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Interpreting Disjunction across Positive and Negative Contexts: Evidence from Child French

Antoine Cochard, Hamida Demirdache, and Angeliek van Hout

Different explanations have been offered for children's non-adult interpretations of statements with disjunction in positive (1a) as opposed to negative (1b) contexts. In positive contexts, their ability to handle pragmatic reasoning seems to be at stake (Chierchia et al., 2004, a.o.). For negative contexts, it has been claimed that learners follow the Semantic Subset Principle (Crain et al., 1994, Goro and Akiba, 2004, Pagliarini et al., 2022, a.o.). No uniform analysis to date, however, has been offered for children's non-adultlike interpretations of disjunction across positive and negative contexts. This study seeks to fill this gap using a single design to test interpretation of disjunction simultaneously across both contexts, as well as improving confounding issues in prior experimental set-ups. We moreover offer a novel and uniform explanation to account for why and how children show target vs. non-target (be it, *inclusive*, *conjunctive*, or *neither*) interpretations of disjunctions across contexts. This account builds on Singh et al.'s (2016) core assumptions that children have the adult capacity to compute scalar implicatures (that is, strengthening), with non-target readings arising because children do not access the full set of alternatives.

(1) a. Liz colored the flower or the tree.
b. Liz did not color the flower or the tree.

Section 1 reviews the literature on the acquisition of disjunction in positive (1.1) and negative (1.2) contexts. Section 2 presents our objectives, section 3 the experiment, section 4 the results, and section 5 discusses our findings.

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1. Background: Disjunction across contexts

1.1. Children's interpretation of OR in positive contexts

The basic logical meaning for disjunction is *inclusive* (2a). The *exclusive* reading is derived as an effect of pragmatic reasoning, i.e., a scalar implicature, that involves a two-step process: generation of alternative(s) (2b) and strengthening (2c). OR and AND form a scale of increasing informativity where AND is the strongest scalar alternative, since a sentence containing AND is more informative than one with OR, i.e. the set of circumstances verifying $(p \wedge q)$ is a subset of the circumstances verifying $(p \vee q)$. Upon hearing OR the hearer infers that the range of situations described by the most informative scalar alternative AND (2b) does not hold, thus strengthening the meaning to *exclusive* OR (2c).

(2) Liz colored the flower or the tree.

a. **Logical meaning:**
Liz colored the flower or the tree or both. *Inclusive* $(p \vee q)$

b. **Strongest scalar alternative:**
Liz colored the flower and the tree. AND alternative $(p \wedge q)$

c. **Strengthened meaning:**
Liz colored the flower or the tree, but not both. *Exclusive* $(p \oplus q)$

Strengthening has been captured in terms of an exhaustification operator (Exh) (Fox, 2007, a.o.) functioning roughly as a covert counterpart to *only*. Exh takes a proposition (3a) and a set of alternatives $ALT(p\ or\ q)$ (3b), and returns an exhaustified assertion (3c) for which as many alternatives as possible from $ALT(p\ or\ q)$ have been negated. Alternatives cannot be negated if they are entailed by the proposition or entail another alternative when negated. For plain disjunction, the alternatives are the prejacent $(p \vee q)$, the individual disjuncts (p) and (q) plus the scalar alternative $(p \wedge q)$. But the only candidate in $ALT(p \vee q)$ that is eligible for negation is $(p \wedge q)$, leading to the exhaustified reading (3c).

(3) a. $(p \vee q)$ Liz colored F or T

b. $ALT(p \vee q) = (p \vee q), p, q, (p \wedge q)$

c. $Exh(ALT)(p \vee q)$
$= (p \vee q) \wedge \neg(p \wedge q)$ Liz colored F or T but not both F and T
$= (p \oplus q)$ Liz colored either F or T

Table 1: Child interpretation patterns for *Liz colored the flower or the tree*

Coloring situation	*Exclusive*	*Inclusive*	*Conjunctive*
Flower and tree	×	✓	✓
Flower but not tree	✓	✓	×
Tree but not flower	✓	✓	×

