

Conjunctive Disjunctions: When adults behave like children*

Paul Marty
University College London
p.marty@ucl.ac.uk

Andreea Nicolae
Leibniz-Zentrum Allgemeine
Sprachwissenschaft
nicolae@leibniz-zas.de

Abstract Results from acquisition studies show that, in contrast to adults, some children interpret disjunctive sentences conjunctively, i.e., they accept sentences of the form ‘ p or q ’ as true only when both p and q are true. According to the missing alternative view (Singh et al. 2016), this discrepancy between children and adults reflects a difference in semantic competence: children perform conjunctive strengthening because, at their stage of development, they haven’t acquired yet the knowledge that ‘ p and q ’ is a scalar alternative to ‘ p or q ’. According to the conflict resolution view (Skordos et al. 2020, see also Tieu et al. 2017), on the other hand, this discrepancy reflects a difference in how children and adults handle pragmatic infelicities: children show conjunctive responding because they default to different resolution strategies than adults in situations where the experimental task brings about conflicting pragmatic inferences, e.g., in situations where the ignorance inferences associated with ‘ p or q ’ conflict with contextual assumptions. In this paper, we explain how these two explanatory views lead to different predictions regarding the availability of conjunctive strengthening/responding in adult speakers, and we report on three experiments that tested these predictions across different tasks and languages. Our results show that, when the experimental task induces acute pragmatic infelicities, some adult speakers start behaving like children in interpreting disjunction conjunctively, and this independently of their general ability to compute scalar implicatures involving lexical alternatives. We explain how these findings support the conflict resolution approach and we discuss their relevance to account for the variations observed across tasks and studies regarding the prevalence of conjunctive responses in children.

Keywords: disjunction, conjunctive interpretation of disjunction, ignorance inferences, scalar implicatures, pragmatic infelicities, conflict resolution

Contents

1 Introduction	3
2 Two competing approaches	4
2.1 The missing alternative approach	4
2.2 The conflict resolution approach	5

* This research was supported by the German Science Foundation (DFG) grant NI 1850/2-1 and by the Leverhulme Trust grant RPG-2018-425.

3	The present study	7
4	Experiment 1: Baseline experiment	9
4.1	Participants	10
4.2	Materials and design	10
4.3	Procedure	11
4.4	Summary of the predictions	11
4.5	Data treatment and analyses	11
4.6	Results	12
4.7	Discussion	13
5	Experiment 2: Conflicting ignorance with English-speaking adults	13
5.1	Participants	15
5.2	Materials and design	15
5.3	Procedure	16
5.4	Summary of the predictions	16
5.5	Data treatment and analyses	17
5.6	Results	17
5.7	Discussion	20
6	Experiment 3: Conflicting ignorance with French-speaking adults	20
6.1	Participants	21
6.2	Materials and design	21
6.3	Procedure	21
6.4	Summary of the predictions	21
6.5	Data treatment and analyses	22
6.6	Results	22
6.7	Discussion	24
7	General Discussion	24
A	Instructions and test sentences for Experiment 1	26
A.1	Instructions	26
A.2	Items	27
B	Instructions for Experiment 2 & 3	28
B.1	English version	28
B.2	French version	28

1 Introduction

Results from acquisition studies show that children sometimes interpret disjunctive sentences conjunctively. Evidence for this conjunctive interpretation comes from the observation that, in sentence-picture verification tasks, some children are found to accept a sentence like *The boy ate the apple or the pear* only in situations where the boy ate both the apple and the pear, that is, when both of the disjuncts are true. This behavior contrasts with the typical adult behavior: presented with the same sentence, in the same experimental set-up, adult subjects generally accept such sentences when only one of the independent disjuncts is true, while they tend to reject it in situations where both disjuncts are true, due to the exclusivity implicature arising from the competition between *or* and its stronger scalemate, *and*.

To illustrate these findings, consider for instance the study by Singh et al. (2016), who tested simple sentences like (1) in two possible conditions: one in which only one of the disjuncts was true (1DT), and one in which both disjuncts were true (2DT), as exemplified below.

- (1) The boy is holding the banana or the apple.
- a. 1DT: picture showing the boy holding only the banana.
 - b. 2DT: picture showing the boy holding both the banana and the apple.

By testing these two conditions, 1DT and 2DT, Singh et al. were able to pinpoint the exact interpretations children ascribe to sentences like (1), as per the classification in Table 1 (see also Paris 1973, Braine & Romain 1981, Chierchia et al. 2004). The basic idea is as follows: if a participant does not derive any implicatures and thus ascribes an inclusive interpretation to disjunction, they should accept the sentence in (1) in both conditions; by contrast, if a participant interprets the disjunction exclusively, they should accept it only in the 1DT condition; finally, if they interpret the disjunction conjunctively, they should accept it only in the 2DT condition.

Interpretation of disjunction	2DT	1DT
Inclusive	✓	✓
Exclusive	✗	✓
Conjunctive	✓	✗

Table 1: Expected responses to sentences like (1) depending on how the disjunction is interpreted. The symbol ✓ indicates acceptance of the sentence in the relevant condition and ✗ its rejection.

Results of this experiment show that children were significantly more likely to judge (1) as correct when both disjuncts were true than when only one disjunct was true. This finding is in stark contrast to what is robustly observed in the adult population: adults are more likely to accept (1) in the 1DT condition and reject it in the 2DT condition. This paper explores two competing views which have been proposed in the literature to explain children’s conjunctive interpretations.

2 Two competing approaches

2.1 The missing alternative approach

The missing alternative approach, as advanced by Singh et al. (2016) among others, hypothesizes that adults and children consider different sets of alternatives when enriching the meaning of a disjunctive sentence. Specifically, Singh et al. (2016) argue that, for a disjunctive sentence of the form ‘ p or q ’, adults generate the sub-constituent alternatives ‘ p ’ and ‘ q ’ as well as the lexical alternative ‘ p and q ’, whereas children only generate the sub-constituent alternatives, i.e., they fail to further generate the lexical alternative ‘ p and q ’. This difference in the composition of the set of alternatives, they argue, is responsible for the discrepancy observed between adults and children, as illustrated in (2) (adopting the notational conventions in Bar-Lev & Fox 2017). Assuming that implicatures come about via a mechanism of meaning strengthening whereby alternative utterances are considered when calculating the enriched meaning of a sentence, we can partition the set of possible alternatives into those which can be consistently negated simultaneously - the Innocently Excludable ones (represented as ALT^{IE}) - followed by those which can be consistently asserted simultaneously - the Innocently Includable ones (represented as ALT^{II}). As one can verify in (2-b), whenever the alternatives to a disjunctive sentence are not closed under negation, the sub-constituent alternatives to that sentence become innocently includable. In such cases, the meaning of a disjunctive sentence can be thus strengthened by adding to its literal meaning the meaning of its sub-constituent alternatives, giving rise, in effect, to conjunctive strengthening.

- (2) IMP [The boy ate the apple or the pear]
- a. Exclusive interpretation (adults)
 - (i) $ALT_{adults} := \{\text{the boy ate the apple, the boy ate the pear, the boy ate the apple and the pear}\}$
 - (ii) $ALT^{IE} := \{\text{the boy ate the apple and the pear}\}$
 - (iii) $ALT^{II} := \emptyset$
 - (iv) \sim the boy ate the apple or the pear, but not both
 - b. Conjunctive interpretation (children)
 - (i) $ALT_{children} := \{\text{the boy ate the apple, the boy ate the pear}\}$
 - (ii) $ALT^{IE} := \emptyset$
 - (iii) $ALT^{II} := \{\text{the boy ate the apple, the boy ate the pear}\}$
 - (iv) \sim the boy ate both the apple and the pear

As Singh et al. (2016) discuss, this proposal appears to be empirically supported by some of the major findings from the literature on the acquisition of scalar implicatures. First, children are generally found to have difficulty generating lexical alternatives, i.e., alternatives derived via lexical replacement (a.o., Chierchia et al. 2001, Gualmini et al. 2001, Tieu et al. 2015).¹ This finding is thus in line with the idea that children may fail to generate the lexical *and*-alternative associated with *or*-sentences. Second, sub-constituent alternatives have been claimed by some researchers to be

¹ In particular, in Gualmini et al.’s (2001) experiment, children accepted disjunctive sentences in conjunctive contexts, yet these same children performed more like adults once they were explicitly provided with the alternatives. It is worth emphasizing however that Gualmini et al.’s (2001) experiment only shows that explicitly providing the relevant alternatives brings out children’s sensitivity to the choice between a sentence and its alternatives; crucially, this finding does not necessarily mean that children can compute the relevant scalar inference.

central to the derivation of other ‘conjunctive-like’ inferences arising from disjunctive sentences such as free choice and distributivity inferences; crucially, these inferences have been found to be acquired much earlier than other scalar inferences (Tieu et al. 2015). This second finding suggests that sub-constituent alternatives and, more generally, conjunctive strengthening are mastered at an early stage of development, consistent with Singh et al.’s proposal.

Synthesizing these previous findings, Singh et al. (2016) propose that children’s conjunctive interpretations result from the fact that children acquire the grammatical mechanisms for generating SIs earlier than they acquire the knowledge that lexical substitution is a step in alternative-generation. On this view, the conjunctive reading of disjunction is thus to be thought of as reflecting a stage of the developmental trajectory toward mastering this knowledge, and English-speaking children at this stage of development are merely one among several populations that perform conjunctive strengthening of a disjunctive sentence when its set of alternatives is not closed under conjunction.² Following this view, other pertinent instances of this behavior would include, for instance, the interpretation of free choice disjunction in adults and children, adult interpretations of disjunctive sentences in languages where there is no conjunctive connective (e.g., Warlpiri, Bowler 2014; American Sign Language, Davidson 2013), or certain disjunctive sentences whose conjunctive alternatives are ill-formed and thus disregarded in SI computation (Meyer 2015).

Before turning to the second approach, let us briefly mention some possible variants of Singh et al.’s original proposal. As Tieu et al. (2017) note, other explanations in a very similar vein could equally explain the missing alternative. In principle, the failure to generate the lexical *and*-alternative to *or* could also arise because the child has not yet learnt the co-scalar status of *or* and *and*, or because the child is unable to retrieve *and* from the lexicon as easily as the adult. As far as we can see, these additional factors are compatible with one another and could each contribute to explain the missing alternative responsible for children’s conjunctive interpretation. For our purposes, we can consider the issue of learning co-scalar status and the difficulty of lexical retrieval as possible and plausible refinements of the proposal in Singh et al.’s paper.

2.2 The conflict resolution approach

The conflict resolution approach, as discussed in Tieu et al. 2015, 2017 and elaborated on in Skordos et al. 2020, starts from the observation that there is more to the pragmatically enriched meaning of disjunction than exclusivity implicatures. In particular, it has long been observed that disjunctive sentences of the form ‘ p or q ’ also give rise to speaker-oriented ignorance inferences about ‘ p ’ and about ‘ q ’ (e.g., Gazdar 1979, Meyer 2013, Marty & Romoli 2021), as illustrated in (3). In the literature, these inferences are generally treated as scalar implicatures arising from the comparison between the whole disjunction ‘ p or q ’ and its stronger sub-constituent alternatives, namely ‘ p ’ and ‘ q ’. For what is most relevant to us, it is crucial to note that the presence of these inferences makes the utterance of a disjunction infelicitous in contexts where it is taken for granted that the speaker knows, or can easily determine, that one of the independent disjuncts is true. The reason is that, in such cases, these inferences directly stand in contradiction with the contextual assumption that the speaker knows, or is able to determine, which of the disjuncts is true.

