

University of Groningen

How adults and children interpret disjunction under negation in Dutch, French, Hungarian and Italian

Pagliarini, Elena; Lungu, Oana; van Hout, Angeliek ; Pintér, Lilla; Surányi, Balázs; Crain, Stephen; Guasti, Maria Teresa

Published in:
Language Learning and Development

DOI:
[10.1080/15475441.2021.1941966](https://doi.org/10.1080/15475441.2021.1941966)

IMPORTANT NOTE: You are advised to consult the publisher's version (publisher's PDF) if you wish to cite from it. Please check the document version below.

Document Version
Publisher's PDF, also known as Version of record

Publication date:
2022

[Link to publication in University of Groningen/UMCG research database](#)

Citation for published version (APA):

Pagliarini, E., Lungu, O., van Hout, A., Pintér, L., Surányi, B., Crain, S., & Guasti, M. T. (2022). How adults and children interpret disjunction under negation in Dutch, French, Hungarian and Italian: A cross-linguistic comparison. *Language Learning and Development*, 18(1), 97-122.
<https://doi.org/10.1080/15475441.2021.1941966>

Copyright

Other than for strictly personal use, it is not permitted to download or to forward/distribute the text or part of it without the consent of the author(s) and/or copyright holder(s), unless the work is under an open content license (like Creative Commons).

The publication may also be distributed here under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license. More information can be found on the University of Groningen website: <https://www.rug.nl/library/open-access/self-archiving-pure/taverne-amendment>.

Take-down policy

If you believe that this document breaches copyright please contact us providing details, and we will remove access to the work immediately and investigate your claim.

Downloaded from the University of Groningen/UMCG research database (Pure): <http://www.rug.nl/research/portal>. For technical reasons the number of authors shown on this cover page is limited to 10 maximum.



How Adults and Children Interpret Disjunction under Negation in Dutch, French, Hungarian and Italian: A Cross-Linguistic Comparison

Elena Pagliarini, Oana Lungu, Angeliek van Hout, Lilla Pintér, Balázs Surányi, Stephen Crain & Maria Teresa Guasti

To cite this article: Elena Pagliarini, Oana Lungu, Angeliek van Hout, Lilla Pintér, Balázs Surányi, Stephen Crain & Maria Teresa Guasti (2022) How Adults and Children Interpret Disjunction under Negation in Dutch, French, Hungarian and Italian: A Cross-Linguistic Comparison, *Language Learning and Development*, 18:1, 97-122, DOI: [10.1080/15475441.2021.1941966](https://doi.org/10.1080/15475441.2021.1941966)

To link to this article: <https://doi.org/10.1080/15475441.2021.1941966>



Published online: 21 Sep 2021.



Submit your article to this journal [↗](#)



Article views: 161



View related articles [↗](#)



View Crossmark data [↗](#)



How Adults and Children Interpret Disjunction under Negation in Dutch, French, Hungarian and Italian: A Cross-Linguistic Comparison

Elena Pagliarini ^a, Oana Lungu^b, Angeliek van Hout ^c, Lilla Pintér ^{d,e}, Balázs Surányi ^{e,f}, Stephen Crain ^g, and Maria Teresa Guasti ^h

^aDiSLL Dipartimento di Studi Linguistici e Letterari, Università degli Studi di Padova, Padova, Italy; ^bLaboratoire de Linguistique de Nantes, CNRS & Université de Nantes, Nantes, France; ^cCenter for Language & Cognition Groningen, Rijksuniversiteit Groningen, Groningen, Netherlands; ^dDepartment of Hungarian Linguistics, Pázmány Péter Catholic University, Budapest, Hungary; ^eInstitute for General and Hungarian Linguistics, Hungarian Research Centre for Linguistics, Budapest, Hungary; ^fDepartment of Theoretical Linguistics, Pázmány Péter Catholic University, Budapest, Hungary; ^gARC Centre of Excellence in Cognition and Its Disorders, Macquarie University, North Ryde, Australia; ^hDepartment of Psychology, Università degli Studi di Milano-Bicocca, Milano, Italy

ABSTRACT

In English, a sentence like “*The cat didn’t eat the carrot or the pepper*” typically receives a “neither” interpretation; in Japanese it receives a “not this or not that” interpretation. These two interpretations are in a subset/superset relation, such that the “neither” interpretation (strong reading) asymmetrically entails the “not this or not that” interpretation (weak reading). This asymmetrical entailment raises a learnability problem. According to the Semantic Subset Principle, all language learners, regardless of the language they are exposed to, start by assigning the strong reading, since this interpretation makes such sentences true in the narrowest range of circumstances. If the “neither” interpretation is children’s initial hypothesis, then children acquiring a superset language will be able to revise their initial hypothesis on the basis of positive evidence.

The aim of the present study is to test an additional account proposed by Pagliarini, Crain, Guasti (2018) as a possible explanation for the earlier convergence to the adult grammar by Italian children. The hypothesis tested here is that the presence of a lexical form such as recursive *né* that unambiguously conveys a “neither” meaning, would lead children to converge earlier to the adult grammar due to a blocking effect of the recursive *né* form in the inventory of negated disjunction forms in a language. We compared data from Italian (taken from Pagliarini, Crain, Guasti, 2018), French, Hungarian and Dutch. Dutch was tested as baseline language. French and Hungarian have – similarly to Italian – a lexical form that unambiguously expresses the “neither” interpretation (*ni ni* and *sem sem*, respectively). Our results did not support this hypothesis however, and are discussed in the light of language-specific particularities of the syntax and semantics of negation.

