy as well as exactly one piece of fruit and received a yellow coin.
 c. *Green medal story*: The dinosaur ate all three items on the table (i.e., a candy and two pieces of fruit) and received a green coin.

⁴A statement about the candy that was systematically eaten by the toy contestants served as a positive lead-in in the test sentence (10) so that a contrastive negation could then be introduced as a mean to point out that a contextually determined expectation (eat all three items) had not been met. This creates a context in which children tend to perform better with negative sentences and offers an optimal felicitous setting for the occurrence of a disjunction in a simple negative sentence (De Villiers and Tager-Flusberg, 1975; Goro and Akiba, 2004) as already highlighted in 2.1.

After each story, three TVJT test items were introduced by three different puppets, each making one statement about the story that had just unfolded, one after the other. The participants were then asked to judge the accuracy of the statement by answering to the puppet whether it was true or false.

Our test sentences involved negated disjunctions following a positive lead-in, uttered with neutral intonation as in (11) and **Figure 1** or with marked prosodic stress on the disjunction, as in (12) and **Figure 2**.

- (11) Le dinosaure a mangé le bonbon, mais n’ a pas mangé
 The dinosaur has eaten the candy, but not has
 double-neg eaten
 la pomme ou l’ orange.
 the apple or the orange.

The dinosaur ate the candy, but he did not eat the apple or the orange.

- (12) Le dinosaure a mangé le bonbon, mais n’ a pas mangé
 The dinosaur has eaten the candy, but not has
 double-neg eaten
 la pomme OU l’ orange.
 the apple or the orange.

The dinosaur ate the candy, but he did not eat the apple or the orange.

We can interpret the responses as follows. If the disjunction is interpreted with a negation wide scope reading, the participant understands (11)/(12) to mean that neither the apple nor the orange was eaten, which is false in cases where the dinosaur ate everything, i.e., the green medal stories, where both are disjuncts true, and also when the dinosaur ate exactly one fruit, i.e., the yellow medal stories, where exactly one disjunct is true, and true in the red medal stories, where neither disjuncts are true. If the disjunction is interpreted with a disjunction wide scope reading, the participant understands the sentence to mean that either the orange or the apple was not eaten which would be true in the yellow medal stories and false in the red and green medal stories.⁵

All the test sentences in three green medal stories were fillers, because as stated above, participants would have judged target items in the green medal stories false regardless of their scope interpretation. Consequently, the yellow and red medal stories, where exactly one or neither of the disjuncts were true, respectively, were distributed evenly among fillers and target sentences. The full list of filler sentence types is provided in the **Appendix**. Their distribution among the stories was such that expected TRUE and FALSE answers overall would be balanced.

To sum up, the test sentences can thus be divided into two categories depending on what context they appear in, each resulting in two possible outcomes namely a disjunction narrow scope reading and a disjunction wide scope reading. Those four possible outcomes are summarized in **Table 1**.

Our prediction was that participants would assign a narrow scope to disjunction relative to the negation under neutral prosody similarly to the adult participants in our pre-test,

⁵Note, however, that semantically speaking the disjunction wide scope reading is true in the red stories. It is only pragmatically false, we will return to this point later.