Turning to acquisition, two types of non-adultlike interpretation patterns have been given by 4-to-5-year-olds (see Table 1). First, Chierchia et al. (2004), a.o., report an *inclusive* interpretation, i.e. children accepted disjunction when only one of the disjuncts was true, like adults, but also when both disjuncts were true, unlike adults (Table 1). This non-adult-like *inclusive* reading arises because children do not compute the scalar implicature and are left with the default *inclusive* meaning of disjunction. Second, Singh et al. (2016) and Tieu et al. (2017) report that children gave a *conjunctive* interpretation for OR, only accepting situations where both disjuncts were true. Singh et al. propose that the *conjunctive* reading arises because children lack the the scalar AND alternative $(p \wedge q)$, as shown in (4).

(4) a. Adult alternatives for *p or q*: $\{(p \vee q), p, q, (p \wedge q)\}$
b. Child alternatives for *p or q*: $\{(p \vee q), p, q\}$

Crucially, on this proposal children have the adult ability to strengthen, but do not reason with the right (i.e., complete) set of alternatives, because they are unable to perform lexical substitution for OR (i.e. replacing the terminal node OR by AND). Recall from the derivation in (3) that the only candidate in $ALT(p \vee q)$ that could be negated was $(p \wedge q)$, but this is precisely the alternative that is missing in the child grammar (4). As a result, Exh must apply again, else there would be no strengthening of the meaning of $p \vee q$, (since there is no proposition that is excluded (5c)). For the second application of Exh (5e), the alternatives under consideration are the pre-exhaustified alternatives of $p \vee q$ (5d).

(5) a. $(p \vee q)$ Liz colored F or the T
b. $ALT(p \vee q) = \{(p \vee q), p, q\}$
c. $Exh(ALT)(p \vee q) = (p \vee q)$
d. $ALT'[Exh(ALT)(p \vee q)] = \{Exh(p \vee q), Exh(p), Exh(q)\}$
$= \{(p \vee q), (p \wedge \neg q), (q \wedge \neg p)\}$
e. $Exh(ALT')[Exh(ALT)(p \vee q)]$
$= (p \vee q)$ Liz colored F or T
$\wedge \neg(p \wedge \neg q)$ and not only T
$\wedge \neg(q \wedge \neg p)$ and not only F
$= (p \wedge q)$ Liz colored F and T

Summarizing so far, the *inclusive* reading has been explained as a failure to compute scalar implicatures.The *conjunctive* reading, on the other hand, arises via reasoning with an incomplete set of alternatives.

1.2. Children's interpretation of OR in negative contexts

When disjunction occurs in negative statements ((1b), repeated as (6)), the relative scope of disjunction and negation appears to vary cross-linguistically. To account for this variation, a positive polarity parameter (PPI) has been put

forth (Szabolcsi, 2002, a.o.). In languages that are [–PPI], disjunction must be interpreted under negation (6a), yielding only one reading: *neither p nor q* (De Morgan's law: $\neg(p \vee q) \Leftrightarrow (\neg p \wedge \neg q)$). This is the case in languages such as English or Romanian, among others (Lungu et al., 2021, a.o.). In languages that are [+PPI], disjunction must be interpreted above negation (6b-c), yielding two possible readings: a *not-both* reading that allows three types of situations (only not *p*, only not *q*, neither *p or q*), and an *exclusive* reading allowing only two of those situations (only not *p*, only not *q*). The *exclusive* reading arises via strengthening of the *not-both* reading (in a similar reasoning process to (3)). Languages such as French, Italian and Japanese have been claimed to fall in this category (Goro and Akiba, 2004, Lungu et al., 2021, a.o.).