² In Singh et al. (2016), the generalization of the possibility of a conjunctive strengthening of a disjunctive sentence is stated as follows (see also Fox 2007, Chemla 2009 and Franke 2011): “A conjunctive strengthening of a disjunctive sentence might be available when the alternatives of the sentence are not closed under conjunction” ((9), p.313).

- (3) The boy ate the apple or the pear.
- a. Exclusivity
 - ↪ The boy didn't eat both the apple and the pear
 - b. Speaker-oriented ignorance
 - ↪ the speaker is not certain that the boy ate the apple
 - ↪ the speaker is not certain that the boy ate the pear

At the core of the conflict resolution approach is the idea that children and adults readily derive ignorance inferences, but differ in terms of how they react to and handle these inferences when they conflict with the context. For instance, Skordos et al. (2020) propose that the prevalence of conjunctive responding among children could result from their higher uncertainty regarding the experimenter's intended question in situations where conflicting inferences arise. Hence, according to these authors, the discrepancies observed between children and adults may not reflect a difference in their semantic competence, but rather a difference in their abilities to resolve pragmatic infelicities. As Skordos et al. (2020) themselves acknowledge, however, this line of explanation is not by itself a formal account of what generates conjunctive responses. In the following, we propose thus to identify some analytical options that can fulfill this explanatory gap.

As a starting point, consider first the typical adult behavior. In standard verification tasks, adults are found to accept simple disjunctive sentences as appropriate descriptions of pictures making only one of the disjuncts true (a.o., Singh et al. 2016, van Tiel et al. 2019b,a, Marty et al. 2020b). These results suggest that, in this kind of task, adults can disregard the ignorance inferences associated with disjunction. It could be so either because adults can easily block or cancel these inferences, or because they manage to adjust the context of the experiment so as to prevent infelicity from arising, e.g., by assuming that the sentence to be verified is not produced with the intention of describing the particular picture it is matched with. Crucially, these conflict resolution strategies are expected to be much less available in experimental set-ups where sentences are assumed to be produced by a speaker who actually intends to describe the accompanying picture. Results from a recent study by Marty et al. (2021) confirm these expectations. In this study, English-adult speakers were presented with a character producing sentences like *There is a blue ball or a green ball in the mystery box*. In situations where the picture showed that the character knew that there was a blue ball, but no green ball in the mystery box, participants rejected these sentences 80% of the time; by contrast, in situations where the picture showed that the character was uncertain about the contents of the mystery box, these same sentences were uniformly accepted. Taken together, these findings teach us that adults are sensitive to pragmatic infelicities resulting from conflicting ignorance inferences, but also that adults can deploy efficient strategies to circumvent these issues when the task allows them to, as in standard verification tasks.

Now, are the conflict resolution strategies we just described similarly available to children? While we cannot offer a definitive answer to this question, we notice that deploying these strategies may be challenging at an early stage of development. For instance, children may encounter difficulties in blocking or cancelling ignorance inferences due to problems of inhibitory control (a.o., Zelazo et al. 1995, Dowsett & Livesey 2000, Munakata et al. 2011). Similarly, as Skordos et al. (2020) discuss, children may be confused about the task they are asked to perform when infelicity arises and thus fail to adjust their behavior in the course of the experiment. The question thus becomes the following: what else can children do to rescue a disjunctive utterance from infelicity? Here we would like to suggest that children may try to rescue these sentences at a minimal cost by

reinterpreting them as including a possibility modal or a universal quantifier, as illustrated in (4) and (5), respectively. Such strategies, in contrast to the previous ones, are semantic in nature: they allow one to avoid the conflict otherwise created by ignorance by deriving a free-choice or a distributive interpretation of the disjunction, both of which can give off the impression of a conjunctive interpretation. As it is easy to verify, either of the options in (4) and (5) would account for children’s apparent conjunctive responding, i.e., why they reject a disjunctive sentence when the possibility of one of the disjuncts is not verified, but accept it when the possibility of both disjuncts can be established.

- | | | |
|-----|---|-----------------------|
| (4) | It is possible that the boy ate the apple or the pear.
~> It is possible that the boy ate the apple.
~> It is possible that the boy ate the pear. | Free Choice strategy |
| (5) | Everything the boy ate is an apple or a pear.
~> Something the boy ate is an apple.
~> Something the boy ate is a pear. | Distributive strategy |

Interestingly, just like the previous approach, the conflict resolution approach finds some empirical support in the acquisition literature. First, results from Hochstein et al. 2014 show that, by the age of 5, children have fully acquired ignorance inferences and can successfully compute these inferences even when they fail to compute exclusivity implicatures. This finding is fully in line with the hypothesis we previously mentioned according to which children succeed on inferences that are based on alternatives whose construction does not require access to the lexicon (a.o., Singh et al. 2016, Tieu et al. 2015). In that respect, we also note that, regardless of one’s assumptions about how free choice and distributivity inferences are actually derived (i.e., in the semantics or via implicatures), the fact that children succeed at computing these inferences supports the empirical plausibility of the interpretive strategies we illustrated in (4) and (5). Second, results from Skordos et al. 2020 suggest that, when ignorance and other pragmatic factors are carefully controlled for, children’s conjunctive responses drop drastically.³ These findings are consistent with the idea that conjunctive responding arises primarily as a result of a conflict resolution strategy which, by definition, need not be deployed if there is no conflict to be resolved in the first place.

3 The present study

The two approaches presented in the previous section make different assumptions regarding the source of conjunctive strengthening, its correlates and the conditions under which it can be

³ A previous attempt to circumvent the issue of conflicting ignorance inferences is offered in Tieu et al. 2017. They presented children with an unfolding story where the speaker was guessing about future actions while being ignorant as to the actual outcome of the story. Unlike Skordos et al. (2020), however, Tieu et al. (2017) did not observe any substantial change in the prevalence of children’s conjunctive responding, replicating essentially the findings from Singh et al.’s original study. These authors interpreted these results as supporting the missing alternative approach, namely that children lack the ability to generate the conjunctive *and*-alternative to disjunction. We will go back to the discrepancies observed in children’s conjunctive responding across studies and methods in the discussion (Section 7) and suggest that, despite some improvements over Singh et al.’s design, the procedure used in Tieu et al. may have reintroduced conflicting inferences through another door.

observed. In this section, we explain how these assumptions lead to different predictions regarding the availability of conjunctive strengthening in the adult population.

According to the missing alternative approach, conjunctive readings of disjunctive sentences arise when the set of alternatives to these sentences is not closed under conjunction. In languages with a conjunctive connective like English, this possibility can be realized only if the conjunctive *and*-alternative to disjunction *or* goes missing from the set of alternatives entering scalar reasoning. As we explained, the prevalence of these readings in English-speaking children is explained on this view by the fact that this population has not yet fully acquired the knowledge to generate lexical alternatives, e.g., the alternative '*p and q*' for '*p or q*'. Crucially, however, these readings are not expected to be available to English-speaking adults, insofar as it can be established by independent means that this population has acquired the relevant knowledge to generate lexical alternatives and actively use this knowledge for deriving other scalar implicatures involving lexical alternatives.

By contrast, on the conflict resolution approach, nothing needs to be said about missing alternatives and it remains an open question whether or not children are adult-like in terms of what alternatives they consider. According to this approach, conjunctive readings of sentences of the form '*p or q*' arise as a result of a strategy of reinterpretation whereby, for instance, '*p or q*' is reinterpreted as '*possibly, p or q*'. This strategy is assumed to be deployed in order to circumvent ignorance inferences in situations where these inferences would otherwise lead to infelicity. On this view, the prevalence of this strategy in English-speaking children (also observed with French and Japanese-speaking children) is explained by the fact that this strategy is semantic in essence and, at this stage of development, may be favored over other conflict-solving strategies relying further on general pragmatic abilities, e.g., inhibition/cancellation of ignorance inferences, adjustment of the context of the experiment. Crucially, this semantic strategy is expected to remain available to adults as well, independently of their ability to generate lexical alternatives.

In the following, we report on three experiments that tested these predictions for adults across different tasks and languages. Experiment 1 acted as a baseline experiment to control for adults' interpretation of simple disjunctive sentences in situations where ignorance inferences are unproblematic. This experiment was designed as an unfolding guessing game where participants were asked to judge whether a player's guess about a possible outcome was right or wrong. Experiments 2 and 3 were designed to test adults' interpretation of simple disjunctive sentences in situations where ignorance inferences are *prima facie* conflicting. For these experiments, we employed a covered-card paradigm where disjunctive sentences were accompanied by two pictures, one visible and one covered with the label 'Better picture?' on it. Participants were told that each sentence was meant to describe one and only one of the two pictures accompanying it, and they were asked to select which picture they thought it described. We conjectured that, by making the descriptive intention behind each sentence more explicit, this experimental set-up had the potential to induce conflicting ignorance inferences while, at the time time, making it more difficult for participants to resolve these inferences simply by adjusting their contextual assumptions about the task, that is to say, by employing a more pragmatic strategy.

According to the missing alternative approach, the task manipulation between Exp.1 and Exp.2-3 should not affect adults' behavior to disjunctive trials. Specifically, adult participants should not display conjunctive responding in any of these experiments insofar as they are found to successfully compute implicatures based on lexical alternatives in these same experiments. On the other hand, according to the conflict resolution view, participants should be looking for conflict resolution

strategies in Exp.2-3. Since a part of the participants may opt for the semantic strategy, evidence of conjunctive responding should be found in Exp.2-3 but, crucially, not in Exp.1.

4 Experiment 1: Baseline experiment

Experiment 1 was designed as a baseline experiment to control for adults' interpretation of simple disjunctive sentences in situations where ignorance inferences are contextually unproblematic. Participants were presented with unfolding scenarios like the two examples in Figure 1 and had to decide whether the guess made in the second scene was right or wrong, given the outcome represented in the final scene. Scenarios were unfolded before the participants, one scene at a time, with the test sentences being uttered in the second scene before the third and last scene was shown on the screen, thus removing any potential conflict with ignorance one may run into. In the True disjunction trials (Fig. 1, top item), the final scene made the guess right, unless disjunction was interpreted conjunctively. In the Target disjunction trials (Fig. 1, bottom item), the final scene made the guess wrong if disjunction was interpreted exclusively, but right if it was not.