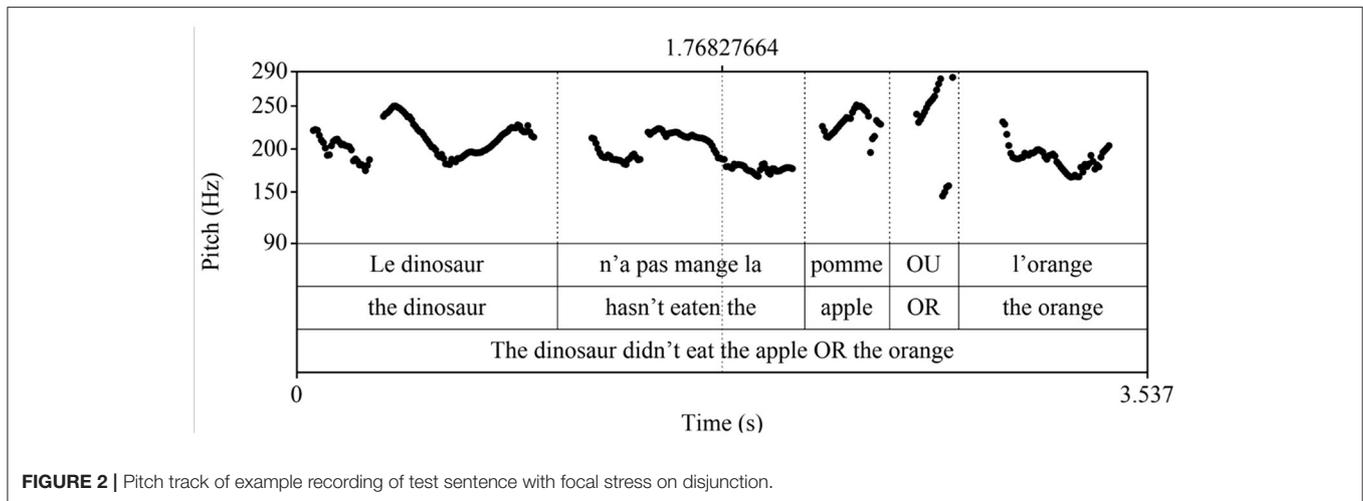
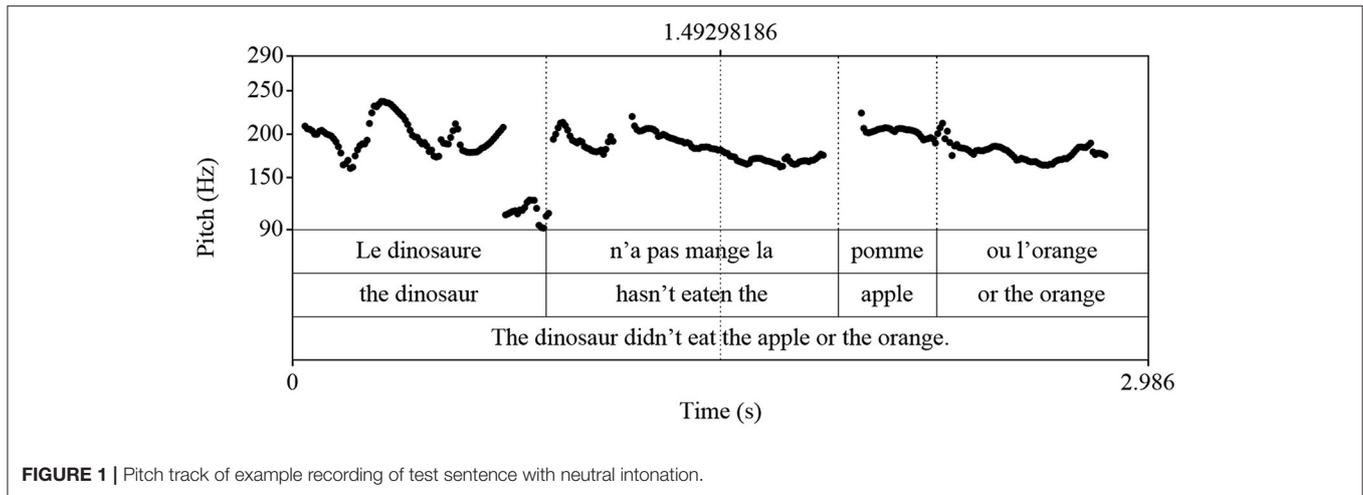


TABLE 1 | Possible responses for test items depending on the relative scope of negation and disjunction in the different story contexts.