(6) Liz did not color the flower or the tree. $\neg(p \vee q)$

a. **NOT > OR**
Liz colored neither the flower nor the tree. $(\neg p \wedge \neg q)$

b. **OR > NOT without scalar implicature.**
Liz did not color the flower and/or the tree. $(\neg p \vee \neg q)$

c. **OR > NOT with scalar implicature.**
Liz did not color either the flower or the tree. $(\neg p \oplus \neg q)$

Several studies have shown that 4-5-year-olds, independently of the type of language they are learning, have a striking preference for *neither* readings (Goro and Akiba, 2004, Pagliarini et al., 2022, a.o.), although this reading is (allegedly) not available in [+PPI] languages. To account for this preference, it has been argued that children adhere to a learnability principle: the Semantic Subset Principle (SSP; Crain et al., 1994), which states that, when two possible readings stand in a subset-superset relation (here, the *neither* reading is true in a narrower set of situations than the *not-both* reading), learners will initially assign the subset meaning (*neither*), until they encounter evidence that their language allows the wider reading (*not-both*). However, this explanation has two flaws. On the theoretical side, while the SSP can account for the preference of *neither* (6a) over *not-both* (6b) readings, it cannot extend to the preference for *neither* over *exclusive* (6c) readings since there is no subset relation between the *neither* and *exclusive* readings. On the empirical side, the *exclusive* status of languages such as French has recently been challenged. In a crosslinguistic study, Lungu et al. (2021) found that the *neither* reading was accepted for disjunction under negation in French and some other alleged [+PPI] languages.

There are currently no other explanations for children's initial non-adult-like interpretation of negated disjunction. As a novel research line, we will explore the possibility that this interpretation in [+PPI] languages, where OR scopes above NOT, arises via the same mechanism (lack of AND alternative, double exhaustification) as the non-adult *conjunctive* reading with plain OR – which, to our knowledge, has not been entertained in earlier work.

2. Present study

As far as we know, no study has sought to investigate how non-target interpretation patterns for positive vs. negative disjunction are related. Our study seeks to fill this gap by investigating the interpretation of disjunction in child French across both contexts within the same design to see if interpretation patterns carry over from one context to the other. Following a growing consensus in the literature (Barner et al., 2011, a.o.), we assume that children have the adult capacity to strengthen, but not necessarily the right set of alternatives (Singh et al., 2016). Comparing children's reasoning with OR in positive versus negative contexts is particularly revealing in French, since the latter is a [+PPI] language where OR is interpreted above negation, which means that the exclusivity inference arises in negative as well as positive contexts (and not only in positive contexts as in English which is [–PPI]). Our premise is that the developmental status of the set of available alternatives is the same in positive and negative contexts alike. In particular, if a learner can generate the adult set of alternatives in positive contexts, she is expected to generate the same set in negative contexts as well, (7). Conversely, if a learner reasons with an incomplete set of alternatives in positive contexts (here, lacks the AND alternative, (4)), she is expected to do so as well in negative contexts (8).

(7) **Target stage:** Access to the full set of alternatives.
   a. Positive context: $ALT = \{(p \vee q), p, q, (\mathbf{p} \wedge \mathbf{q})\}$
   b. Negative context: $ALT = \{(\neg p \vee \neg q), \neg p, \neg q, (\neg \mathbf{p} \wedge \neg \mathbf{q})\}$

(8) **Non-Target stage:** No access to the full set of alternatives.
   a. Positive context: $ALT = \{(p \vee q), p, q\}$
   b. Negative context: $ALT = \{(\neg p \vee \neg q), \neg p, \neg q\}$

The proposal in (8) that children lack the AND alternative uniformly across OR and OR > NOT predicts that *conjunctive* children should only allow *neither* readings in negative contexts, as shown with the derivation in (9) below. The lack of the AND alternative (9b) renders the first application of Exh vacuous (9c). As a result, Exh must apply again, else there would be no strengthening of the meaning of $(\neg p \vee \neg q)$. Negating the pre-exhaustified alternatives of $(\neg p \vee \neg q)$ (9d) automatically yields the *neither* reading (9e).