Introduction

Languages can differ in scope assignment when a sentence contains two (or more) logical operators. The present work concerns negative sentences with disjunction. Even when negation has scope over disjunction in the surface syntax, such sentences can be assigned different interpretations across

languages. These cross-linguistic differences have been attributed to variation in the scope relations between disjunction¹ and negation (Szabolcsi, 2002). In English, for example, a sentence like (1) is ambiguous between the “neither” reading and the “not this or not that” reading; yet such a sentence is typically assigned a “neither” interpretation, as in (2), where negation takes wide scope over disjunction (NEG>OR).

1. Mary didn't order pizza or salad.
2. Mary did not order pizza and Mary did not order salad.

In Japanese and Mandarin Chinese, the analogues to the English sentence in (1) are typically interpreted as (3); that is, adult speakers of Mandarin Chinese and Japanese typically assign a ‘not this or not that’² interpretation, where disjunction takes scope over negation (OR>NEG).

3. Mary did not order pizza or Mary did not order salad.

In assigning a “neither” interpretation to a negative sentence with disjunction, English mirrors classical logic whereas Mandarin Chinese and Japanese appear to not comply with it.³ This is because the second De Morgan's law of propositional logic states that $\neg(A \vee B) \Rightarrow \neg A \wedge \neg B$ (where \Rightarrow represents logical entailment; \wedge represents conjunction and \vee represents disjunction). So, in classical logic, a formula of the form $\neg(A \vee B)$ is true only if both A and B are false and therefore it is logically equivalent to the conjunction of two negated expressions. In other words, the interpretation generated by the scope assignment NEG>OR corresponds to the logical formula $\neg A \wedge \neg B$, which is true only if both disjuncts are false. The interpretation generated by the scope assignment OR>NEG, on the other hand, corresponds to the logical formula $\neg A \vee \neg B$, which is true if one of the disjuncts is false (as well as if both disjuncts are false).

Following a suggestion by Szabolcsi (2002), Goro (2004) and Crain (2012) attributed the cross-linguistic variation in scope assignment of disjunction in simple negative sentences to a lexical parameter called the Disjunction Parameter. On the “plus” value of the Disjunction Parameter, disjunction is analyzed as a Positive Polarity Item (+PPI).⁴ On the alternative “minus” value, disjunction is not a Positive Polarity Item (–PPI). According to this proposal, the English word for disjunction, *or*, is –PPI, whereas its Mandarin and Japanese counterparts are +PPI. An expression that is +PPI must by definition be interpreted outside of the scope of negation, regardless of its position in surface syntax. As a result, when a +PPI disjunction element appears in object position, the Disjunction Parameter triggers the scope assignment on which disjunction takes scope over negation (OR>NOT). In contrast, when a disjunction form is –PPI, it can be interpreted locally within the scope of negation, in which case there is isomorphism between the surface position of disjunction with respect to negation and the semantic interpretation (NOT>OR). This narrow scope reading of disjunction is the preferred one for –PPI OR forms, but the wide scope reading is available too under certain conditions, leading to a principled ambiguity of (1) (see Jing, 2008; Lungu, Fălăuș, Panzeri, 2021., 2021 for experimental evidence in English).

In all languages, the polarity sensitivity of disjunction is exempted when disjunction takes scope over negation in the surface syntax.⁵ For example, the “neither” interpretation is not preferred when

¹Throughout the paper, when referring to the expression “negative sentences with disjunction”, we mean ‘negated sentences containing disjunction in the verb phrase’.

²Throughout the paper, when we are using the “not this or not that” label for the interpretation, the sentence can be true in three circumstances {A-AND-notB, notA-AND-B, notA-AND-notB}.

³More accurately, the relevant rule of classical logic simply does not apply to negative sentences with disjunction in Mandarin Chinese and Japanese, because disjunction does not reside within the scope of negation at the level of semantic interpretation.

⁴Importantly, an expression that is –PPI is not a Negative Polarity Item (NPI). Rather, it is an expression that can be interpreted in the local scope of negation and other downward entailing operators.

⁵The polarity sensitivity of disjunction is also neutralized when negation appears outside the clause that contains disjunction, such that negation takes wide scope. This is characteristic of Positive Polarity Items more generally (see Crain, 2012).

disjunction appears in subject position, as in sentence (4). Because disjunction resides above negation in the surface syntax, (4) is judged to be true if either the blue team or the red team (or possibly both) did not pass the qualification.

4. The blue team or the red team didn't pass the qualification.

The fact that languages vary in the way disjunction expressions are interpreted in negative sentences raises an interesting challenge for language acquisition. How do children interpret disjunction in negated contexts across different languages? Is there a default scope assignment? To determine children's initial interpretation of negated disjunctions, experimental research has presented children with sentences that can be associated with alternative scope assignments, and children were asked to indicate which interpretation they prefer. Goro and colleagues (Goro, 2007; Goro & Akiba, 2004a, 2004b; Shimada & Goro, 2020) tested Japanese-speaking children and adults in negative sentences with disjunction. The results showed that adults assigned a "not this or not that" interpretation, thus providing support for the +PPI status of disjunction in Japanese, whereas children assigned a "neither" interpretation. Very similar findings have been found in a study of children acquiring Mandarin Chinese (Crain, 2012) and in two studies of children acquiring Turkish⁶ (Geçkin et al., 2015; Geçkin et al., 2017). In all of these languages, adult speakers were found to assign a "not this or not that" interpretation to negative sentences with disjunction, whereas child speakers were found to assign a "neither" interpretation to these sentences. In German, where disjunction *oder* "or" is -PPI, no difference was found between adults and children (Geçkin et al., 2017). Importantly, in this latter work, a direct comparison between German and Turkish was drawn, revealing that the interpretation patterns of Turkish-speaking children were not significantly different from those by German-speaking children or German-speaking adults.