	Disjunction narrow scope reading of (Not A or B)	Disjunction wide scope reading of (Not A or B)
Yellow medal story (i.e., exactly one disjunct true)	FALSE	TRUE
Red medal story (i.e., neither disjuncts true)	TRUE	FALSE

meaning that they would judge the test sentences false in the yellow medal stories, where exactly one of the disjuncts is true, and they would judge the test sentences true in the red medal stories, where neither disjunct is true. In contrast, we hypothesized that under the prosodic stress condition, taking this new grammatical information into account would cause at least some participants to interpret the sentence with disjunction wide scope relative to the negation, and thus judge the test sentences true in the yellow medal stories but false in the red medal stories.

Procedure

Participants were tested one by one in a quiet room of their kindergarten. The same French native speaker tested all of the participants. Each session started by introducing the child to a box full of toy dinosaurs. Following Goro and Akiba (2004), it was explained that, one by one the dinosaurs were going to take part in an eating contest for which they needed to eat all three food items on the table in order to win the best medal. The participants were introduced to the three types of medals (green, red and yellow) as well as to the conditions for awarding each one of them. Following this explanation, the understanding of the award scheme was tested with trial stories of a dinosaur eating either one, two or three items. Once the participant was comfortable with the procedure, the test started. After each dinosaur had completed its eating attempt, the participant was asked to award the appropriate medal. Then all food items were removed from the table and a puppet entered the scene explaining that it had just arrived and missed the contest. The puppet then acknowledged the medal that the dinosaur had received and made a guess regarding the performance of the dinosaur based on its medal. After that, the puppet asked the child to judge the truth value

of its guess allowing the experimenter to record the truth value judgment of each test sentence emitted by the puppet. This procedure presents the advantage of avoiding asking questions to which the answer should be obvious; since the puppet has not witnessed the scene and demonstrates interest in the contest, it is not pragmatically odd that it asks the child for feedback on a genuine guess. It also avoids putting the child in a situation of having to challenge an adult's statement if judging the test sentence false.

Each participant watched a total of nine stories acted out. Given that each story led to the utterance of three truth value judgments on the part of the child, each participant gave 27 responses. All three scenarios were evenly spread and thus all types of medals were awarded three times. Out of the 27 test sentences, 9 were target items [e.g., (11) or (12)] and 18 were fillers. Out of the nine target sentences, five appeared in stories in which the dinosaur had received a yellow medal (i.e., a story in which exactly one of the disjuncts is true) and four were in a red medal context (i.e., a story in which neither disjuncts are true).

Results

In order to explore whether the children's perception of the test items with neutral prosody matched that of the adults, a mixed ANOVA was run on the proportion of disjunction narrow scope reading responses with a between subject factor of age group [adults ($n = 14$) vs. children ($n = 21$)]⁶ and a within subject factor of story type (Red vs. Yellow). The analysis showed no effect of group ($p = 0.118$), story type ($p = 0.546$), or interaction between the two factors ($p = 0.666$). This indicates that the children assigned to the neutral prosody condition adopted an adult-like disjunction narrow scope reading of the test sentences in 96% of cases in the red story (0 disjuncts true) context and 94% of cases in the yellow story (1 disjunct true) context (95% overall), see **Figure 3** below.

Comparing the performance of the two groups of children that heard test items in the neutral vs. the prosodic stress condition, a mixed ANOVA was run on the proportion of disjunction narrow scope reading responses with a between subject factor of condition (Neutral Intonation condition and Prosodic Stress condition), a within subject factor of story type (Red vs. Yellow) and the participants' age as a covariate.⁷ The analysis returned a highly significant main effect on condition [$F_{(1,47)} = 15.193$, $p < 0.0001$, $\eta^2 = 0.968$], which, the descriptive statistics revealed, was due to the higher proportion of disjunction narrow scope responses in the Neutral Intonation condition ($M = 0.948$) compared to the Prosodic Stress condition ($M = 0.741$). Despite the numeric difference, no effect of story type was found ($p = 0.554$), however, the story type*condition interaction was significant [$F_{(1,47)} = 5.079$, $p = 0.029$, $\eta^2 = 0.098$], which was due to the larger difference between the Red and Yellow story type conditions in the Prosodic Stress condition (22%) compared

to that difference in the Neutral Intonation condition (3%), see **Figure 4** below. No main effect of age or its interaction with any other factors was detected in the data.