(9) a. $(\neg p \vee \neg q)$ Liz did not color F or (she did not color) T
   b. $ALT(\neg p \vee \neg q) = \{(\neg p \vee \neg q), \neg p, \neg q\}$
   c. $Exh(ALT)(\neg p \vee \neg q) = (\neg p \vee \neg q)$
   d. $ALT'[Exh(ALT)(\neg p \vee \neg q)]$
      $= \{Exh(\neg p \vee \neg q), Exh(\neg p), Exh(\neg q)\}$
      $= \{(\neg p \vee \neg q), (\neg p \wedge \neg\neg q), (\neg q \wedge \neg\neg p)\}$

e. $Exh(ALT')[Exh(ALT)(\neg p \vee \neg q)]$

$= (\neg p \vee \neg q)$ Liz colored F or T

$\wedge \neg(\neg p \wedge \neg\neg q)$ and not (only not T)

$\wedge \neg(\neg q \wedge \neg\neg p)$ and not (only not F)

$= (\neg p \wedge \neg q)$ Liz did not color F and (she did not color) T

Conversely, the proposal in (7) that children who retrieve the full set of alternatives with plain OR, will also do so with OR > NOT, automatically predicts *exclusive* interpretations of OR and OR > NOT only. Note that certain patterns – e.g. combination of *conjunctive* OR and *exclusive* OR > NOT – are thus expected to be unattested since they are formally underivable on our proposal.

3. Method

3.1. Participants

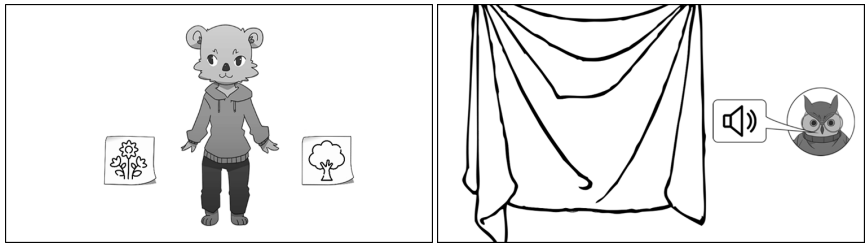
96 native French children participated in the tablet version of the experiment. Testing sessions were done at school. To be included in the study, participants had to be native French speakers, and have completed the experiment. After exclusion, 84 children remained for analysis (range = 3;6-8;5, M = 6;3). In addition, 83 native French adults were recruited on Prolific and participated in the web-based version. After exclusion, 74 adults remained for analysis (range = 18-67, M = 28;2). In order to track development over age, the children were divided into four groups: 3-5-year-olds (n = 24, range = 3;5-5;5, M = 4;8), 5-6-year-olds (n = 19, range = 5;6-6;5, M = 5;10), 6-7-year-olds (n = 21, range = 6;6-7;5, M = 6;10) and 7-8-year-olds (n = 20, range = 7;6-8;5, M = 7;10).

3.2. Experimental set-up and task

We ran a truth-value judgment task in prediction mode (Crain and Thornton, 1998). For this task, participants listened to short stories about animal characters doing different activities, such as coloring drawings, catching bugs or finding objects (Figure 2a). The animals would hide behind a curtain to do their activity. An owl made a guess about what they did there (Figure 2b). The guess was a positive or negative sentence with OR (for Figure 2, see (10-11) below). Subsequently, participants had to judge this guess based on the final situation which showed the reward that the animal got (see Figure 1a for the rewards, and Figure 3 for a sample picture of the final situation).

(a) (b) (c)

Figure 1: a) 2 biscuits = 2 true disjuncts; b) 1 biscuit = 1 true disjunct; c) red dot sticker = 0 true disjunct.



(a) Introduction scene (b) Curtains and owl's prediction

Figure 2: Sample pictures for *Liz colored the flower or the tree*.

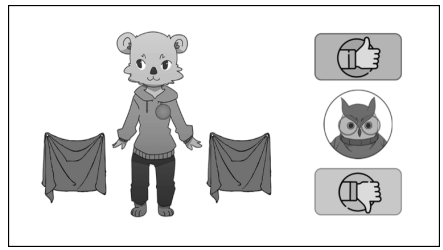


Figure 3: Reward and judgment scene.

Each character was rewarded according to their performance. There were three types of rewards corresponding to the three possible outcomes, tracking the number of true disjuncts in the situation (Figure 1a). An animal got two biscuits if she did both actions, one biscuit if she did only one and a red sticker if she did neither.