This line of research has been motivated, at least in part, by a principle of language learnability that has been proposed in the acquisition literature. This is known as the Semantic Subset Principle (SSP) (Crain et al., 1994). According to this principle, children are expected to initially prefer "stronger" interpretations of certain potentially ambiguous sentences. The Semantic Subset Principle is stated in (5).⁷

5. If the interpretative component of UG makes two interpretations, A and B, available for a sentence S, and if interpretation A makes S true in a narrower range of circumstances than interpretation B does, then interpretation A is hypothesized before B in the course of language development (Crain et al., 1994, p. 455).

By initially hypothesizing an interpretation that makes a sentence true in the narrowest range of circumstances, as dictated by the SSP, children's grammars can accommodate positive evidence that the interpretation of disjunction is not limited to the "neither" interpretation. Therefore, positive evidence may lead children acquiring +PPI languages to reset the Disjunction Parameter such that negative sentences with disjunction can be used to describe a wider range of situations. The SSP

⁶In Turkish disjunction is expressed by two distinct morphemes, *ya ya da* and *veya*. Both expressions are tolerated with both case-marked and not case-marked disjunction phrases. The results by Geçkin et al. (2015) showed that Turkish-speaking children assigned a "neither" interpretation to negative sentences with disjunction, regardless of case marking, whereas adults assigned a "neither" interpretation only to sentences in which the disjunctive phrase was not case-marked; when the disjunction phrase was case-marked, adults assigned a "not this or not that" interpretation.

⁷The predictions made by the SSP are not different from those that can be derived from Dalrymple et al.'s (1994) Strongest Meaning Hypothesis (SMH) (Dalrymple et al., 1998, 1994). The SMH is a principle governing adult language, initially proposed as specific to the interpretation of reciprocals but it has been – and can be – generalized beyond that. As such, the SMH is a principle of preferential interpretation proposed independently of the developmental SSP. The two bear an obvious similarity, and therefore provide indirect support for each other, since we can see essentially the same mechanism at play both in the processing of meaning by adults and in the acquisition of meanings in children.

explains a variety of phenomena in which learnability issues arise, such as the acquisition of negative sentences with disjunction and negative sentences with epistemic modals (Moscati & Crain, 2014).

In the case of negative sentences with disjunction, the interpretation with negation taking scope over disjunction (NEG>OR) is only true when both disjuncts are false, yielding the “neither” reading: {not-A-AND-not-B}. By contrast, the “not this or not that” interpretation on which disjunction takes scope over negation (OR>NEG) makes sentences true in three different circumstances, including circumstances corresponding to the “neither” interpretation: {A-AND-not-B, not-A-AND-B, and not-A-AND-not-B}. Hence, the single situation in which the NEG>OR scope assignment is true constitutes a subset of the situations in which the OR>NEG scope assignment is true, because the “neither” reading asymmetrically entails the “not this or not that” reading, that is, if it is true that “neither A nor B,” it is also true that “not A or not B.” The SSP predicts that all learners, regardless of the value that is adopted by adult speakers of the language, initially assign the -PPI value to disjunction elements, so that negation can take scope over disjunction (NEG>OR), and the sentence is interpreted as “neither.” Upon encountering evidence that makes negative sentences with disjunction true on the “not this or not that” interpretation, namely, situations in which only one of the disjuncts is false, children will be driven to reset the Disjunction Parameter from the initial -PPI value for the disjunction form that was prompted by the SSP to +PPI which is the adult setting.

The process of converging to the adult grammar could also be explained in a Bayesian learning framework. Within this framework learners are assumed to follow Bayes’ rule: they compute posterior probabilities (relating to their belief as to how likely different interpretations are), proportional to the product of prior probabilities (which is their *a priori* belief as to how likely different interpretations are) and likelihood (relating to the statistical information present in the input). Repeating this inference process, where each next iteration uses the computed posterior probabilities as the new prior probabilities, would lead to convergence to the adult meaning, under the influence of input (as captured by the likelihood). The Bayesian learning framework thus describes, in abstract, a learning process. However, within the Bayesian learning framework the initial prior distribution still has to be set. The initial prior distribution can be unbiased (uniformly distributed, wherein a finite number of values are equally likely to be observed), but can just as well incorporate innate biases, thus giving rise to a distribution peaked at some values. In the literature it has been shown that all kids start off with a preference for the strongest meaning (a distribution peaked around the subset interpretation), which, in our case, corresponds to the “neither” interpretation; then, with input, in languages in which disjunction is +PPI, children update their prior distribution toward the adult-interpretation (the weaker interpretation). This would correspond to starting the Bayesian learning with a biased prior. Thus, Bayesian learning is a way to explain the acquisition trajectory, but does not preclude the possibility – or necessity – of an innate bias. So, no difference is expected in the outcome when we assume that we are dealing with Bayesian learners and there is no inherent incommensurability between Bayesian learning and the SSP.

In sum, previous developmental studies investigating the interpretation of negative sentences with disjunction have reported strikingly uniform non-adultlike behavior in children: learners across languages assigned a “neither” interpretation to negated sentences with disjunction, regardless of the parameter value for disjunction in the adult language. This supports the prediction that disjunction initially has the “minus” value of the Disjunction Parameter as predicted by the SSP.