DISCUSSION

Just like the adults in our pre-test, children in the neutral stress condition gave responses that are consistent with a disjunction narrow scope reading. Specifically, in red medal stories (0 disjuncts true), they accepted the test sentence with negation and disjunction and in yellow medal stories (1 disjunct true), they rejected it. So, they clearly understood NOT A OR B in the sentences to mean "neither A nor B." Not only does this match the adultlike judgment, as shown by the pre-test, but it also constitutes the reading that conforms to the Semantic Subset Principle (Crain, 2008). The disjunction narrow scope reading is true if and only if both propositions are false. These contexts are in a proper subset relation with the set of contexts that make the disjunction wide scope reading true, namely when at least one of the propositions is false.

When it comes to the experimental manipulation, our results show that significantly more children assigned a disjunction wide scope reading in the stress condition, compared to the neutral condition. This means that children were sensitive to the difference between the neutral stress and focal stress on the disjunct and took this difference to indicate a disjunction wide scope reading. This result is consistent with our hypothesis that the focalisation of the disjunction can make it scope out of the negation in contexts where it would normally be interpreted within the scope of negation. Glanzberg (2009) argues that for semantic reasons, focus marking on the disjunct automatically gives it wide scope over the negation. This is because focussing the disjunct partitions the sentence in terms of information structure in such a way that the negation no longer forms part of the assertion but is rather presupposed. As illustrated in (13), applying focal stress to the disjunct creates a presupposition that the dinosaur did not eat some contextually salient entity. Then the focal sentence asserts that this entity was the apple or the pear.

- The dino didn't eat the apple OR the pear.
 (13) Assertion: The dino didn't eat the apple or the dino didn't eat the pear.
 Presupposition: The dino didn't eat some contextually salient entity.

Of course, prosodic stress marking is almost never a deterministic cue. So, although some of the children clearly interpreted the prosodic manipulation to be a marker of contrastive focus, and thus entertained at the disjunction wide scope reading, others were more reluctant to do so.

The results showed that, in the prosodic stress condition, there was an interaction between children's readiness to assign wide scope to the disjunct and the type of test story they received. Specifically, we found that children, in the prosodic stress condition, were more willing to entertain a disjunction wide scope reading in yellow medal stories (1 disjunct true)

⁶Homogeneity of variances assumption (Lavene's test) held in this case despite the unequal sample size.

⁷Homogeneity of variances assumption (Lavene's test) was violated, likely due to the unequal sample size; the violation, however, was considered acceptable since the variance in the larger sample was not more than that in the smaller sample (Howell, 1997).