With the animals hiding behind a curtain, neither the owl nor the participants witnessed the activity being carried out. The owl made a guess about the action carried out behind the curtain (Figure 2b). The curtain thus created a plausible setting for the prediction mode. Guesses involved a disjunctive statement (critical items) or an obviously true or false sentence (control items). When the curtain rose, participants could see which reward the character got and could infer what had happened behind the curtain. Participants had to judge whether or not the owl made the right prediction by clicking on the thumb-up or thumb-down button on the screen (Figure 3).

Several setup infelicities pointed out for previous studies (Skordos et al. (2020) a.o.) have been addressed with our curtains setup. First, previous studies showed what actually happened, making a disjunctive statement pragmatically infelicitous (e.g. Singh et al. 2016). Here, we committed to a prediction mode that fully satisfies the ignorance requirement for the use of disjunction by hiding what happened behind a curtain. Ignorance was satisfied because the outcome was never shown, only the reward. Second, our setup made the use of disjunction felicitous without having to introduce a contextual third alternative as in other recent studies (Skordos et al. 2020).

3.3. Materials and conditions

A 2 × 3 design was used (*context* × *number of true disjuncts*), as present in Table 2. The critical conditions consisted of a disjunctive statement, either in a positive context (10) or in a negative context (11), with one of three possible outcomes (*0 true disjunct; 1 true disjunct; 2 true disjunct*).

Table 2: Conditions, number of items and expected target answer.

Context	Red dot sticker 0 true disjunct	1 biscuit 1 true disjunct	2 biscuits 2 true disjunct
Positive	Control 3× (Reject)	Critical 6× (Accept)	Critical 6× (Reject)
Negative	Critical 6× (Alleged reject)	Critical 6× (Accept)	Control 3× (Reject)

(10) Liz l'ours a colorié la fleur ou l'arbre.
Liz the-bear AUX colored the flower or the-tree
Liz the bear colored the flower or the tree.

(11) Liz l'ours n'a pas colorié la fleur ou l'arbre.
Liz the-bear NEG-AUX NEG colored the flower or the-tree
Liz the bear did not color the flower or the tree.

In addition, six filler items consisted of obviously true or false statements for each of the three outcomes, such as *Liz the bear colored everything / one thing / nothing*. All items and instructions avoided the use of *et* 'and', so as to not provide children with the relevant scalar alternative to disjunction. The test was counterbalanced so that each participant saw a unique combination of verb, character, context and situation. The items were distributed over four pseudo-randomized lists of stimuli. The sentences were pre-recorded to ensure that participants heard the same prosody.

4. Results

4.1. Results by age groups

Figure 4 and Figure 5 show the mean acceptance of disjunction for the relevant conditions as well as the distribution of participants in positive and negative contexts, respectively.

In the positive context, the adults and the oldest child group gave an *exclusive* reading, showing ceiling acceptance of the target condition (1 true disjunct) and rejection of the non-target condition (2 true disjuncts). In contrast, the younger child groups performed less accurately, in particular, they accepted the non-target condition to quite a large extent. In the negative context, both adults and children show around 50% acceptance for both the target (1 true disjunct) and the non-target condition (0 true disjunct). The hourglass shape of the distribution of participants

in Figure 5 reveals a bi-modal distribution with two subgroups of participants with opposite interpretation patterns.

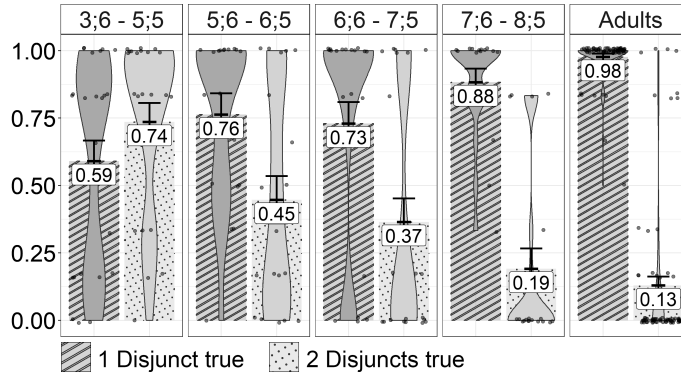


Figure 4: Mean acceptance of disjunction in positive context for each age group. The lines indicate standard error. The shapes show the distribution, each dot representing one participant.