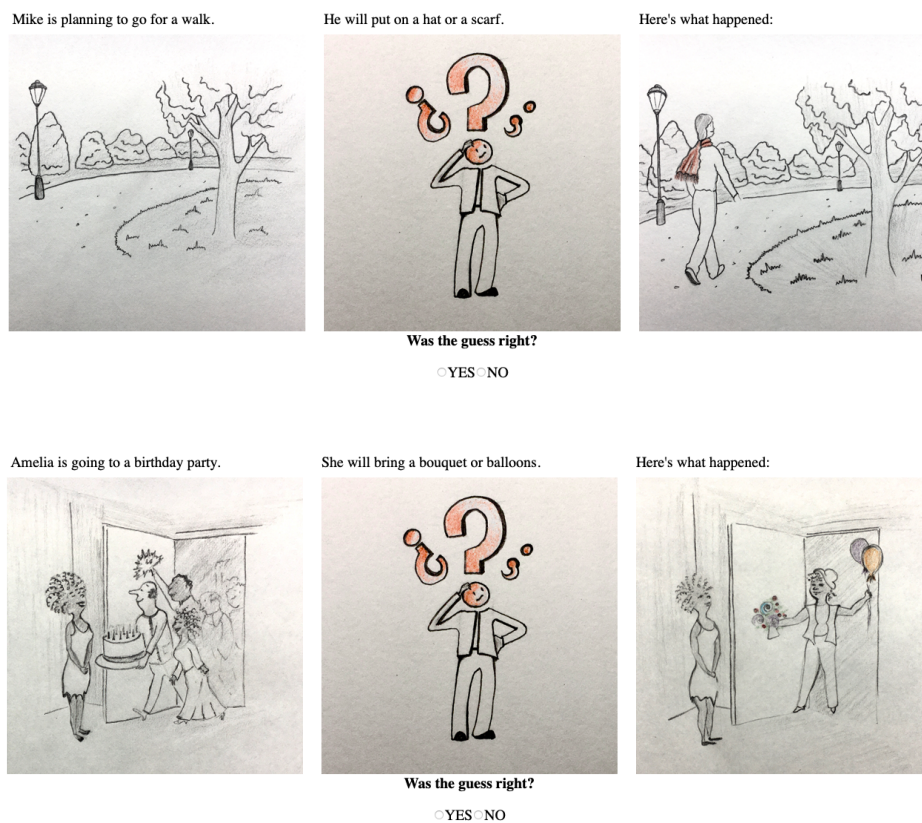


Figure 1: Examples of scenarios used in the True (at the top) and Target (at the bottom) disjunction trials in Experiment 1. Scenarios were unfolded before the participants, one scene at a time.

Adult participants in this experiment were not expected to perform conjunctive strengthening on either of the views of interest. On the missing alternative view, the reason is that adults should

access all the alternatives to disjunctive sentences: since the conjunctive alternative is not missing, no conjunctive strengthening should be observed. On the conflict resolution view, the reason is that ignorance inferences are non-conflicting in this set-up, and therefore no specific conflict-solving strategy needs to be deployed to handle them: since no such strategies are warranted, no conjunctive strengthening should be observed. Hence, all participants should accept the disjunctive guesses in the True conditions, i.e., in conditions where only one of the disjuncts is found to be true.

4.1 Participants

100 participants (average age 32.6 yrs) were recruited online using Prolific (first language: English). Of these, 5 reported technical issues during the experiment in our feedback form and were excluded prior to analyses. Participants were paid \$1.90 for their participation (\$9.5/hr) and average completion time was about 10 minutes. All participants gave written informed consent to the processing of their information for the purposes of this study. All data were collected and stored in accordance with the provisions of Data Protection Act 2018, the UK’s implementation of the General Data Protection Regulation.

4.2 Materials and design

Each trial consisted of a scenario unfolding over three scenes, where the test sentences appeared in the second scene before the third and last scene was shown to participants (see examples in Fig. 1). The structure of the scenarios was the same across all trials: the first scene set the stage of a story by displaying a picture together with a short sentence describing a future event; the second scene showed a character making a guess about what is going to happen next in that story in relation to the relevant event; finally, the third and last scene revealed the outcome of the story by means of a novel picture accompanied by the lead-up ‘Here’s what happened’. Test sentences were constructed using one of the three frames in (6). There were two variants for *Disjunction* sentences, one involving simple disjunctions of the form *A or B* and one involving complex disjunctions of the form *either A or B*.⁴ The [pronoun] term always agreed with the subject of the sentence displayed in the first scene. The [verb] term was an action verb and the [noun] terms were common nouns denoting inanimate, concrete objects. The list of test sentences is provided in full in Appendix A.2.

- | | | | |
|-----|----|--|-------------|
| (6) | a. | [Pronoun] will [verb] (either) [noun] or [other noun]. | Disjunction |
| | b. | [Pronoun] will [verb] some of the [noun]. | Quantifier |
| | c. | [Pronoun] will [verb] two [noun]. | Number |

Each sentence type was presented with one of three possible story outcomes obtained by manipulating the contents of the picture displayed in the final scene so as to create False, True and Target conditions. For the *Disjunction* sentences, the final picture depicted a situation that made true neither of the disjuncts (False), only one of them (True), or both of them (Target). For the *Quantifier* sentences, the final picture depicted a situation where none of the relevant objects (False), only some of them (True), or all of them (Target) were acted upon. Lastly, for the *Number* sentences, the

⁴ In the spirit of previous studies (a.o., Paris 1973, Tieu et al. 2017), we included simple and complex disjunctions in all our experiments. Overall, we found little-to-no variation in responses to either sub-type of *Disjunction* sentences across-the-board. For our purposes, we can thus set aside this distinction without any loss of relevant information.

final scene depicted a situation including only one of the relevant objects (False), exactly two of them (True), or more than two (Target). All three sentence types were tested in all three conditions, with four iterations of each condition, giving rise to a total of 36 test trials.

4.3 Procedure

The experiment was run as an online survey. At the beginning of the survey, participants were given general instructions (see Appendix A.1). They were told that they would witness a guessing game between two friends, Kate and Henry. The game was described as follows: Kate will first show and tell Henry the beginning of a story; next, Henry will make a guess about what will happen; finally, Kate will show Henry the story's outcome. Participants were told that their task would be to judge whether or not Henry's guess was right. Following these instructions, the participants were asked two demographic questions and then they continued to the experiment.

For each participant, it was pseudo-randomly determined which variant of the *Disjunction* sentences they would see so that participants only ever saw one of the two variants (i.e., with *or*, or with *either...or*). Participants started the experiment with two practice trials and then completed the 36 test trials, presented to them in a random order. In every trial, participants had to click on a 'Next' button to advance from one scene onto the next. Previous scenes remained on the screen throughout the unfolding scenario. After the last scene was displayed, the question 'Was the guess right?' appeared underneath. Participants provided their answer by clicking with the mouse on one of two response buttons labelled 'Yes' and 'No', respectively. Items remained on the screen until participants validated their response. At the end of the survey, participants were asked to fill out a short feedback form.

4.4 Summary of the predictions

For *Quantifier* and *Number* sentences, we expected to replicate previous results from the literature showing that such sentences tend to receive intermediate acceptance rates in conditions where their literal meaning is true while their enriched meaning is false, corresponding here to our Target conditions. For *Disjunction* sentences, we expected to find a similar pattern of ambiguity. Crucially, however, we were also interested in examining how people responded to these sentences in the True conditions. Recall from Table 1 that acceptance in the True condition (corresponding to 1DT in Table 1) corresponds to either an inclusive or an exclusive interpretation of disjunction, whereas rejection corresponds to a conjunctive interpretation. As we discussed in Sections 2 and 3, neither view predicts adult participants to do conjunctive strengthening here, meaning that few participants, if any, are expected to reject *Disjunction* sentences in their True conditions.

4.5 Data treatment and analyses

Responses from 5 participants were excluded from analyses because their performance to the *Quantifier* and *Number* sentences in their True and False control conditions did not reach the threshold of 75% accuracy we had pre-established. One of the False *Quantifier* trial (the item referred to as 'q3' in the list in Appendix A.2) was further removed from analyses: the accuracy score to this trial was very low across all participants, indicating that the pictures used to create this trial were not interpreted as we intended them to be. In total, 270 out of 3,420 responses were

removed from the analysed data through this procedure (7.8% of the data). Data were analyzed by modeling response-type likelihood using logit mixed effects regression models (Jaeger 2008). Analyses were conducted using the lme4 (Bates et al. 2011, 2014) and emmeans (Lenth et al. 2018) libraries for the R statistics program (R Core Team 2013). Here and in the following, the notations ‘M’ and ‘CI’ are used as abbreviations for ‘mean’ and ‘95% confidence intervals’, respectively.

4.6 Results

Global analysis Figure 2 shows the mean proportion of ‘No’ responses in the whole sample of subjects for each sentence type by experimental condition. Recall that a ‘No’ response in the Target conditions amounts to rejecting the guess as right in scenarios which made the sentences true on their literal reading, but false on their pragmatically enriched meaning. Thus, the higher the rate of ‘No’ responses in the Target conditions, the higher the rate of enriched interpretations.

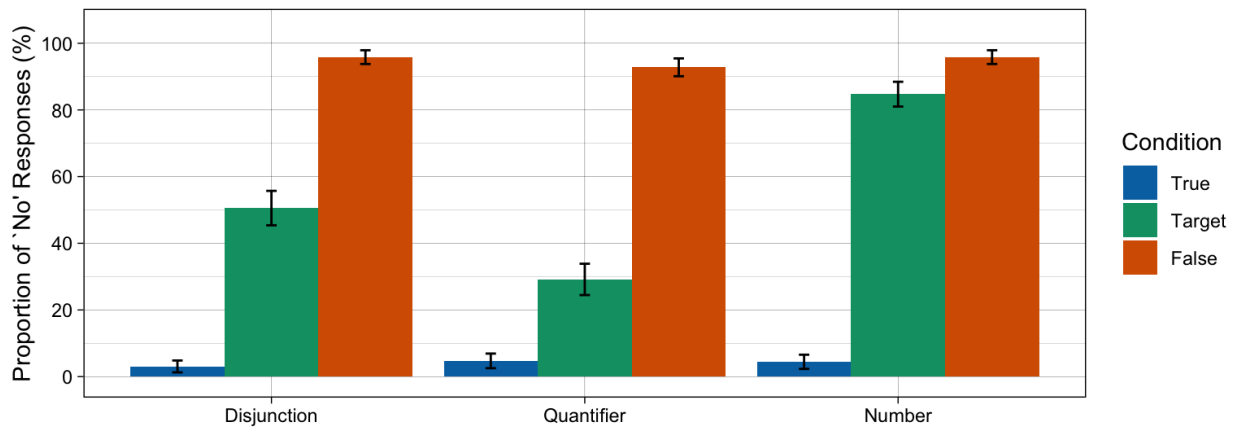


Figure 2: Proportion of ‘No’ responses in Experiment 1 for each sentence type by experimental condition. Error bars indicate 95% confidence intervals.

The patterns of responses were as expected: for each sentence type, the rate of ‘No’ responses was lowest in the True conditions (all $M_s < 5$), highest in the False conditions (all $M_s > 90$) and somewhat intermediate in the Target conditions. In our analyses, we assessed whether responses in the True, False and Target conditions differ as a function of the sentence type. For each condition, the model included Sentence type as a fixed effect (3 levels: Disjunction, Quantifier and Number), a random effect for Subject as well as a random effect for Item. Only the model examining responses to Target conditions yielded a significant effect of Sentence type (Target: $\chi^2(2) = 89.43$, $p < .0001$; False: $\chi^2(2) = 0.004$, $p = .99$; True: $\chi^2(2) = 0.93$, $p = .62$). The effect established in that model was investigated further in a post-hoc analysis by comparing with one another the estimated marginal means (EMMs) for the levels of the Sentence type factor (p-value adjusted for multiple comparisons). Results revealed that the estimated means for each sentence type were all significantly different from one another in the Target conditions: there were less pragmatic responses in the *Quantifier* than in the *Disjunction* trials ($p < .001$) and, in turn, less pragmatics responses in these trials than in the *Number* trials ($ps < .001$).