However, a more recent study by Pagliarini, Crain, Guasti (2018) revealed a more complicated picture in Italian, where disjunction *o* “or” under clausemate negation is taken to have a +PPI value (as confirmed by the adult participants). In Italian, three, four and five-year-old children⁸ showed a bimodal distribution: one group of children assigned the “neither” interpretation, as predicted by the SSP; another group assigned the “not this or not that” reading, giving an adult-like interpretation of negative sentences with disjunction. This pattern of findings called for an explanation of the

⁸Two experiments were run: in the first experiment, children ranging in age from 3;5 to 6;0 were tested. In the second experiment, children ranging in age from 4;10 to 5;7 were tested. Both experiments revealed similar results.

discrepancy with findings from the other languages reported in the literature. Pagliarini and colleagues suggested that children acquiring Italian initially assume the “minus” value of the Disjunction Parameter, adhering to the SSP, but converge on the adult grammar earlier than children acquiring other languages, such as Japanese and Mandarin, due to the fact that in Italian there are two disjunction forms: one form lexicalizes disjunction with the negative coordinator *né né* (*nor nor*) which unambiguously encodes the “neither” interpretation (6); the other form *o* (*or*) is used for the “not this or not that” interpretation, with disjunction taking scope over negation. Note that the negative coordinator *né né* (*nor nor*) in (6) must be licensed by a c-commanding negation (e.g., Giannakidou, 2006; Zanuttini, 1997; Zeijlstra, 2004).

6. Maria * (non) ha mangiato né la mela né la banana.
 Mary NEG has eaten nor the apple nor the banana.
 ‘Mary ate neither the apple nor the banana.’

The Italian negative coordinator *né né* has the semantic properties of a Negative Polarity Item (NPI): when it appears in postverbal position, it must be licensed by and reside in the scope of negation.⁹ Pagliarini and colleagues argued that children acquiring Italian can use the sentence in (6) uttered in a context in which Mary ate neither the apple nor the banana, as evidence that adult speakers use (6) to convey the meaning $\neg A \wedge \neg B$ (i.e., the NEG>OR interpretation). According to their proposal, *né né* effectively blocks the “neither” interpretation for +PPI *o* in negative sentences, which subsequently cues the adult “not this or not that” interpretation of *o* “or” in negative sentences instead. Thus, the availability of *né né* as another disjunction form, competing with *o*, would lead children acquiring Italian to converge earlier to the adult grammar than Japanese or Mandarin speaking children, since these latter languages have only one disjunction form. In support of their proposal, Pagliarini and colleagues tested the interpretation of sentences like (6) in another group of Italian speaking children ranging in age from 4;0 to 5;9 and found that at that age almost all the tested Italian speaking children knew that sentences such as (6) can express only the “neither” interpretation. This is compatible with the hypothesis that presence of *né né* in Italian speeds up acquisition of *o* in negated sentences.

The present study draws a crosslinguistic comparison of the interpretation of negative sentences with disjunction, which to our knowledge is lacking in the field of the acquisition of semantics and, more generally, in the field of adult semantics as well (with the exception of (Lungu et al., 2021) 2021). The aim is to empirically assess Pagliarini, Crain, Guasti’s (2018) proposal about children’s earlier convergence to the adult grammar. More precisely, the hypothesis tested here is that children converge earlier on the adult “not this or not that” (+PPI) interpretation of disjunction in languages that use both a lexical form that unambiguously conveys the “neither” meaning, such as recursive *né né* in Italian, in addition to another disjunction form, such as Italian *o*. Earlier convergence is due to a blocking effect that the lexical expression that unambiguously conveys the “neither” meaning (e.g., Italian *né né*) has on the alternative expression for disjunction (Italian *o*). Italian, French and Hungarian are all languages where adult speakers tend to interpret disjunction as +PPI in negative sentences (see Pagliarini, Crain, Guasti, 2018 for Italian; Spector, 2014 for French; Szabolcsi, 2002 for Hungarian). French and Hungarian are negative concord languages which, like Italian, have a recursive neg-word similar to Italian *né né* which unambiguously conveys the “neither” meaning (French *ni ni*, Hungarian *sem sem*). The equivalent constructions for (6) are reported in (7) and (8). In contrast to previous studies that used English to establish a baseline level of performance for -PPI languages, the present study used Dutch as establish the baseline; like English, adult speakers of Dutch tend to interpret local negation as taken scope over disjunction in negative sentences (i.e., Dutch is classified as -PPI).

⁹However, when *né né* is in preverbal position, it does not occur with negation, as Italian is a non-strict negative concord language (e.g., Giannakidou, 2006; Zanuttini, 1997; Zeijlstra, 2004).

7. Marie n'a mangé **ni** la pomme **ni** la banane. (French)
 Marie CL has eaten nor the apple nor the banana.
 'Mary ate neither the apple nor the banana.'
8. Mari nem ette meg **sem** az almát, **sem** a banánt. (Hungarian)
 Mari NEG has eaten nor the apple, nor the banana.
 'Mary ate neither the apple nor the banana.'

We addressed two questions for language acquisition. The first question is whether the mere availability of an alternative lexical form for disjunction in a language, i.e., a form that unambiguously conveys the “neither” meaning (such as those reported in (6), (7) and (8)), suffices to trigger the blocking of the “neither” interpretation (NEG>OR) for the “ambiguous” lexical form for disjunction in the NEG ... OR construction. If so, it is expected that (some) French and Hungarian children should acquire the “not this or not that” interpretation of the simple lexical OR form at an earlier age than their Mandarin and Japanese-speaking peers, similar to the finding reported in Pagliarini, Crain, Guasti (2018), namely that a subset of Italian-speaking children preferred the adult-like interpretation of negative sentences with disjunction. The second question is whether age plays a role in predicting parameter resetting in French, Italian and Hungarian children. In addition, we ascertained whether disjunction has a +PPI status in French and Hungarian in the experimental contexts that we introduced, by comparing the preferred interpretation of negative sentences with disjunction by French and Hungarian-speaking adults to that of Italian-speaking adults (where the Italian data are taken from Pagliarini, Crain, Guasti (2018), Experiment 2).