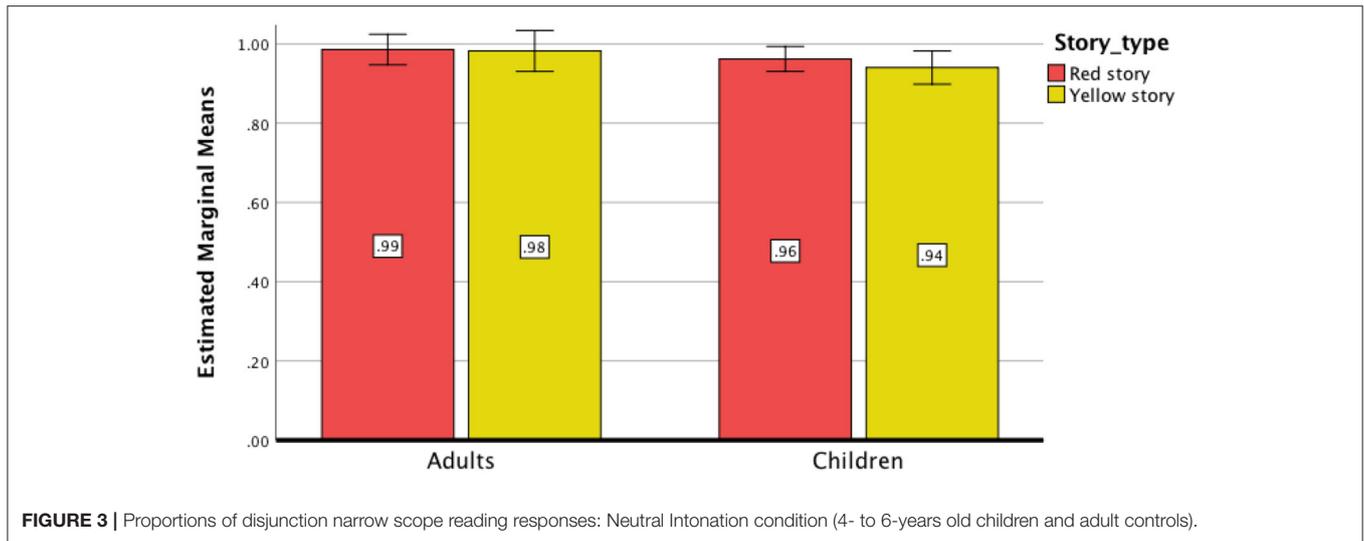


FIGURE 3 | Proportions of disjunction narrow scope reading responses: Neutral Intonation condition (4- to 6-years old children and adult controls).

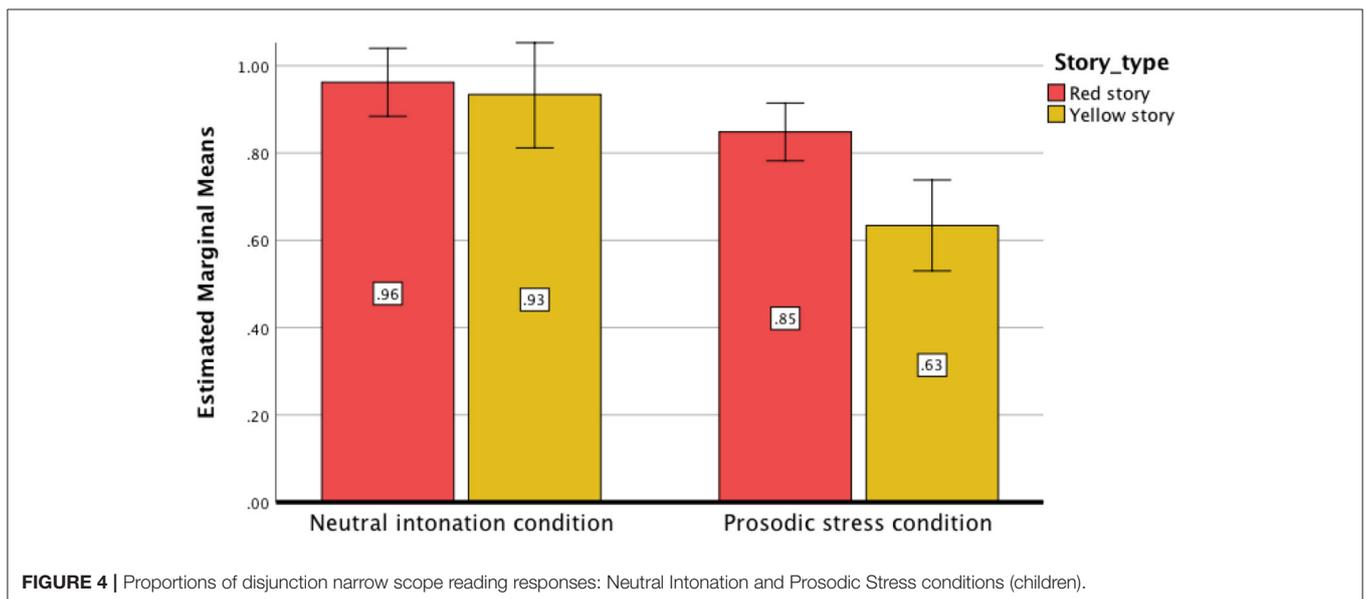


FIGURE 4 | Proportions of disjunction narrow scope reading responses: Neutral Intonation and Prosodic Stress conditions (children).