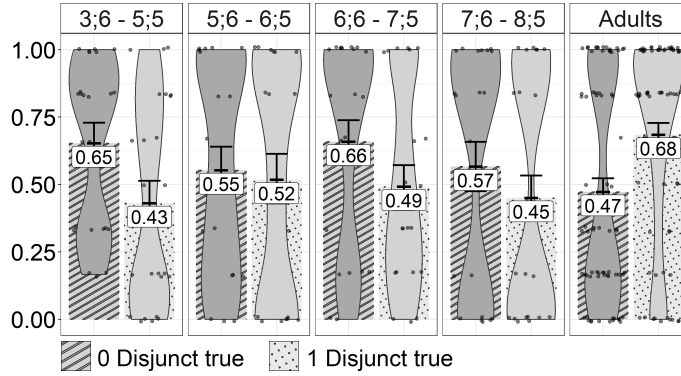


Figure 5: Mean acceptance of disjunction in negative context for each group.

In order to determine whether age played a role, we ran logistic mixed effects models in R (R Core Team, 2022), using the `glmer()` function from package *lme4* (Bates et al., 2015). Positive disjunction and negative disjunction were analyzed separately. Fixed effects were *Age* (4 groups of children), *Situation* (2 critical conditions) and the interaction of the two. *Participant* and *Item* were included as random effects, with *Situation* as random slope for *Participant*. Finally the 1-true-disjunct situation was defined as the reference level for *Situation* and the oldest group of children (7;6-8;5) as the reference level for *Age*. For positive contexts, likelihood tests revealed main effects of *Situation* ($\chi^2(4) = 32.96, p = .0001$) and *Age* ($\chi^2(6) = 24.70, p = .0004$), as well as an interaction of *Situation* × *Age* ($\chi^2(3) = 20.86, p < .0001$). For negative contexts, the test returned no main or

interaction effect (*Situation*: $\chi^2(4) = 3.43, p < .47$; *Age*: $\chi^2(6) = 5.14, p < .52$; *Situation* × *Age*: $\chi^2(3) = .65, p < .88$). Models that included the adult group showed no better results. In positive contexts, the 1-true-disjunct situation was less likely to be accepted by 3-5-year-olds than 7-8-year-olds ($\beta = -3.480, z = -3.197, p = .0014$). No significant difference was found between 7-8-year-olds and 5-6-year-olds ($\beta = -1.733, z = -1.546, p = .12$), and between 7-8-year-olds and 6-7-year-olds ($\beta = -1.514, z = -1.345, p = .18$). Finally, the 2-true-disjunct situation was less likely to be accepted by 7-8-year-olds ($\beta = -8.125, z = -4.553, p < .0001$) than 3-5-year-olds ($\beta = 9.794, z = 4.276, p < .0001$).

4.2. Individual response patterns

4.2.1. Response patterns for positive and negative contexts

Having six items per condition allowed us to analyze the consistency of interpretations and determine individual patterns. This was based on a criterion of 5 or 6 times the same answer (accept or reject) out of 6 items. Participants who did not show any systematic response pattern were classified as *Other*. Table 3 gives the distribution of participants for each of the possible interpretive patterns of disjunction in positive contexts. Most adults showed the expected *exclusive* interpretation, except for eight who showed an *inclusive* interpretation. As for children, most *exclusive* interpreters were older than 5;6, while most *inclusive* and *conjunctive* interpreters belonged to the group of 3-5-year-olds, with the notable exception of five *conjunctive* 6-7-year-olds.

Table 3: Number of participants per pattern in positive contexts.