In sum, the patterns of responses reported here show that participants’ responses to *Disjunction*, *Quantifier* and *Number* sentences only differ in the Target conditions. The differences observed indicate that participants accessed the enriched interpretation of these sentences to a different extent depending on which scalar expression was involved.

Participants’ profile We examined responses to *Disjunction* trials in the True condition to determine whether any of the participants in our sample displayed a preference for interpreting disjunction conjunctively. For our purposes, we considered that a participant showed a standard profile if they answered ‘No’ no more than 25% of the time in these trials (i.e., at most one ‘No’ out of 4 trials); conversely, we considered that they showed a non-standard, conjunctive profile if they answered ‘No’ more than 25% of the time (i.e., at least two ‘No’ out of 4 trials). All the participants in our sample were found to consistently accept *Disjunction* sentences in their True conditions, as reported in Table 3. Thus, all participants, without exception, behaved in a standard fashion and robustly accepted disjunctive guesses as right in scenarios where only one of the disjuncts was shown to be true in the final scene.

Profile	Selection criteria	<i>n</i> of subjects	% of sample	Mean (%)	95%CI
Standard	‘No’ response $\leq 25\%$	90	100	3	[5, 1]
Non-Standard	‘No’ response $> 25\%$	0	0	n/a	n/a

Figure 3: Analysis of participants’ profile in Experiment 1 based on their responses to the True *Disjunction* trials. None of the participants was found to display conjunctive responding.

4.7 Discussion

Our results replicate to a large extent the findings from previous studies with adult speakers showing that, in experimental set-ups using classical verification tasks or unfolding scenarios similar to ours, adults readily accept simple disjunctive sentences when presented with situations where only one of the disjuncts is true. As we explained, these results are consistent with either view. For the missing alternative view, they can be taken as evidence that adults master the co-scalar status of *and* and know how to generate lexical alternatives and, furthermore, that they have no particular issue retrieving the relevant scale-mate in such experiments. For the conflict resolution view, these results are consistent with the idea that, unless conflicting inferences arise from disjunctive sentences, speakers have no reason to turn to a conflict-solving strategy, which is the alleged source of the conjunctive readings of these sentences. In the following, we turn to two experiments testing adults’ interpretation of disjunction in a different experimental set-up where the presence of ignorance inferences is now expected to lead to conflicting situations.

5 Experiment 2: Conflicting ignorance with English-speaking adults

Experiments 2 and 3 were designed to investigate how English-speaking and French-speaking adults interpret simple disjunctive sentences in situations where, in contrast to Experiment 1, the

ignorance inferences associated with these sentences are conflicting. Both experiments involved a picture selection task using the covered-card paradigm, adapted from Huang et al.'s (2013) covered-box paradigm (see Bott & Chemla 2016, Rees & Bott 2018, Waldon & Degen 2020, Marty et al. 2020a for the use of similar tasks in priming studies). Participants were presented with items like the two examples in Figure 4 and had to decide which of the two cards the sentence was intended to describe: the uncovered card or the covered one? Participants were asked to select the uncovered card if they considered it a match for the sentence, otherwise to select the covered one, which had the label 'Better picture?' on it. In the True disjunction trials (Fig. 5, left item), participants should select the uncovered card, unless they interpret the disjunction conjunctively. In the Target disjunction trials (Fig. 5, right item), they should select the covered card if they interpret the disjunction exclusively; otherwise, they should select the uncovered card.

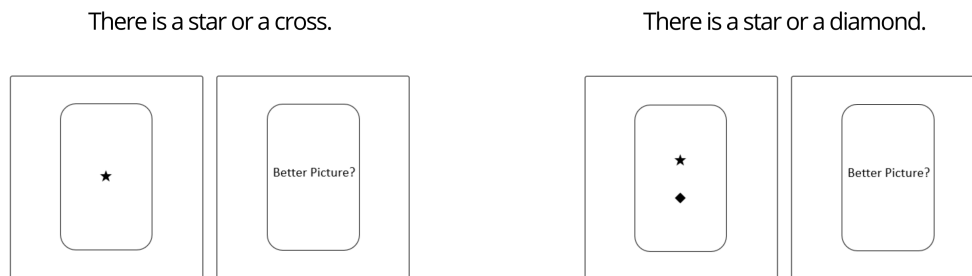


Figure 4: Example of items used in the True (on the left) and Target (on the right) disjunction trials in Experiment 2. The presence of ignorance inferences in these trials makes both response options equally inappropriate. Participants must first resolve these inferences in order to make a non-arbitrary choice between the two cards.

We conjectured that the present task offers a suitable experimental set-up for testing the diverging predictions made by the missing alternative and the conflict resolution views. The reason is that, in this set-up, the presence of ignorance inferences is expected to make both response options equally inappropriate in the True and Target disjunction trials (see examples in Fig. 4); as a result, any participant readily accessing these inferences needs to resolve them in some way in order to make a non-arbitrary choice in these trials. We hypothesized that, if speakers can use conjunctive strengthening as a rescue strategy to resolve such conflicts, some of the participants in these experiments should display conjunctive responding, in contrast to what we found in Experiment 1. Before going on, it is worth emphasizing that the present set-up allows participants to rely on the strategy of their choosing to resolve the conflict at stake. In particular, participants can also block or cancel the relevant ignorance inferences by disregarding the task's assumption that each sentence is produced with the communicative intention of describing one and only one of the two cards. While a majority of adult speakers may ultimately favor this resolution strategy, some of them may be more reluctant to withhold this assumption in the present task, compared to classical verification tasks. Crucially, if these speakers default to conjunctive strengthening as an alternative rescue strategy, a conjunctive profile should emerge and be detectable in our data.

5.1 Participants

105 participants (76 female; average age 34.7 yrs) were recruited online using Prolific (nationality: UK; country of birth: UK; first language: English; minimum prior approval rate: 90%). Of these, 1 was excluded prior to analyses because they did not declare English as their native language in our demographic questionnaire. Participants were paid £0.56 for their participation (£10/hr) and average completion time was about 4 minutes. The consent and data collection procedures were the same as in Experiment 1.

5.2 Materials and design

Items were built upon the materials used in [Bott & Chemla 2016](#), [Rees & Bott 2018](#), [Waldon & Degen 2020](#) and [Marty et al. 2020a](#). Each trial involved a sentence presented above two pictures. Sentences were constructed using one of the three frames in (7). As in Exp.1, there were two variants for *Disjunction* sentences, one involving simple disjunctions and one involving complex disjunctions (see footnote 4). The [symbol] term was a common noun denoting a symbol type from the following list: arrow, cross, circle, diamond, heart, square, star or triangle.

- | | | | |
|-----|----|---|-------------|
| (7) | a. | There is (either) a [symbol] or a [other symbol]. | Disjunction |
| | b. | Some of the symbols are [symbol]. | Quantifier |
| | c. | There are four [symbol]. | Number |

Pictures consisted of a rectangle containing either symbols, henceforth symbol cards, or the text 'Better Picture?', henceforth the covered card. Symbol cards could be either false, true or target. Every trial involved the covered card and one symbol card: a false card in the False conditions, a true card in the True conditions, and a target card in the Target conditions. Example trials for each sentence type and condition are given in Figure 5. All three sentence types (Disjunction, Quantifier and Number) were tested in all three conditions (True, False and Target), with four iterations of each condition, giving rise to a total of 36 experimental trials.

For *Disjunction* trials, target cards contained two symbols, each of which matched one of the [symbol] terms in the accompanying sentence. True and false cards contained only one symbol: on true cards, this symbol matched one of the [symbol] terms whereas, on false card, it didn't. For *Quantifier* trials, target cards involved nine symbols of the type that matched the [symbol] term. True and false cards contained nine symbols, three symbols of one type and six symbols of another type: on true cards, the minority symbol type matched the [symbol] term whereas, on false cards, none of the symbols did. Finally, for *Number* trials, target cards contained six symbols that matched the [symbol] term. True and false cards contained four symbols: on true cards, these symbols matched the [symbol] term whereas, on false cards, they didn't.

For each trial, the symbol type(s) used in the sentence was picked at random from our list of symbol types, with replacement across trials. The contents of the symbol card accompanying each sentence were pseudo-randomly determined according to the relevant sentence and the relevant condition: the matching symbol type(s) always corresponded to the symbol type(s) used in the sentence; the non-matching symbol types were randomly chosen from our list by excluding the matching symbol type(s). For each trial, the position of the symbol and covered cards on the screen (i.e., left or right) was chosen randomly.









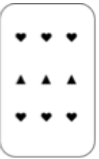









	True	False	Target
DISJUNCTION There is a cross or a triangle.	 	 	 
QUANTIFIER Some of the symbols are crosses.	 	 	 
NUMBER There are four crosses.	 	 	 

Figure 5: Example trials for each sentence type and condition in Experiment 2. In the True *Disjunction* trials, participants should select the symbol card, unless they interpret the disjunction conjunctively. In the Target *Disjunction* trials, they should select the symbol card if they interpret the disjunction exclusively, but the covered card if they interpret it inclusively or conjunctively.

5.3 Procedure

The experiment was run as an online survey. At the beginning of the survey, participants were given general instructions (see Appendix B.1). Participants were told that they would be presented with sentences, and that each of them would be accompanied by two pictures, one visible to them and another one covered with the text ‘Better Picture?’ on it. They were further told that each sentence is intended to describe one and only one of the two pictures accompanying it. They were instructed to click on the visible picture if they considered it a match for the sentence, otherwise to click on the covered picture. Following these instructions, participants continued to the experiment. For each participant, it was pseudo-randomly determined which variant of the *Disjunction* sentences they would see so that participants only ever saw one of the two variants (i.e., with *or*, or with *either...or*). Experimental trials were presented in a random order. On each trial, a fixation cross appeared and remained on the screen for 500 ms before the items were displayed. For each item, participants provided their response by clicking with the mouse on the picture of their choosing. Items remained on the screen until participants gave their response. At the end of the survey, participants were asked to fill out a short demographic questionnaire.

5.4 Summary of the predictions

This experiment was designed so that the ignorance inferences associated with *Disjunction* sentences lead to pragmatic infelicities in the True and Target trials: in these trials, participants need to resolve

these inferences in some way in order to make a non-arbitrary choice between the two response options. If the conflict-resolution approach is correct, adult speakers may opt in these trials for a semantic resolution strategy and perform conjunctive strengthening. On this view, some participants should display a strong preference for the covered card in the True *Disjunction* trials and for the uncovered card in the Target *Disjunction* trials. On the other hand, if conjunctive strengthening only arises because of a failure to generate the lexical *and*-alternative to *or*, adult speakers should rely on other strategies to resolve the conflict at stake in these trials, i.e., by blocking or cancelling the conflicting inferences. On this view, participants' responses to *Disjunction* trials should be similar to those observed in classical verification tasks and in Exp.1. In particular, all participants are expected to show a robust preference for the uncovered card in the True *Disjunction* trials.