Method

Participants

Dutch. Twenty-four monolingual Dutch children and twelve adults were tested. The children were recruited from two local kindergartens in the Groningen area and tested there. The adults were recruited through the research assistant's personal network. They were tested at their homes, the research assistant's home or in the university canteen.

French. Twenty-seven French monolingual children and twelve French monolingual adults participated in the experiment. The child participants were recruited from a kindergarten in the Nantes area. Adults were recruited through the research assistants' personal network. Some of the adults were tested at the university, others at home.

Hungarian. Twenty-nine Hungarian children and sixteen Hungarian adult participants took part in the experiment. Children were recruited from a public kindergarten in Budapest. Adults were recruited through the researchers' personal network. Some of them were tested at the Research Institute for Linguistics of the Hungarian Academy of Sciences; some of them were tested at their homes.

Italian. The Italian data were taken from Pagliarini, Crain, Guasti, (2018), Experiment 2. They included twenty-one Italian monolingual children and fourteen Italian monolingual adults. The child participants were recruited from a day-care center in Milan. The adult participants were students at the University of Milano-Bicocca and were tested at the university.

None of the participants had a history of speech, language or hearing delay or impairment. Table 1 reports demographic information of the Dutch, French, Hungarian and Italian participants who have been included in the data analyses (after participant inclusion criteria were applied, see the Results section).

Procedure

The experiment was modeled on the procedure used by Goro (2007) (see also Goro & Akiba, 2004a, 2004b) and used the Uncertainty Mode of the Truth Value judgment Task (TVJT) (Crain & Thornton, 1998). The experiment was divided into two parts and required the involvement of two experimenters.

For the first part of the experiment vignettes were used that were acted out by one experimenter using a paper-crafted story book. Each page showed an animal and two vegetables (a carrot and a green pepper). The participant was told that it was an eating game and the animals were invited to eat the two vegetables: (Figure 1, Panel A; Figure 2, Panel A). But not all animals liked vegetables, and so they did not always eat both. The experimenter acted out the scenes by letting the animals eat the veggies or put them away in a fridge or trash can. The participant was instructed to award a medal to each of the animals, depending on how many vegetables the animal had decided to eat. The reward system was introduced as follows:

- The participant was instructed to award the animal a gold medal sticker if it decided to eat both vegetables. Henceforth, we will refer to this as the Gold Medal condition.
- The participant was instructed to give to the animal a silver medal sticker (Figure 1, Panel C) if it decided to eat only one of the vegetables (Figure 1, Panel B). Henceforth, we will refer to this as the Silver Medal condition (Figure 1).
- The participant was instructed to give the animal a sad face sticker (Figure 2, Panel C) if it did not eat either of the vegetables (Figure 2, Panel B). Henceforth, we will refer to this as the Sad Face condition (Figure 2).

After the reward system was introduced, the experimenter went through each of the stories, one animal at a time. There was a total of twelve animals. Four were rewarded with a gold medal; four were rewarded with a silver medal; and four received a sad face. A puppet manipulated by the second experimenter listened to the stories with the vignettes along with the participant. After all the twelve stories were told, all of the vegetables were removed from the fridges and from the bins, and only the sticker rewards remained on the animals. Only children who provided the correct reward for all the 12 stories continued to the second part of the experiment, in which the actual TVJT took place. In this part, the experimenter went through the story book for a second time, starting from the beginning. Now, the experimenter asked the puppet to tell the participant what happened in each story, beginning with the first animal and then continuing with the others one at a time. On each trial, the puppet said that he could not remember exactly what the animal had eaten, but based on the reward the animal had been given, he could guess what it had eaten and then uttered the target sentence. Target sentences were presented auditorily using a neutral prosody, avoiding stress on the disjuncts. Considering that there had been twelve preceding stories, it was unlikely that the participant would remember which vegetable each animal had eaten, and which they had put in the fridge or in the trash can. So the participant had to judge whether the sentence produced by the puppet was right or wrong based on the medals. If the participant said that the puppet was wrong, the participant was asked to tell the puppet what had really

Table 1. Demographic information of the participants included in the data analyses.

	Dutch	French	Hungarian	Italian
Children	N = 20	N = 26	N = 27	N = 18
Age range (in months)	50–73	52–70	49–77	58–67
Mean age in months	58	63	62	63
Gender	11 females; 9 males	10 females; 16 males	16 females; 11 males	13 females; 5 males
Adults	N = 12	N = 12	N = 16	N = 14
Age range	20–58	21–59	20–60	21–30
Gender	7 females; 5 males	6 females; 6 males	8 females; 8 males	6 females; 8 males