compared to red medal stories (0 disjuncts true). One possible interpretation of this finding is that the disjunction wide scope reading leads to a TRUE judgment in yellow medal stories (1 disjunct true), while it leads to a FALSE judgment in red medal stories (0 disjuncts true). In other words, in red medal stories (0 disjuncts true), children face a scopal ambiguity whose default interpretation would lead to a TRUE judgment, and the prosodic focus on the disjunct is enticing them to abandon this reading in favor of a reading that would lead to a FALSE judgment. In contrast, in yellow medal stories (1 disjunct true), children's default disjunction narrow scope interpretation would lead to a FALSE judgment and considering the alternative disjunction wide scope reading allows them to respond TRUE. Given the Principle of Charity (Crain and Thornton, 1998), this seems to us to provide an explanation for the interaction.

At the same time, we would like to draw attention to a possible alternative explanation for this finding. Consider the logical truth table of an utterance with disjunction wide scope over negation, provided here in **Table 2** for ease of reference. Such an utterance would be true if one proposition is false and the other is true, or the other way around, and false if both propositions are true. In addition, logically speaking the utterance would also be true if both propositions are false.

A pragmatically competent speaker would nevertheless reject this utterance in such a scenario, due to the fact that this scenario is also compatible with the unmarked disjunction scope reading. This blocking step, however, involves a manner implicature (Grice, 1975), and what Reinhart (2006) called reference set computation: a global comparison of different derivations under the same interpretation. Reinhart (2006), Noveck (2001), Tieu et al. (2016), Barner et al. (2011) and many others have shown

TABLE 2 | Logical truth table and expected judgments of disjunction wide scope.

A	B	(NOT A) OR (NOT B)	Pragmatically competent judgment
T	T	F OR F= F	F
T	F	F OR T= T	T
F	T	T OR F= T	T
F	F	T OR T= T	F *blocked by NOT (A OR B)

that children under Age 6 are reluctant or unable to carry out such computations. As a result, they often show semantic, or logical judgments, rather than pragmatic ones in implicature contexts. If this is on the right track, then we can also provide an alternative explanation for the relatively higher proportion of TRUE judgments in the yellow medal story context (1 disjunct true) compared to the proportion of FALSE judgments in the red medal stories (0 disjuncts true). It is possible that in fact an equal number of children were willing to consider the disjunction wide scope reading, induced by the prosodic manipulation, in the two types of stories. But while in the yellow medal scenario (1 disjunct true), all of these children judged the sentence TRUE, in the red medal scenario (0 disjuncts true) only some of the children who considered the disjunction wide scope reading gave a FALSE judgment. Some of them failed to perform the required pragmatic implicature, and gave a logical or semantic judgment, TRUE, which is indistinguishable from the reply they would have given if they understood the test sentence to have disjunction narrow scope.

In order to verify this *post-hoc* hypothesis, we looked at children's performance on fillers that involved a disjunction in a positive sentence in a green medal story (2 disjuncts true), as in (14).

- (14) Le dinosaure a mangé la pomme ou la poire.
The dinosaur has eaten the apple or the pear
The dinosaur ate the apple or the pear.