Interpretation	3;6-5;5	5;6-6;5	6;6-7;5	7;6-8;5	Total Ch.	Adults
Exclusive	3	8	13	14	38	61
Inclusive	7	1	1	1	10	8
Conjunctive	8	1	5	0	14	0
Other	6	9	2	5	22	4

Table 4 presents the distribution of response patterns in negative contexts. As expected, most adults were *exclusive* interpreters who systematically accepted the 1 true disjunct situation and rejected the 0 true disjunct situation. However, there was also a sizable subgroup of adults (14 out of 74) who consistently gave *a neither* interpretation, accepting the 0-true-disjunct situation and rejecting the 1-true-disjunct situation. This supports the bi-modal distribution visualized by the hour-glass shape in Figure 4. In addition, there were some *not-both* interpreters among the adults (acceptance of 0 as well as 1 true disjunct). The younger children showed a clear preference for the *neither* reading, as in previous studies, whereas there was a bimodal distribution in the older children's response patterns, similar to the adults.

Table 4: Number of participants per pattern in negative contexts.

Interpretation	3;6-5;5	5;6-6;5	6;6-7;5	7;6-8;5	Total Ch.	Adults
Exclusive	2	6	6	8	22	29
Inclusive	1	0	0	0	1	8
Conjunctive	12	7	7	11	37	14
Other	9	6	8	1	24	22

4.2.2. Combined patterns: positive and negative contexts

Given that our primary objective was to investigate the interpretation of disjunction for positive and negative contexts within the same speakers, we combined both response patterns for each participant. The criterion to build these patterns also followed a threshold of acceptance/rejection of 5 out of 6 items. Tables 5 and 6 combine the interpretation patterns for positive and negative contexts for adults and children, respectively.

Table 5: Number of adult participants for combined patterns.

		NOT OR			
		Exclusive	*Not-both*	*Neither*	*Other*
OR	*Exclusive*	29	2	13	17
	Inclusive	0	4	1	3
	Conjunctive	0	0	0	2
	Other	2	2	0	2

Table 6: Number of child participants for combined patterns.

		NOT OR			
		Exclusive	*Not-both*	*Neither*	*Other*
OR	*Exclusive*	20	0	9	10
	Inclusive	0	1	5	4
	Conjunctive	0	0	12	2
	Other	2	0	11	8

Table 5 shows two systematic patterns of interpretation for adults, identifying two subgroups. They both share the *exclusive* interpretation for positive contexts, but differ for negative contexts. The largest group had an *exclusive* interpretation of negated disjunction (OR > NEG), which has been commonly assumed for French (Pagliarini et al., 2022, a.o.). The other group consistently showed *neither* readings (NOT > OR). Table 6 shows that a subset of children behaved adult-like by showing one of the two adult patterns: an *exclusive* reading in positive contexts and either the *exclusive* or the *neither* reading in negative contexts.

Turning now to the three predictions made in section 3. Importantly, they are all validated as shown in Table 6. In particular, *conjunctive* children only allowed *neither* readings and *exclusive* interpretations of OR went hand in hand with *exclusive* interpretations of OR > NOT, as expected. Two of the unattested patterns in Table 6 thus automatically follow: as predicted, no child that had a target-like *exclusive* reading in negative contexts had a non-target reading in positive contexts – be it *conjunctive* or *inclusive*.

5. Discussion

The goal of this study was to investigate the interpretation of disjunction across positive and negative contexts in child French seeking to provide a unified explanation of non-target readings across both contexts. We now discuss (non-)adult-like interpretation patterns one by one. The analysis we put forth simultaneously achieves three objectives: (i) it correlates (non-)target interpretations across contexts; (ii) accounts for why certain patterns are unattested; and finally (iii) suggests a novel take on younger children's *inclusive* readings in positive contexts.

Note, first, that this study provides evidence for two populations of French adults differing on their interpretation of OR with negation: 29 gave the *exclusive* reading (Adult 1 in table 7 below), while 14 gave the *neither* reading (Adult 2 in table 7, thus corroborating recent results in Lungu et al. (2021). This finding, however, has critical consequences for learners since it means that there are two adult target grammars: one with a [+PPI] OR yielding the *exclusive* reading (Adult 1), and one with [–PPI] OR yielding the *neither* reading (Adult 2).