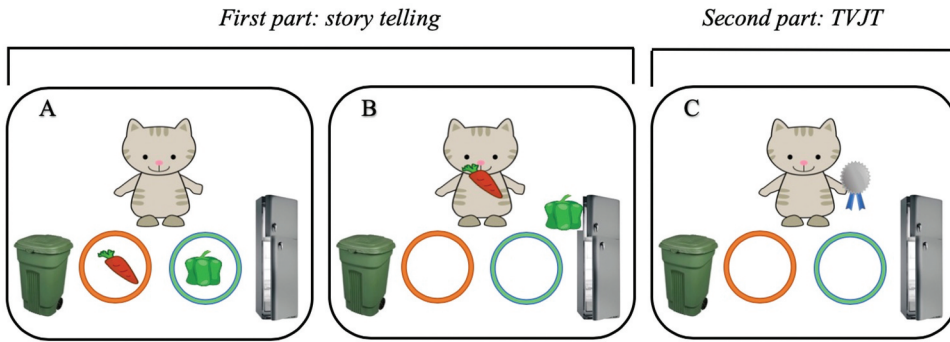


Figure 1. Example of a vignette of the Silver medal condition. Panel A depicts the protagonist of the story, in this case a cat, and a choice of two vegetables (a carrot and a green pepper). Panel B depicts the moment in which the cat decides to eat one of the vegetables (in this case the carrot), but to put the other one in the fridge (the green pepper). Panel C depicts the cat rewarded by the silver medal. No vegetable was visible to the participants. This is the moment in which the puppet uttered the test sentence. At this point, the medal was the only cue for the participant's judgment about the truth or falsity of the puppet's test sentence.

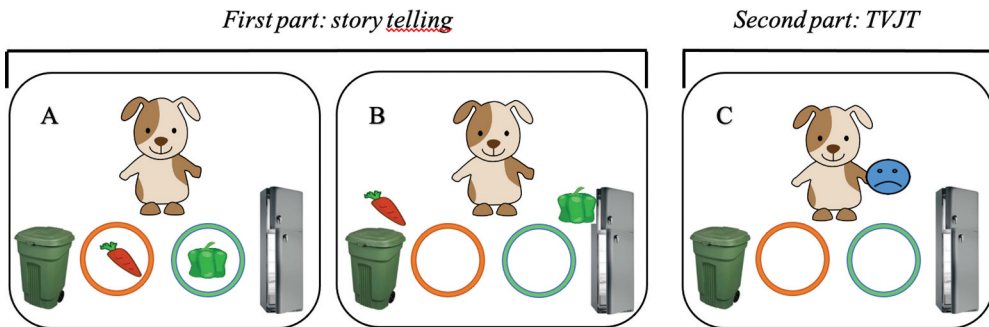


Figure 2. Example of a vignette of the Sad face condition. Panel A depicts the protagonist of the story, in this case a dog, and a choice of two vegetables (a carrot and a green pepper). Panel B depicts the moment in which the dog decides to put one veggie in the bin and the other in the fridge. Panel C depicts the dog rewarded by the sad face sticker. At this point, the puppet uttered the test sentence. Since none of the vegetables was visible to the participants, the sad face sticker was the only cue for the participant's judgment about the truth or falsity of the puppet's test sentence.

happened in the story. A training session with three items preceded the first part to ensure that the child participants understood the reward system. In total, the whole session lasted approximately 15–20 minutes. Children's responses and the justifications for their rejections of the puppet's test sentences were written down as well as audio-recorded for later transcription.

Materials

The test sentences consisted of negative sentences with disjunction, in each of the tested languages (9–12).¹⁰ A detailed description of the materials is presented in the Appendix A.

9. De poes houdt **niet** van wortel **of** paprika. (Dutch)
the cat likes NEG of carrot or pepper

¹⁰PRT stands for verbal particle.

10. Le chat **n'** a **pas** mangé la carotte **ou** le poivron. (French)
the cat CL has NEG eaten the carrot or the peper
11. A cica **nem** ette meg a répát **vagy** a paprikát. (Hungarian)
the cat not ate PRT the carrot or the pepper
12. Il gatto **non** ha mangiato la carota **o** il peperone. (Italian)
The cat NEG has eaten the carrot or the pepper

“The cat didn’t eat the carrot or the pepper”

The syntactic structure of the Italian, French and Hungarian test sentences (10–12) involved a negated transitive sentence in which negation NEG appeared in front of the verb and disjunction OR appeared between the two nouns in the direct object, (13).

13. NP_{Subject} NEG Verb [the NOR the N]_{Object}
[The cat]_{Subject} did **not** eat [the carrot **or** the pepper]_{Object}

“The cat didn’t eat the carrot or the pepper”

The Dutch test sentences used a different verb and a slightly different structure than the other languages. While it is possible in Dutch to use sentential negation adverb *niet* “not” in a transitive sentence, combining it with a definite noun phrase, however, as in the test sentences above, yields a marked word order, (14a). This is because definite NPs in Dutch typically scramble to the front of negation, (14b) (c.f. De Hoop, 1992).¹¹ Both transitive constructions in (14) pose problems for the present task. The marked order in (14a) requires focal stress on *niet* “not,” which creates a contrast (“he did not eat the carrot or the pepper, but something else”). Stress on the negation element would likely also affect the scope relation between negation and disjunction (possibly even reversing the scope relation of NOT and OR). In the unmarked order in (14b), on the other hand, disjunction precedes negation, which deviates from the order in the other three languages where negation precedes disjunction, (10–12).

- 14a. [The poes]_{Subject} heeft niet [de wortel of de paprika]_{Object} gegeten
[The cat]_{Subject} has **not** [the carrot **or** the pepper]_{Object} eaten
“The cat did not eat not the carrot or the pepper.”
- b. [The poes]_{Subject} heeft [de wortel **of** de paprika]_{Object} **niet** gegeten
[The cat]_{Subject} has [the carrot **or** the pepper]_{Object} **not** eaten
“The cat didn’t eat the carrot or the pepper.”

The most straightforward translation into Dutch would be to use nominal negation *geen* “no” instead of sentential *niet* “not,” (15). While this construction is neutral, the construction with negation inside the noun phrase involves a different syntax in comparison to the other languages, which moreover affects interpretation, because the scope of NEG and OR is now fixed (Larson, 1985).