(14) is semantically, or logically speaking TRUE in a green medal story, where the dinosaur ate both the apple and the pear. However, by implicature, pragmatically competent speakers judge this sentence FALSE in such a context, due to the availability of the alternative utterance involving a conjunction. There were four children who gave a pragmatically competent FALSE judgment in two of the two fillers of this type. Looking at the performance of these four children on our test items revealed that they gave a disjunction wide scope response (i.e., FALSE in red, 0 disjuncts true, and TRUE in yellow story, 1 disjunct true, context) 75% of the time in both red and yellow story contexts. Given the low number of such children we were unable to run statistical analysis, but we note that numerically speaking, these findings are consistent with the idea that children that are pragmatically competent would not treat the two story contexts differently, suggesting that some of the TRUE responses in the red story (0 disjuncts true) contexts for pragmatically immature children could actually be due to a disjunction wide scope reading combined with a failure to compute the implicature.

CONCLUSION

In this paper, we looked at French children's interpretation of negation and disjunction. We found that under neutral intonation, children, just like adults, entertain a disjunction narrow scope reading. This was expected given Crain's (2008) arguments that the disjunction narrow scope reading is the one favored in acquisition by the Semantic Subset Principle. At the same time, we found that children are not incapable at this age to consider the disjunction wide scope reading and that prosodic focus on the disjunct is a successful cue to induce the marked scope reading. Children showed a differential behavior in red (0 disjuncts true) and yellow (1 disjunct true) story contexts, either because it is harder to flip a scope judgment away from a TRUE to a FALSE judgment, or perhaps because some of the children were still pragmatically immature and thus gave TRUE answers in the red story (0 disjuncts true) context despite them entertaining a disjunction wide scope reading. In the future, we would aim to explore this idea further as well as test adults also on the prosodic stress condition which we were not able to do in this study. Given the unnatural nature of stress shift in adult French, this would have to be tested in person, rather than in an online format. Overall, we can conclude that at least in a mixed language like French, focus seems to be a successful manipulator to induce a marked disjunction wide scope reading in pre-schoolers, showing that the distinction between PPI-disjunctor vs. non-PPI disjunctor languages needs to be more fine-grained.

DATA AVAILABILITY STATEMENT

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

ETHICS STATEMENT

The studies involving human participants were reviewed and approved by Research Ethics Committee UCL. Written informed consent from the participants' legal guardian/next of kin was not required to participate in this study in accordance with the national legislation and the institutional requirements.

AUTHOR CONTRIBUTIONS

CL is responsible for the design of the experiment, for creating the material, and carrying out the experiment. KS supervised CL's work. KS and CL co-wrote the introduction and discussion. AK carried out the data analysis, statistical calculations, and wrote the results part. All authors contributed to the article and approved the submitted version.

SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/fcomm.2020.595799/full#supplementary-material>