5.5 Data treatment and analyses

Responses from 2 participants were excluded from analyses because their performance to the *Quantifier* and *Number* sentences in their True and False control conditions did not reach the threshold of 75% accuracy we had pre-established. In total, 72 out of 3,780 responses were removed from the analysed data through this procedure (about 2% of the data). Data from the remaining 103 participants were included in the analyses. The data were analysed using the data analysis pipelines from Exp.1 (see Section 4.5).

5.6 Results

Global analysis Figure 6 shows the mean proportion of covered card selection in the whole sample of subjects for each sentence type by experimental condition. At a general level, the patterns of responses were quite similar to those observed in Exp.1: for each sentence type, the rate of covered card selection was lowest in the True conditions, highest in the False conditions and somewhat intermediate in the Target conditions. As in Exp.1, we assessed whether responses in the True, False and Target conditions differ as a function of the sentence type. For each condition, the model included Sentence type as a fixed effect (3 levels: *Disjunction*, *Quantifier* and *Number*) and Subject as a random effect.

Each model yielded a significant effect of Sentence type (False: $\chi^2(2) = 30.9$, $p < .0001$; True: $\chi^2(2) = 90.82$, $p < .0001$; Target: $\chi^2(2) = 187.38$, $p < .0001$). Established effects were investigated further in a post-hoc analysis by comparing with one another the estimated marginal means for the levels of the Sentence type factor in the models (p-value adjusted for multiple comparisons). Results revealed that the estimated means for *Quantifier* and *Number* trials were about the same in the True and False conditions (all $ps > 0.2$), but significantly different from the estimated means for *Disjunction* in both these conditions (all $ps < .0001$). Results also revealed significant differences between each sentence type in the Target conditions: there were less pragmatic responses in the *Disjunction* than in the *Quantifier* and *Number* trials ($ps < .001$) and, in turn, less pragmatic responses in the *Quantifier* than in the *Number* trials ($p < .001$).

In sum, despite superficial similarities, the general patterns of responses reported here displayed subtle differences compared to those reported in Exp.1. For what is most relevant to us, the proportion of non-standard responses observed for *Disjunction* trials in the True conditions (i.e., proportion of covered card choice) was substantially higher than those observed for *Quantifier*

and *Number* trials in these same conditions as well as substantially higher than those previously observed in Exp.1 in comparable conditions.

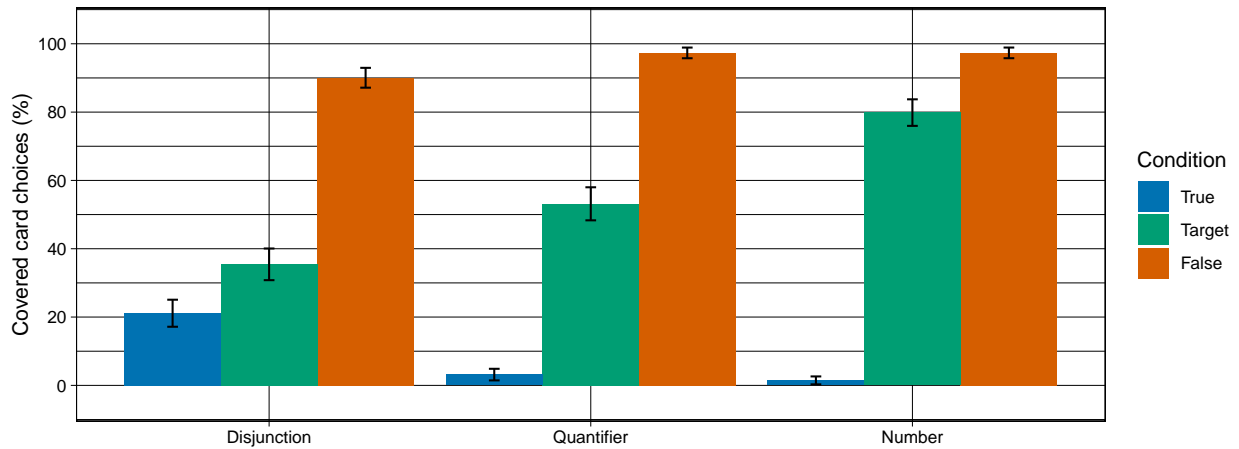


Figure 6: Proportion of covered card selection in Experiment 2 for each sentence type by experimental condition. Error bars indicate 95% confidence intervals.

Participants’ profile As in Exp.1, we examined responses to *Disjunction* trials in their True conditions to determine the profile of each participant in our sample. Adapting the criterion used in Exp.1 to the present design, we considered that a participant showed a standard profile if they selected the covered card no more than 25% of time in these trials (i.e., at most once out of 4 trials); conversely, we considered that they showed a non-standard profile if they selected the covered card more than 25% of time (i.e., at least twice out of 4 trials). In total, 81 subjects showed a standard profile and 21 showed a non-standard profile, as reported in Table 2.⁵ Thus, in contrast to what we found in Exp.1, about 20% of the participants robustly rejected disjunctive sentences as a good match for a situation making only one of the disjuncts true. Although relatively small, the sample of participants exhibiting a non-standard profile was large enough for us to carry out a group analysis and compare the responses from the standard and non-standard group in the Target conditions.

Group analysis Figure 7 shows the mean proportion of covered card selection for each sentence type by participants’ group (i.e., Standard, Non-standard) and experimental condition.

Participants’ responses to the Target trials were analyzed by fitting a mixed-effect model testing the fixed effect of Sentence type, Group and of their interaction, with Subject as a random effect and a by-subject random slope for Sentence type. There was a main effect of Sentence type ($\chi^2(2) = 16.61$, $p < .001$) as well as a significant interaction between Sentence type and Group ($\chi^2(2) = 18.92$,

⁵ For completeness, we note that the majority of the subjects showing a non-standard profile in Exp.2 were subjects presented with complex, rather than simple disjunctions (16 out of 21 subjects). Given the small size of the non-standard sample, however, it is impossible to say whether or not this asymmetry should be given any theoretical importance. For the time being, we shall simply observe that this asymmetry was only found in Exp.2 (see footnote 7).

Profile	Selection criteria	<i>n</i> of subjects	% of sample	Mean (%)	95% CI
Standard	Covered card $\leq 25\%$	82	79.5	3	[5,1]
Non-Standard	Covered card $> 25\%$	21	20.5	91	[97,85]

Table 2: Analysis of participants’ profile in Experiment 2 based on their responses to the True *Disjunction* trials. In contrast to Exp.1, about 20% of the adult participants in this experiment was found to display conjunctive responding.

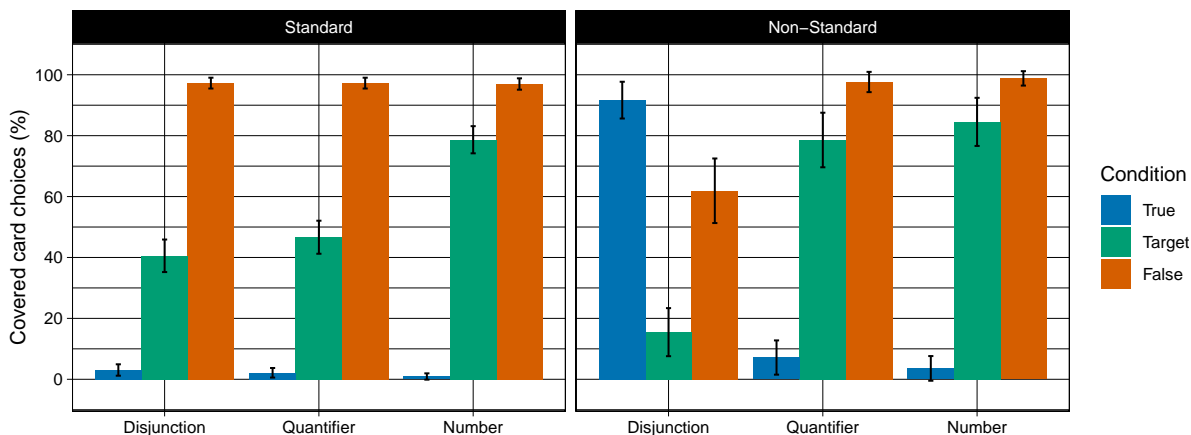


Figure 7: Proportion of covered card selection in Experiment 2 for each sentence type by participants’ group and experimental condition. Error bars indicate 95% confidence intervals.

$p < .0001$).⁶ To better identify the source and direction of the established interaction, we next compared responses to each sentence type between the two groups. For each sentence type, the model included Group as a fixed effect (2 levels: Standard, Non-standard) and Subject as a random effect. Results showed that, for *Disjunction* sentences, subjects in the Non-standard group gave less exclusive responses than those in the Standard group: $M = 15$, $CI[23,7]$ vs. $M = 40$, $CI[45,35]$, $\chi^2(1) = 9.21$ $p < .005$. For *Quantifier* sentences, on the other hand, subjects in the Non-standard group gave more pragmatic responses than those in the Standard group: $M = 78$, $CI[87,69]$ vs. $M = 42$, $CI[52,41]$, $\chi^2(1) = 9.46$ $p < .005$. Finally, for *Number* sentences, no difference was found between the two groups: $M = 79$, $CI[83,74]$ vs. $M = 84$, $CI[92,76]$, $\chi^2(1) = 0.03$ $p = .84$. In sum, subjects in the Non-standard group derived fewer ‘not-and’ SIs for *Disjunction* sentences, but more ‘not-all’ SIs for *Quantifier* sentences than subjects in the Standard group.

Before closing, we note that the present results show a further difference between the two groups. For *Disjunction* sentences, the rate of covered card selection in the False conditions was surprisingly low in the Non-standard group ($M = 62$, $CI[72, 51]$) compared to the Standard group ($M = 97$, $CI[99, 95]$). Specifically, we found that 7 out of 21 subjects in the Non-standard group systematically selected the uncovered, false card in these conditions. This result is unexpected on either of the

⁶ The effect of Group did not reach significance: $\chi^2(1) = 2.65$, $p = .1$.

approaches we discussed, and we shall therefore reflect on its consequences regarding the validity of our results. We come back to this point in the discussion.