15. [The poes]_{Subject} heeft [geen wortel of paprika]_{Object} gegeten
[The cat]_{Subject} has [**no** carrot **or** pepper]_{Object} eaten
“The cat didn’t eat any carrot or pepper.”

¹¹Van Bergen and De Swart (2010) found in a corpus study that definite NPs do not scramble that much, but their data involved all sorts of adverbial elements, including adverbs in higher positions than negation. For negation, we maintain the position that scrambling is preferred.

So, in order to avoid the above complications with transitive constructions in Dutch, we used a slightly different syntactic structure with the disjunction in a PP-complement instead of a direct object, as in (16), because in this construction sentential negation involves adverb *niet* “not,” as in the other three languages.¹² This meant choosing a different verb though. So, instead of transitive verb *eat*, *houden van* “like” was used, which in Dutch selects a PP-complement, and was appropriate for the set-up with the animals and the medals, see (16).

16. NP_{Subject} Verb NEG Prep [the N OR the N]_{Object}
 [De poes]_{Subject} houdt **niet** [van de wortel **of** de paprika]_{PP complement}
 [The cat]_{Subject} likes **not** [of the carrot **or** the pepper]_{PP complement}

Four test sentences were presented in the Silver Medal condition and four test sentences in the Sad face condition. Experimental items were presented in pseudo-randomized order and interspersed with control items (Gold medal condition), which were inserted to check whether children were paying attention. There were two true control items and two false control items. On the control items, the animal was rewarded with a gold medal. Examples of a true controls are given in (17–20) and examples of false controls in (21–24). The order of presentation was the same for all the tested languages.

17. De leeuw houdt van allebei de groentes. (Dutch)
 “The lion likes both veggies.”
18. Le lion a tout mangé. (French)
19. Az oroslán mindent megevett. (Hungarian)
20. Il leone ha mangiato tutto. (Italian)
 “The lion ate everything.”

Examples of false controls are given in (21–24).

21. De hond houdt niet van groentes. (Dutch)
 ‘The dog doesn’t like veggies.’ (English)
22. Le chien n’a rien mangé. (French)
23. A kutya nem evett meg semmit. (Hungarian)
24. Il cane non ha mangiato niente. (Italian)
 ‘The dog ate nothing.’

Each test sentence was preceded by a lead-in sentence that mentioned the reward the animal had received. The lead-in used in the experiment was (25–28) respectively for each language.

25. Hmm, de poes heeft een zilveren medaille . . . (Dutch)
26. Hmm, le chat a une médaille d’argent . . . (French)
27. Hmm, a cica ezüstérmét kapott . . . (Hungarian)
28. Mmm, il gatto ha una medaglia di argento . . . (Italian)
 ‘Mmm, the cat has a silver medal . . .’

¹²Hoeksema (2014) provides corpus evidence which shows that Dutch main clauses with negation hardly ever have scrambling of the PP to a position in front of negation (0% in cases where the PP is followed by a finite verb, 8% in cases where there is a nonfinite verb following the PP). Note that the Dutch test sentences like (16) all involved sentences with finite verbs.

Predictions

The Silver medal condition is the condition that most straightforwardly allows to differentiate the two types of languages: those in which disjunction patterns as a +PPI and those in which it patterns as a -PPI. In Dutch (our baseline language), where disjunction was expected to pattern as a -PPI and therefore can be interpreted within the scope of negation (NEG>OR), no differences were expected between children and adults: both groups of participants were expected to reject the test sentences in the Silver medal condition. In contrast, in French and Hungarian, as in Italian, where disjunction was expected to pattern as +PPI, at least for the adults, disjunction should scope above negation (OR>NEG) (the interpretation corresponding to the relative scope of OR and NOT in an English cleft structure *It is the pepper or the carrot that the cat did not eat*). Therefore, adult French and Hungarian speakers were expected to accept the test sentence in the Silver medal condition.

As for the children, regardless of the language, if they start with the more restricted interpretation and thus assign the -PPI value to the disjunctive element of their language in compliance with the SSP, they were expected to reject the test sentence for the Silver medal condition, because -PPI prefers a narrow scope reading of OR (NEG>OR). Based on this, we predicted a difference between adults and children in those languages where adults assign the +PPI value to disjunction: Italian, French and Hungarian. Nevertheless, following Pagliarini, Crain, Guasti's (2018) explanation, this difference may be modulated given the presence in the language of a disjunctive construction that will act as a blocker for the "neither" interpretation (see the Introduction). Thus, it was expected that some French and Hungarian children would already be adult-like in having acquired the +PPI value of the Disjunction Parameter (where OR>NEG), and accept the Silver medal condition, like adults. Still, a difference between children and adults would be possible, as not all children were expected to be adult-like, as in the Italian study.

The Sad face condition may provide additional information. In Dutch, both adults and children were expected to accept the target sentence in the Sad face condition. Adult speakers of French, Hungarian and Italian may accept a negative sentence with disjunction in the Sad face condition, since disjunction has the truth conditions associated with inclusive *or*: "p or q" is true if *at least* one of the disjuncts is true, which is also satisfied if both of them are true (Crain, 2012; Crain & Khlentzos, 2010). Thus, from a logical point of view, the sentences in (10–12) are true in circumstances in which both disjuncts are false (that is to say, situations in which the animal did not eat either vegetable) when they are interpreted with disjunction having wide scope (OR>NEG), paraphrased in (29a). However, disjunction readily licenses an "exclusivity" inference ("not both") in sentences (10–12). This inference is a type of scalar implicature and is triggered by the Maxim of Quantity (Grice, 1975), a conversational norm that instructs speakers to produce the most informative utterance that is relevant for the purposes of the conversation. Assuming that speakers conform to this Principle of Cooperation, hearers may infer that if the speaker intended to express the message that the cat ate neither of the vegetables, then she/he would have uttered a sentence that conveys this message more straightforwardly (such as (29b)). Such an alternative sentence would express a conjunction instead of a disjunction.