REFERENCES

- Barner, D., Brooks, N., and Bale, A. (2011). Accessing the unsaid: the role of scalar alternatives in children's pragmatic inference. *Cognition* 118, 84–93. doi: 10.1016/j.cognition.2010.10.010
- Crain, S. (2008). The interpretation of disjunction in universal grammar. *Lang. Speech* 51, 151–169. doi: 10.1177/00238309080510010901
- Crain, S. (2012). *The Emergence of Meaning. Cambridge Studies in Linguistics; No. 135*. Cambridge: Cambridge University Press.
- Crain, S., and Thornton, R. (1998). *Investigations in Universal Grammar: A Guide to Experiments on the Acquisition of Syntax and Semantics. Language, Speech, and Communication Y*. Cambridge, Mass; London: MIT Press.
- De Villiers, J.G., and Tager-Flusberg, H.B. (1975). Some facts one simply cannot deny. *J Child Lang.* 2, 279–286. doi: 10.1017/S0305000900001100
- Geçkin, V., Thornton, R., and Crain, S. (2018). Children's interpretation of disjunction in negative sentences: a comparison of Turkish and German. *Lang. Acquisit.* 25, 197–212. doi: 10.1080/10489223.2017.1280796
- Glanzberg, M. (2009). "Descriptions, negation, and focus," in *Compositionality, Context and Semantic Values*, eds J. Stainton, and C. Viger (Berlin: Springer-Verlag), 193–220.
- Goro, T., and Akiba, S. (2004). "The acquisition of disjunction and positive polarity in Japanese," in *Proceedings of the 23rd West Coast Conference on Formal Linguistics*, eds G. Garding and M. Tsujimura (Somerville, MA : Cascadilla Press), 251–264.
- Grice, P. (1975). "Logic and conversation," in *Syntax and Semantics. 3: Speech Acts*, eds P. Cole, J. Morgan (New York, NY: Academic Press), 41–58.
- Gualmini, A., Stephen, C., and Luisa, M. (2000). "Acquisition of disjunction in conditional sentences," in *BUCLD 24 Proceedings* (Somerville, MA: Cascadilla Press), 367–378.
- Hamlaoui, F. (2008). "Focus, contrast, and the syntax-phonology interface: the case of French cleft-sentences," in *Unity and Diversity of Languages. 18th International Congress of Linguists (CIL18)* (Seoul: Linguistic Society of Korea).
- Han, C., and Romero, M. (2004). Disjunction, focus, and scope. *Linguist. Inq.* 35, 179–217. doi: 10.1162/002438904323019048
- Howell, D. C. (1997). *Statistical Methods for Psychology*. 4th ed. Boston, MA: Duxbury Press.
- Lambrecht, K. (1994). *Information Structure and Sentence form: Topic, Focus, and the Mental Representations of Discourse Referents*. Cambridge: Cambridge University Press. doi: 10.1017/CBO9780511620607
- Lungu, O., Falaus, A., and Panzeri, F. (2019). *Disjunction in downward entailing contexts: a crosslinguistic study*. Available online at: <https://olungu.wordpress.com/publications/>
- Nicolae, A. (2017). Deriving the positive polarity behavior of plain disjunction. *Semant. Pragmat.* 10:5. doi: 10.3765/sp.10.5
- Notley, A., Zhou, P., Jensen, B., and Crain, S. (2011). Children's interpretation of disjunction in the scope of 'before': a comparison of english and mandarin. *J. Child Lang.* 39, 482–522. doi: 10.1017/S0305000911000092
- Noveck, I. A. (2001). When children are more logical than adults: experimental investigations of scalar implicature. *Cognition* 78, 165–188. doi: 10.1016/S0010-0277(00)00114-1
- Pagliarini, E., Guasti, M. T., Lungu, O., van Hout, A., and Crain, S. (2017). "The acquisition of negated disjunction : evidence from Italian, French and Dutch," in *The 42nd Annual Boston University Conference on Language Development (BUCLD 42)* (Boston, MA: Boston University).
- Reinhart, T. (2006). *Interface Strategies: Optimal and Costly Computations (Linguistic Inquiry Monographs 45)*. Cambridge, MA: MIT Press. doi: 10.7551/mitpress/3846.001.0001
- Spector, B. (2014). Global positive polarity items and obligatory exhaustivity. *Semant. Pragmat.* 7, 1–6. doi: 10.3765/sp.7.11
- Szabolcsi, A. (2002). "Hungarian disjunctions and positive polarity," in *Approaches to Hungarian, Vol. 8*, eds I. Kenesei and P. Siptár (Budapest: Akadémiai Kiado), 217–241.
- Szendroi, K., Bernard, C., Berger, F., Gervain, J., and Höhle, B. (2018). Acquisition of prosodic focus marking by English, French, and German Three-, Four-, Five- and Six-year-olds. *J. Child Lang.* 45, 219–41. doi: 10.1017/S0305000917000071
- Tieu, L., Romoli, J., Zhou, P., and Crain, S. (2016). Children's knowledge of free choice inferences and scalar implicatures. *J. Semant.* 3, 269–298. doi: 10.1093/jos/ffv001
- Verbuk, A. (2007). "The acquisition of the russian or," in *Proceedings of the thirty-fourth Western Conference On Linguistics (WECOL 2006)*, eds B. Erin and A. Brian (Fresno: California State University Fresno, Department of Linguistics), 443–455.

Conflict of Interest: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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