5.7 Discussion

Our findings are threefold. First, we found that a subset of participants (about 20% of our sample) systematically chose the covered card over the uncovered card in the True *Disjunction* trials, evidencing their reluctance for matching disjunctive sentences with situations making only one of the disjuncts true. Capitalizing on this finding, we next carried out a group analysis to compare the responses from these participants (the Non-standard group) to the rest of the sample (the Standard group) in the Target conditions. We found that subjects in the Non-standard group derived very few exclusivity SIs for *Disjunction* sentences (about 15%) and significantly less so than subjects in the Standard group (about 40%). This pattern of responses is reminiscent of the one observed for children in acquisition studies and it is fully explained if we assume that subjects in the Non-standard group arrived at a conjunctive interpretation of disjunctive sentences. This explanation accounts for why these subjects robustly rejected the uncovered card in the True conditions where only one disjunct was true, but accepted it in the Target conditions where both disjuncts were true. Finally, we found that subjects in the Non-standard group derived more implicatures than the Standard group for *Quantifier* sentences and behaved similarly for *Number* sentences. This finding establishes that subjects in this group had no issue deriving SIs in general and, in particular, in deriving the regular SI associated with *some*-sentences, which is also based on a lexical alternative. Taken together, these results indicate that, in certain experimental set-ups, some adults behave like children in interpreting disjunction conjunctively and, crucially, that this behavior is independent of their general ability to derive alternatives and compute implicatures. These results speak against the missing alternative approach and support instead the conflict resolution approach on which conjunctive strengthening arises as a result of an interpretive strategy to circumvent ignorance inferences in situations where they are conflicting. As we noted above, however, our data also show an unexpected result: a third of the subjects in the Non-standard group strongly preferred the uncovered card in the False *Disjunction* trials; consequently, the overall rate of covered card selection to these trials is lower than expected in this group (62% contra 97% in the Standard group). *Prima facie*, this discrepancy could be a coincidental effect resulting from the unbalanced distribution of the two groups in our sample: the Non-standard group was four times smaller and thus less representative than the Standard group (21 contra 82 subjects), potentially leaving a sampling error spread across comparisons. Nonetheless, this discrepancy could also indicate that certain subjects in the Non-standard group actually accessed some other interpretation for disjunction that we haven't figured out yet. To address this question, we carried out a follow-up experiment with French-speaking adults using the same task, design and materials as in Exp.2.

6 Experiment 3: Conflicting ignorance with French-speaking adults

This follow-up experiment aimed at testing the generality of the findings from Exp.2 by testing speakers from a language other than English. For these purposes, the materials used in Exp.2 were translated into French so as to test the same hypotheses as before with French-speaking adults. There were two questions of primary interest that we aimed to address. First, is the prevalence of conjunctive responding in French-speaking adults similar to the one that we found among

English-speaking adults? Second, does the unexpected result we found in the False *Disjunction* trials reproduce with French speakers?

6.1 Participants

122 participants (72 female; average age 28.8 yrs) were recruited online using Prolific (nationality: FR; country of birth: FR; first language: French; minimum prior approval rate: 90%). All of them declared French as their native language in our demographic questionnaire. Participants were paid £0.56 for their participation (£10/hr) and average completion time was about 4 minutes. The consent and data collection procedures were the same as in Exp. 1 and 2.

6.2 Materials and design

The items were the same as in Exp.2, except that the sentences were in French. In parallel to (7), French sentences were constructed using one of the three frames in (8). As in Exp.1 and 2, there were two variants for *Disjunction* sentences, one involving simple disjunctions of the form *A ou B* and one involving complex disjunctions of the form *ou bien A ou bien B* (see footnote 4). The [symbol] terms were translated from their English counterparts as follows: *flèche* (arrow), *croix* (cross), *cercle* (circle), *carreau* (diamond), *coeur* (heart), *carré* (square), *étoile* (star) and *triangle* (triangle).

- | | | | |
|-----|----|---|-------------|
| (8) | a. | Il y a (ou bien) un [symbol] ou (bien) un [other symbol]. | Disjunction |
| | b. | Certains des symboles sont des [symbol]. | Quantifier |
| | c. | Il y a quatre [symbol]. | Number |

Symbol card types (false, true, target) were the same as in Exp.2 and were used in a similar way as in Exp.2 to create the True, False and Target conditions associated with each sentence type. The text on the covered card was translated into French as *Meilleure Image?* (literally, ‘Better Picture?’). As in Exp.2, all three sentence types were tested in all three conditions, with four iterations of each condition, giving rise to a total of 36 experimental trials. The randomization procedures used to select the symbol type(s) used in the sentence, the contents of the symbol card and the positions of the two cards on the screen were the same as in Exp.2.

6.3 Procedure

The procedure was identical to the one used in Exp.2 (see Section 5.3 for details). The instructions were the same as in Exp.2 (see Appendix B.2 for the French version).

6.4 Summary of the predictions

The main predictions were the same as those tested in Exp.2 (see Section 5.4). In addition, we were interested in checking whether the differences between the Standard and the Non-standard group that we found with English speakers reproduce with French speakers. We hypothesized that, if the discrepancy we found in the False *Disjunction* trials is coincidental, it should not generalize to a larger population, unlike the effects associated with the True and Target *Disjunction* trials.

6.5 Data treatment and analyses

All participants' performance to the *Quantifier* and *Number* sentences in their True and False conditions reached the threshold of 75% accuracy that we had pre-established. Thus, data from all the participants were included in our analyses. The data were analysed using the data analysis pipelines from Exp.1 and Exp.2.

6.6 Results

Global analysis Figure 8 shows the mean proportion of covered card selection in the whole sample of subjects for each sentence type by experimental condition. As in Exp.2, there was a significant effect of Sentence type in the True and Target conditions: $\chi^2(2) = 78.64, p < .0001$ and $\chi^2(2) = 120.31, p < .0001$, respectively. In contrast to Exp.2, however, no such an effect was found in the False conditions ($\chi^2(2) = 0.14, p = .92$). Post-hoc analyses confirmed these observations: in the False conditions, all three sentence types patterned alike (all $M_s > 95\%$, all $p_s > .9$); in the True conditions, *Quantifier* and *Number* sentences patterned alike, but distinctly from *Disjunction* sentences (all $p_s < .0001$). Finally, the three sentence types gave rise to different rates of pragmatic responses in the Target conditions, with an ordering similar to the one reported in Exp.2 (i.e., *Disjunction* < *Quantifier* < *Number*; all $p_s < .001$). In sum, the patterns of responses were essentially the same as in Exp.2 with one noticeable exception: *Disjunction* trials gave rise to a similar rate of covered card selection as *Quantifier* and *Number* trials in the False conditions.

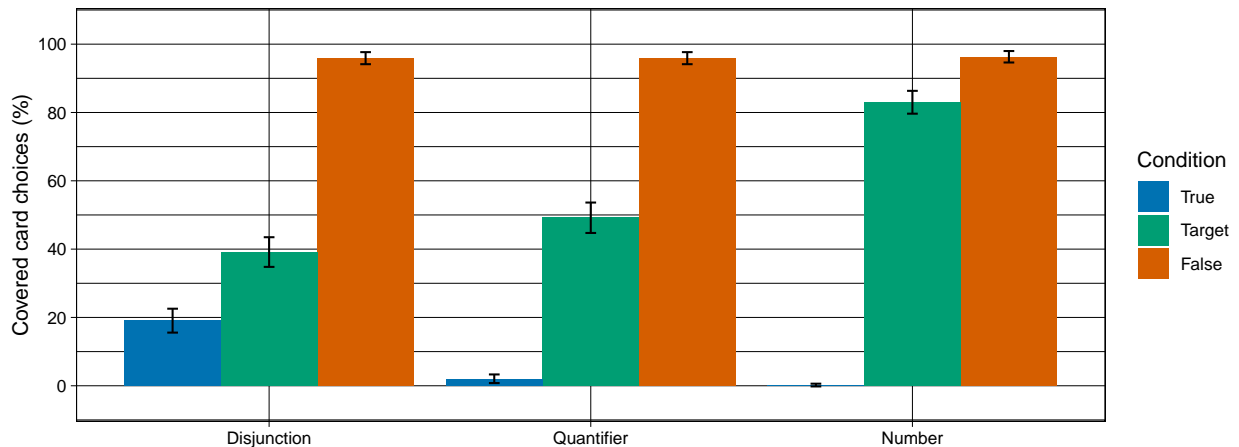


Figure 8: Proportion of covered card selection in Experiment 3 for each sentence type by experimental condition. Error bars indicate 95% confidence intervals.

Participants' profile The examination of participants' responses to *Disjunction* sentences in the True condition established that 100 subjects showed a standard profile and 22 showed a

non-standard profile, as reported in Table 3. In terms of ratio, the distribution of the two profiles among French speakers was thus similar to that we found among English speakers in Exp.2.⁷

Profile	Selection criteria	<i>n</i> of subjects	% of sample	Mean (%)	95% CI
Standard	Covered card $\leq 25\%$	100	82%	6	[8,3]
Non-Standard	Covered card $> 25\%$	22	18%	78	[87,69]

Table 3: Analysis of participants' profile in Experiment 3 based on their responses to the True Disjunction trials. As in Exp.2, some participants were found to display conjunctive responding.

Group analysis Figure 7 shows the mean proportion of covered card selection for each sentence type by participants' group and experimental condition.

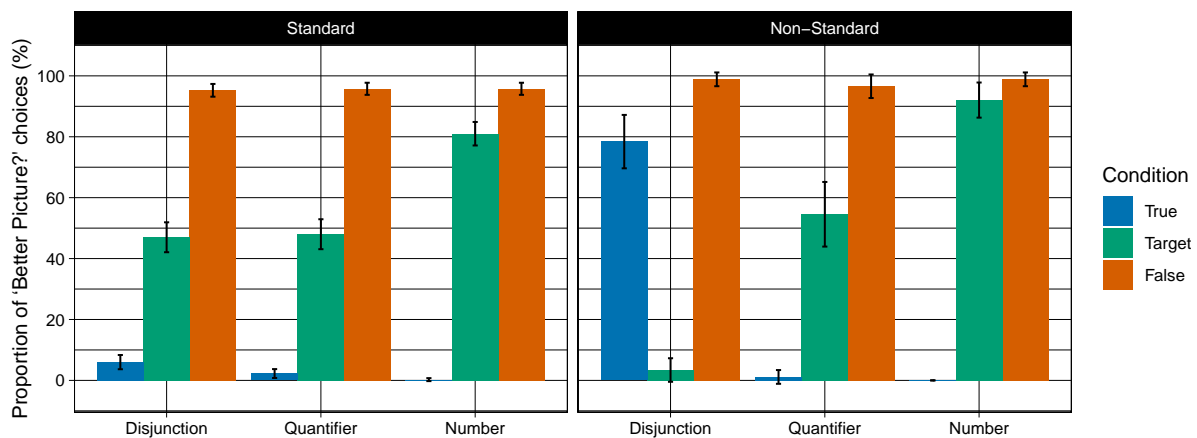


Figure 9: Proportion of covered card selection in Experiment 3 for each sentence type by participants' group and experimental condition. Error bars indicate 95% confidence intervals.

The model fitting participants' responses to the Target trials yielded a main effect of Sentence type ($\chi^2(2) = 51.85, p < .001$) as well as a significant interaction between Sentence type and Group ($\chi^2(2) = 22.73, p < .0001$).⁸ The simpler models comparing the effect of Group on each Sentence type yielded a significant result for Disjunction and for Disjunction only. These results show that the Non-standard group behaved similarly to the Standard group in the Quantifier trials ($M = 54, CI[65,44]$ vs. $M = 48, CI[53,43], \chi^2(1) = 0.36, p = .54$) and Number trials ($M = 92, CI[98,86]$ vs. $M = 81, CI[85,77], \chi^2(1) = 0.29, p = .58$), but provided significantly less pragmatic responses in the Disjunction trials than the Standard group: $M = 3, CI[7,0]$ vs. $M = 47, CI[52,42], \chi^2(1) = 22.2$,

⁷ In contrast to Exp.2, we found no asymmetry between the two disjunction types. Out of the 22 subjects showing a non-standard profile, 9 were presented with simple disjunctions and 13 with complex disjunctions. As far as we can see, such variations are very much expected given the size of the samples under consideration.