We now show how we uniformly account for the combined patterns identified in Table 6, focusing on the attested combined patterns but setting aside for the moment *inclusive* readings. Table 7 summarizes our account of how these grammars are derived. Adults who have a [+PPI] grammar compute scalar implicatures across contexts, yielding *exclusive* readings across the board (Adult 1). Adults who have a [–PPI] grammar must interpret OR in the scope of negation, yielding the *neither* reading, but compute scalar implicatures in positive contexts (Adult 2).

Table 7: Adult-like and non-adult-like grammars for *exclusive* and *conjunctive* interpretations (STR = strengthening).

Grammar	OR	NOT OR	STR	AND Alt.	PPI	Explanation
Adult 1	Excl.	Excl.	✓	✓	+	SI (both ctxs.)
Adult 2	Excl.	Neither	✓	✓	−	SI (positive ctx.)
Child 1	Conj.	Neither	✓	×	+	Double *Exh* (both ctxs.)
Child 2	Conj.	Neither	✓	×	−	Double *Exh* (positive ctx.)

Turning to *conjunctive* children. Like adults, they can have either a [+PPI] or a [–PPI] grammar. With a [+PPI] grammar (Child 1), the *neither* reading arises via double exhaustification, assuming that if the AND alternative is missing with OR, it is missing with OR > NOT (cf. non-target stage hypothesis (8)). Then double exhaustification yields a *conjunctive* reading with OR (5), and a *neither* reading with OR > NOT (9). With a [–PPI] grammar (Child 2), the *neither* reading arises because OR is interpreted under the scope of negation (by De Morgan's law).

Consider lastly *inclusive* children. Table 8 summarizes our account of how we derive the attested combined *inclusive* patterns with children, as well as adults.

Table 8: Adult-like and non-adultlike grammars for *inclusive* interpretations.

Grammar	OR	NOT OR	STR	Exh.ALT	PPI	Explanation
Adult 3	Incl.	Neither	×		–	No SI (positive ctx.)
Adult 4	Incl.	Not-both	×		+	No SI (both ctxs.)
Children 3	Incl.	Neither	✓	×	–	Vacuous STR (positive ctx.)
Children 4	Incl.	Not-both	✓	×	+	Vacuous STR (both ctxs.)

Eight adults gave *inclusive* readings (Table 3), which can only mean they are not computing scalar implicatures in positive contexts. From Table (3), we see that one had a [–PPI] grammar (Adult 3) in Table 3, interpreting OR under negation, and four had a [+PPI] grammar (Adult 4), interpreting OR over negation and again not calculating scalar implicatures.

Now, comparing with children, we see from Table 3 that 10 children also gave *inclusive* readings. We could assume that they are not calculating scalar implicatures for the same reasons that aldults do not – whatever these reasons are (a question we leave open). But this is not satysfying since, importantly, seven of these ten children are in the very youngest age group (3-5-year-olds). Indeed, the youngest children are mostly either *conjunctive* or *inclusive* interpreters (Table 3). This suggests that there need be more to say about how to derive *inclusive* readings with the younger children.

To this effect, we offer here a novel and uniform explanation for why younger children are either *conjunctive* or *inclusive* interpreters of disjunction. This proposal builds on Singh et al.'s (2016) core assumptions that children have the adult capacity to compute scalar implicatures (that is, strengthening), but do not possess the adult set of alternatives. Recall that *conjunctive* readings (5) arise because younger children lack the AND alternative (5b), triggering a second application of Exh (5e)), where the alternatives under consideration are the pre-exhaustified alternatives of $(p \vee q)$ (5d). Suppose, however, that children fail to retrieve the set of pre-exhaustified alternatives ($Exh(\neg p)$ and $Exh(\neg q)$), then there will be no strengthening of the basic *inclusive* meaning of disjunction. In other words, younger *inclusive* interpreters strengthen vacuously. This proposal takes a step further in extending Singh et al. by proposing that the source of

younger children's non-target readings is uniformly failing to access the full set of alternatives. Specifically, children's failure to calculate scalar implicatures can be reanalysed as strengthening, but vacuously, resulting from an incomplete set of alternatives. Children who lack the AND alternative will show *conjunctive* readings, while children who also lack the pre-exhaustified alternatives will show *inclusive* readings.

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