⁸ As in Exp.2, the effect of Group was not significant: $\chi^2(1) = 0.7, p = .4$.

$p < 0001$. Hence, participants in the Non-standard group almost never derived the exclusivity SI associated with *Disjunction* sentences, but otherwise performed just like the rest of our sample for *Quantifier* and *Number* sentences. Finally, we note that the unexpected result reported in Exp.2 is absent from the present results: in the False conditions, the rates of covered card selection were at ceiling for all sentence types in both groups (all $M_s > 92\%$).

6.7 Discussion

These results replicate the main findings from Exp.2 and extend them to another language in showing that a subset of the French adult participants (about 18% of our sample) behaved as if they interpreted *Disjunction* sentences conjunctively: these participants systematically chose the covered card in the True *Disjunction* trials and the uncovered card in the Target *Disjunction* trials. As in Exp.2, conjunctive responding was found to be uncorrelated to performance to other scalar sentences: subjects in the Non-standard group derived little-to-no exclusivity SIs for *Disjunction* sentences, but otherwise behaved like the rest of our sample in the *Quantifier* and *Number* trials. In addition, the present results suggest that the unexpected result reported in Exp.2 is likely attributable to a sampling error stemming from the unbalanced distribution of the two interpretation profiles in our samples. Concretely, 1 out of 5 participants, on average, showed a non-standard, conjunctive profile. Hence, the samples for the Non-standard group are necessarily less representative than those for the Standard group and this discrepancy may have affected in turn their effectiveness in the group analysis in decreasing the generalizability of some of the findings. For now, the comparison between Exp.2 and Exp.3 suggest that the oddity we found for the False *Disjunction* trials in Exp.2 is coincidental, rather than structural, and does not generalize to a larger population, unlike the effects associated with the True and Target *Disjunction* trials, which we replicated in full.

7 General Discussion

Our data show that, under certain circumstances, a small, but clearly identifiable subset of the adult population behaves like children in interpreting disjunction conjunctively. This behavior was found to be task-specific: it was observed in Experiment 2 & 3, but not in Experiment 1. In addition, this behavior was found to be independent from the general ability to compute scalar implicatures: adults performing conjunctive strengthening performed like the rest of the population on other scalar elements, e.g., the scalar implicature accompanying *some* and the exact interpretation of numerals. These findings are inconsistent with the idea that conjunctive strengthening arises due to a limited access to the lexical, conjunctive alternative to disjunctive sentences for a number of reasons. For one, if it were an issue of alternative access, we would be hard-pressed to explain why it should be difficult to access the ‘ p and q ’ alternative to ‘ p or q ’ but not the ‘ all p ’ alternative to ‘ $some$ p ’, given that none of the participants in our experiments interpreted the existential quantifier as a universal one. Furthermore, if it were a matter of alternative accessibility, we would not expect these non-standard interpretations of disjunction to surface only in Experiments 2 and 3 since neither experiment made the conjunctive alternative any more or less salient. On the other hand, these findings are consistent with the idea that the issue at hand is connected with the pragmatics of disjunction and that conjunctive strengthening arises if the task creates the condition

for the conflict with ignorance to arise. Thus, the present findings support the conflict resolution approach while they raise a challenge for the missing alternative view.⁹

As we explained in Section 2, there are at least two conflict solving strategies which speakers can in principle appeal to for circumventing the presence of infelicitous ignorance inferences, a pragmatic one and a more semantic one. We argued that, even though both strategies may be available to speakers, the extent to which they are available depends on the speaker's developmental stage and on the experimental set-up. In a nutshell, adults generally favor the pragmatic strategy whenever suitable, as it leaves the structure of the utterance untouched. Children, as we suggested, may favor instead the semantic strategy; it could be so for instance because the pragmatic strategy is too demanding for them at their stage of development. We interpret our experimental results as showing that, when the conditions needed to apply the pragmatic strategy are harder to satisfy, as in Experiments 2 and 3, adults can also default to the semantic strategy, hence why their behavior becomes more child-like. In that respect, it bears pointing out that our results are by no means a refutation of the idea that children may encounter difficulties for generating/accessing alternatives and perhaps even more so for lexical rather than sub-constituent alternatives. Our results do, however, cast doubt on the idea that these difficulties are the only source of conjunctive strengthening of disjunctive sentences. Specifically, our results show that some adults also perform conjunctive strengthening, particularly when the experimental set-up creates a conflict with ignorance and makes the pragmatic strategy to resolve this conflict less available.

Interestingly, our approach may furthermore help reconcile apparently conflicting findings from previous acquisition studies. In particular, it invites us to reconsider how subtle differences in the experimental designs of these studies may have impacted children's evaluation of ignorance, leading to drastically different results. Consider for example the study by Tieu et al. 2017, who themselves suggested that the conflict with ignorance inferences in Singh et al.'s (2016) study may have resulted in the high number of conjunctive children. Specifically, Tieu et al. pointed to (i) the use of static pictures rather than full stories, and (ii) the presentation in description mode rather than in prediction mode. The suggestion here was that children may not know what to do with a task where a puppet utters a disjunctive sentence after having seen the picture it is meant to describe, given the stark incompatibility with ignorance normally accompanying disjunction. In other words, and along the same lines as the conflict resolution approach, children may not know how to handle the conflict with the ignorance inferences created by having the target sentences presented in description mode. In an attempt to circumvent this problem, Tieu et al. suggested to use unfolding stories which involved a puppet making a guess about the future action of a particular character (e.g., *The chicken pushed the plane or the boat.*): since the puppet was ignorant about the outcome, as the authors argued, the incompatibility with ignorance should be removed, the use of disjunction should be rendered felicitous, and children's responses should truly reflect their interpretation of disjunctive sentences. While the switch to prediction mode did lead to a slight decrease in the prevalence of conjunctive responding, it by no means eliminated it: 19 of the 46 children in their sample (which included Japanese and French speakers) still showed a conjunctive

⁹ We note here that one limitation of our data is that they do not allow us to locate precisely enough the source of the unexpected effect we found with English-speaking adult in Exp.2, i.e., the discrepancy between the Standard and Non-standard group in the False *Disjunction* trials. Based on the results from Exp.3, we suggested that this was likely a sampling error, as small sample sizes generate a wide range of effect size estimates; nonetheless, we cannot formally exclude that the differences observed between Exp.2 and Exp.3 could instead point to theoretically-relevant differences in the interpretation of disjunctive expressions between English and French.

profile (compare to Singh et al.'s (2016) 16 out of 31 English children, using the description mode). Tieu et al. took these results to indicate that the conflict with ignorance could not be at the heart of the conjunctive interpretation.

So how can we reconcile the results from Tieu et al. with our conclusion that the conflict with ignorance is actually a major factor in explaining conjunctive responding? We begin by noting that, upon closer examination, certain task features in Tieu et al. (2017)'s studies may have inadvertently reintroduced ignorance inferences through another door. In their studies, the story outcome was explicitly described by the experimenter (e.g., 'Look, p'), after the puppet's utterance and prior to the child's response. This procedure, one might argue, makes it rather unclear for children which state of knowledge (or stage of the story) is ultimately to be taken into account when evaluating the puppet's utterance 'p or q' against the story outcome: is it the initial stage as seen by the puppet or the final stage as described by the experimenter? In the first case, the puppet's utterance can be taken as a *mere guess*, which can be either right or wrong; in the other case, however, the same utterance can be taken as a *description* of the last scene, which can be felicitous or infelicitous. While the study targeted the first option, one cannot exclude the possibility that some children encountered difficulties with these trials and opted for the second option, severing off the puppet's utterance from its original context of utterance in favor of the novel context described by the experimenter. In other words, the reminder description may have operated a shift from prediction to description mode, whereby children considered the contents of the puppet's guess 'p or q' at the stage where the experimenter had described the outcome, i.e., where one of the disjuncts was shown and said to be true. That this task feature may have had such an effect receives support from Skordos et al. (2020). These authors replicated the design from Tieu et al. (2017) and, in addition, ran a variant of it where the experimenter did not re-describe the scene to the child. Their results showed that children become more adult-like in the latter case: 14 out of 43 children showed a conjunctive profile in the replication study versus 7 out of 41 in the altered design. Pursuing this line of work, our results show that, in turn, adults become more child-like when the conflict with ignorance is there and is made more challenging to solve than in standard verification tasks.

All in all, these findings invite us to consider the possibility that some of the critical differences between typical adult and child behaviors do not lie in the alternatives they generate when deriving scalar implicatures, but rather in the strategies these populations preferentially appeal to when trying to resolve pragmatic infelicities. We argued that one of these strategies leads to a conjunctive interpretation of disjunction and may be more prevalent at earlier stages of development. Crucially, we have shown that this strategy remains available to adult speakers and may become more dominant in this population when other strategies become less available.

A Instructions and test sentences for Experiment 1

A.1 Instructions

Kate and Henry are two friends who like playing games. In this experiment you will witness one of their games. The rules are as follows: Kate draws two pictures and doesn't show them to Henry. The first picture depicts a situation and comes with a sentence describing it. The second picture depicts a follow-up scene. She shows Henry the first picture and asks him to make a guess about what's going to happen. Then, Kate presents the second picture with the follow-up scene. **Your task is to judge whether Henry's guess was right by clicking the 'yes' or 'no' button.**

A.2 Items

In the following, we provide the list of sentences used in the *Disjunction* (d1-d12), *Quantifier* (q1-q12) and *Number* (n1-n12) trials, respectively. The first sentence always corresponds to the short description accompanying the first picture, i.e., the initial scene. The second corresponds to the guess participants were asked to evaluate in light of the story's outcome, i.e., the final scene.

DISJUNCTION TRIALS

d1. Laura decided to start a garden. She will plant a cherry or an apple tree.	TARGET
d2. Jen wants to decorate the wall. She will hang a poster or a clock.	TRUE
d3. John is going to the market. He will buy a watermelon or a pumpkin.	FALSE
d4. Amelia is going to a birthday party. She will bring a bouquet or balloons.	TARGET
d5. Mike is planning to go for a walk. He will put on a hat or a scarf.	TRUE
d6. Oscar is going to a party. He will bring a cake or chips.	FALSE
d7. Rachel is invited to a gala. She will wear a necklace or a hat.	TARGET
d8. Gabe wants to relax this evening. He will knit a scarf or socks.	TRUE
d9. Mary is ordering food on the phone. She will order a soup or a salad.	FALSE
d10. The children are starting a new school year. They will bring flowers or balloons.	TARGET
d11. The villagers are setting up for a fair. They will put up balloons or flags.	TRUE
d12. Charlie's parents took him to the toy store. They will buy him a car or a train.	FALSE

QUANTIFIER TRIALS

q1. June is going to the barn. She will feed some of the animals.	TARGET
q2. A tornado is coming this night. It will tear down some of the trees.	TRUE
q3. Rona is planning a yard sale. She will sell some of her dresses.	FALSE
q4. Victoria is looking forward to her party. She will give some of the guests birthday hats.	TARGET
q5. Nick is making soup for dinner. He will use some of the vegetables.	TRUE
q6. Paul decided to go to bed. He will put away some of the books.	FALSE
q7. Olivia is done gardening for today. She will put some of the tools back.	TARGET
q8. Julia is going to the beach with friends. They will rent some of the sun umbrellas.	TRUE
q9. Carmen made snacks for her son. He will try some of the snacks.	FALSE
q10. Marta plans to take a bubble bath. She will light up some of the candles.	TARGET
q11. Benny woke up from a nap. He will play with some of his toys.	TRUE
q12. Lily is moving out of her shared apartment. She will take some of the living room paintings.	FALSE

NUMBER TRIALS

n1. May is wondering who's making the noise. She will find two children playing.	TARGET
n2. Joan wants to build garden furniture. She will build two things for the garden.	TRUE
n3. Alex is cooking dinner for his mother. He will cook two dishes for her.	FALSE
n4. Emily is going to the flower shop. She will buy two plants at the store.	TARGET
n5. Sofie wants to clean the house. She will clean two rooms in the house.	TRUE
n6. Jessica is competing in the Olympics. She will win two medals in the Olympics.	FALSE
n7. Anton is going on a trip. He will bring two suitcases with him.	TARGET

- | | |
|---|--------|
| n8. Tracy is advertising a new play. She will put up two posters in the hall. | TRUE |
| n9. Kyle is going shopping to the mall. He will buy two jackets at the store. | FALSE |
| n10. Mark received a box of chocolates from grandma. He will eat two pieces from the box. | TARGET |
| n11. Megan’s cousin is getting married this weekend. Megan will give her two gifts. | TRUE |
| n12. Jamie works at an animal shelter. He will take two dogs for a walk. | FALSE |

B Instructions for Experiment 2 & 3

B.1 English version

In this study, we will ask for your judgments about English sentences.

Every sentence will be accompanied by two pictures: one of them will be visible to you, while the other one will remain covered with the label ‘Better picture?’ on it. The sentence is meant to describe **one and only one of these two pictures**. Your task is to decide which picture you think the sentence is describing: the visible one or the covered one? You will click on the visible picture if you consider it a match for the sentence; otherwise, you will click on the covered picture.

B.2 French version

Dans cette étude, nous vous demandons de nous donner des jugements sur des phrases en français. Chaque phrase que vous lirez sera accompagnée de deux images: l’une de ces images sera visible, tandis que l’autre restera cachée sous le label ‘Meilleure image?’. La phrase qui vous est donnée a pour but de décrire **une et une seule de ces deux images**. Votre tâche est de décider laquelle de ces images est, selon vous, décrite par la phrase: l’image visible ou l’image cachée? Cliquez sur l’image visible si vous pensez que la phrase lui correspond; sinon, cliquez sur l’image cachée.

References

- Bar-Lev, Moshe E. & Danny Fox. 2017. Universal free choice and innocent inclusion. In Dan Burgdorf, Jacob Collard, Sireemas Maspong & Brynhildur Stefánsdóttir (eds.), *Semantics and Linguistic Theory (SALT) 27*, 95–115. Washington, DC: LSA.
- Bates, Douglas, Martin Mächler, Ben Bolker & Steve Walker. 2014. Fitting linear mixed-effects models using lme4. *arXiv preprint arXiv:1406.5823*.
- Bates, Douglas, Martin Maechler & Ben Bolker. 2011. lme4: Linear mixed-effects models using s4 classes.
- Bott, Lewis & Emmanuel Chemla. 2016. Shared and distinct mechanisms in deriving linguistic enrichment. *Journal of Memory and Language* 91. 117–140.
- Bowler, Margit. 2014. Conjunction and disjunction in a language without “and”. In Todd Snider, Sarah D’Antonio & Mia Weigand (eds.), *Semantics and Linguistic Theory (SALT) 24*, 137–155.
- Braine, Martin D. S. & Barbara Romain. 1981. Children’s comprehension of ‘or’: evidence for a sequence of competencies. *Journal of Experimental Child Psychology* 31. 46–70.
- Chemla, Emmanuel. 2009. Universal implicatures and free choice effects: Experimental data. *Semantics and Pragmatics* 2. 2–1.

- Chierchia, Gennaro, Stephen Crain, Maria Teresa Guasti, Andrea Gualmini & Luisa Meroni. 2001. The acquisition of disjunction: Evidence for a grammatical view of scalar implicatures. In A.H.-J. Do et al. (eds.), *BUCLD 25 proceedings*, 157–168.
- Chierchia, Gennaro, Maria-Teresa Guasti, Andrea Gualmini, Luisa Meroni, Stephen Crain & Francesca Foppolo. 2004. Semantic and pragmatic competence in children and adults comprehension of “or”. In Noveck Ira & Dan Sperber (eds.), *Experimental pragmatics*, 283–300.
- Davidson, Kathryn. 2013. ‘And’ and ‘or’: General use coordination in ASL. *Semantics and Pragmatics* 6(4). 1–44.
- Dowsett, Sharon M & David J Livesey. 2000. The development of inhibitory control in preschool children: Effects of “executive skills” training. *Developmental Psychobiology: The Journal of the International Society for Developmental Psychobiology* 36(2). 161–174.
- Fox, Danny. 2007. Free choice disjunction and the theory of scalar implicatures. In Uli Sauerland & Penka Stateva (eds.), *Presupposition and Implicature in Compositional Semantics*, 71–120. New York: Palgrave Macmillan.
- Franke, Michael. 2011. Quantity implicatures, exhaustive interpretation, and rational conversation. *Semantics and Pragmatics* 4. 1–1.
- Gazdar, Gerald. 1979. *Pragmatics: Implicature, Presupposition, and Logical Form*. New York, N.Y.: Academic Press.
- Gualmini, Andrea, Stephen Crain, Luisa Meloni, Gennaro Chierchia & Maria Teresa Guasti. 2001. At the semantics/pragmatics interface in child language. In *Proceedings of salt*, 231–247. Ithaca, N.Y.
- Hochstein, Lara, Alan Bale, Danny Fox & David Barner. 2014. Ignorance and inference: do problems with gricean epistemic reasoning explain children’s difficulty with scalar implicature? *Journal of Semantics* 33. 107–135.
- Huang, Yi Ting, Elizabeth Spelke & Jesse Snedeker. 2013. What exactly do numbers mean? *Language Learning and Development* 9(2). 105–129.
- Jaeger, T Florian. 2008. Categorical data analysis: Away from ANOVAs (transformation or not) and towards logit mixed models. *Journal of memory and language* 59(4). 434–446.
- Lenth, Russell, Henrik Singmann, Jonathon Love, Paul Buerkner & Maxime Herve. 2018. Emmeans: Estimated marginal means, aka least-squares means.
- Marty, Paul & Jacopo Romoli. 2021. Presupposed free choice and the theory of scalar implicatures. *Linguistics and Philosophy* 1–62.
- Marty, Paul, Jacopo Romoli, Yasu Sudo & Richard Breheny. 2020a. What primes what - an experimental framework to explore alternatives for scalar implicatures. *Talk presented at the 34th Annual CUNY Conference on Human Sentence Processing* https://www.cuny2021.io/wp-content/uploads/2021/02/CUNY_2021_abstract_137.pdf.
- Marty, Paul, Jacopo Romoli, Yasu Sudo & Richard Breheny. 2021. On the strength of being positive. *Talk presented at the workshop "Scales, degrees and implicature: Novel synergies between semantics and pragmatics"*.
- Marty, Paul, Jacopo Romoli, Yasu Sudo, Bob van Tiel & Richard Breheny. 2020b. Processing implicatures: a comparison between direct and indirect sis. *Talk presented at the first Experiments on Linguistic Meaning (ELM) Conference* [https://campuspro-uploads.s3-us-west-2.amazonaws.com/2a1da9b9-a2cb-4a63-b175-3c919aa79aca/1fc946ff-35a6-427f-b473-efae316fc584/ELM-Directvs.IndirectSIs-Martyetal.\(2020\).pdf](https://campuspro-uploads.s3-us-west-2.amazonaws.com/2a1da9b9-a2cb-4a63-b175-3c919aa79aca/1fc946ff-35a6-427f-b473-efae316fc584/ELM-Directvs.IndirectSIs-Martyetal.(2020).pdf).

- Meyer, Marie-Christine. 2013. *Ignorance and grammar*: Massachusetts Institute of Technology dissertation.
- Meyer, Marie-Christine. 2015. Generalized free choice and missing alternatives. *Journal of Semantics* 33(4). 703–754. <https://doi.org/https://doi.org/10.1093/jos/ffv010>.
- Munakata, Yuko, Seth A Herd, Christopher H Chatham, Brendan E Depue, Marie T Banich & Randall C O'Reilly. 2011. A unified framework for inhibitory control. *Trends in cognitive sciences* 15(10). 453–459.
- Paris, Scott G. 1973. Comprehension of language connectives and propositional logical relationships. *Journal of experimental child psychology* 16. 278–291.
- R Core Team. 2013. *R: A language and environment for statistical computing*. Vienna, Austria: R Foundation for Statistical Computing.
- Rees, Alice & Lewis Bott. 2018. The role of alternative salience in the derivation of scalar implicatures. *Cognition* 176. 1–14.
- Singh, Raj, Ken Wexler, Andrea Astle-Rahim, Deepthi Kamawar & Danny Fox. 2016. Children interpret disjunction as conjunction: Consequences for theories of implicature and child development. *Natural Language Semantics* 24. 305–352.
- Skordos, Dimitrios, Roman Feiman, Alan Bale & David Barner. 2020. Do children interpret 'or' conjunctively? *Journal of Semantics* 37(2). 247–267.
- van Tiel, Bob, Paul Marty, Elizabeth Pankratz & Chao Sun. 2019a. Scalar inferences and cognitive load. In *Proceedings of sinn und bedeutung*, vol. 23 2, 427–442.
- van Tiel, Bob, Elizabeth Pankratz & Chao Sun. 2019b. Scales and scalarity: Processing scalar inferences. *Journal of Memory and Language* 105. 93–107.
- Tieu, Lyn, Jacopo Romoli, Peng Zhou & Stephen Crain. 2015. Children's knowledge of free choice inferences and scalar implicatures. *Journal of Semantics* 33. 269–298.
- Tieu, Lyn, Kazuko Yatsushiro, Alexandre Cremers, Jacopo Romoli, Uli Sauerland & Emmanuel Chemla. 2017. On the role of alternatives in the acquisition of simple and complex disjunctions in French and Japanese. *Journal of Semantics* 34. 127–152.
- Waldon, Brandon & Judith Degen. 2020. Symmetric alternatives and semantic uncertainty modulate scalar inference. *Talk given at CogSci 2020* <https://cognitivesciencesociety.org/cogsci20/papers/0029/0029.pdf>.
- Zelazo, Philip David, J Steven Reznick & Denise E Piñon. 1995. Response control and the execution of verbal rules. *Developmental Psychology* 31(3). 508.