29. a. It is the pepper or the carrot that the cat did not eat. (Weak)
 b. It is the carrot and the pepper that the cat did not eat. (Strong)
 c. It is the carrot or the pepper, only one but not both, that the cat did not eat. (Exclusivity inference)

Another way to express this conjunction is to use a *né né* sentence (or a quantifier *the cat didn't eat any veggies*). Since the speaker chose to use the weaker statement, with disjunction, the hearer infers that the speaker did not have sufficient evidence to assert the stronger statement, with conjunction. As a consequence, the hearer will infer that the puppet intended to convey the message in (29 c) (this strengthened interpretation is called the exclusive-*or* reading). Therefore, we expected adult speakers

of French, Hungarian and Italian to judge the test sentence (10–12) as false in the Sad face condition, via the calculation of the “exclusivity” inference. As for children acquiring these languages, previous developmental studies have found that 4 and 5 year-old children derive scalar implicatures at lower rates than adults; in particular, a bimodal distribution is typically found with some children computing implicatures and some failing to compute it (see among others, Chierchia et al., 2001; Foppolo et al., 2012; Noveck, 2001; Pagliarini, Bill et al., 2018; Papafragou & Musolino, 2003; Tieu et al., 2016). Here, some children were expected to reject the Sad face situation, like adults, while others would accept it, because they fail to calculate the exclusivity inference.

Results

Percentages of acceptance (standard deviation in brackets) for the true and false fillers for each group in each language are reported in Table 2. Participants had to correctly answer at least 75% (3 out of 4) of the control items in order to be included in the analysis. All participants passed this criterion. Nevertheless, some child participants had to be excluded for reasons related to the procedure. Four Dutch children were excluded: two for lack of attention; one failed to award the prizes properly; one gave judgments based on knowledge of the world (e.g., the mouse did not eat vegetables, because he only eats cheese). One French child was excluded from the analysis because she did not understand the system of rewards. Two Hungarian children were excluded: one because he always responded “Yes” in the main phase and one because he did not understand the system of rewards. Three Italian children were excluded: two because they always responded “Yes” in the main phase of the experiment; one because he did not understand the system of rewards. After applying these exclusion criteria, 20 Dutch children, 26 French children, 18 Italian children and 27 Hungarian children were included in the analysis (demographic information is reported in Table 1).

For all the analyses reported below, we ran mixed logit models on participants’ responses using R (version 3.6.2), the lme4 package (1.1–21 version) and lmerTest (3.1–1 version). The multcomp (version 1.4–12) was used to run multiple comparisons (Tukey contrasts). The Silver medal condition and the Sad face condition were analyzed separately. Figure 3 reports the proportion of target sentence acceptance in the Silver medal condition (left panel) and in the Sad face condition (right panel) by children and adults in the four tested languages. Percentages of acceptance (standard deviation in brackets) for each condition for each group in the four tested languages are reported in Table 2.

Analyses on the Silver medal condition

We start by reporting the results of the Silver medal condition. A backward elimination procedure was used to compare the goodness-of-fit of the models, starting with the maximal structure that allowed the models to converge (Barr et al., 2013). For this analysis, the maximal structure contained two random intercepts – for participants and for items – and three fixed effects: Group (Adults vs. Children), Language (Dutch, French, Hungarian, Italian), and the interaction of Group-by-Language. As for reference level, “Adult” was the reference level for Group; “Dutch” was the reference

Table 2. Percentage of acceptance (standard deviation into brackets) for experimental conditions and filler items for each group.

		Dutch	French	Hungarian	Italian
Filler true	Adult	100 (0)	100 (0)	100 (0)	100 (0)
	Children	100 (0)	100 (0)	100 (0)	100 (0)
Filler false	Adult	0 (0)	0 (0)	0 (0)	0 (0)
	Children	0 (0)	2 (14)	4 (19)	0 (0)
Silver medal	Adult	8 (28)	96 (20)	90 (29)	91 (29)
	Children	19 (39)	34 (48)	25 (43)	54 (50)
Sad face	Adult	94 (24)	17 (38)	28 (45)	25 (44)
	Children	94 (24)	70 (46)	75 (43)	61 (49)

level for Language. The use of likelihood-ratio tests to compare models shows that the interaction between the two fixed effects significantly contributed to the model ($\chi^2(3) = 31.99, p < .001$), as well the fixed effect of Group ($\chi^2(4) = 71.22, p < .001$) and the fixed effect of Language ($\chi^2(6) = 48.16, p < .001$) (when Group and Language were compared to a model with the interaction Group-by-Language). Therefore, we included in the model the interaction Group-by-Language as well as the fixed effects of Group and Language. Estimated coefficients, their standard errors, Z-values, and associated p -values of the Wald test for the chosen model are reported in Table 3.

The results revealed a main effect of Language and a significant Group-by-Language interaction. Group was not significant. The main effect of Language was due to the fact that French, Hungarian and Italian participants were significantly more likely to accept the target sentence than Dutch participants (Tukey post-hoc tests all $p < .001$), whereas no significant difference was found among French, Hungarian and Italian (see Table A1, Appendix B, for the complete list of post-hoc comparisons).

Tukey post-hoc comparisons of the Group-by-Language interaction revealed that French ($p < .05$) and Hungarian ($p < .001$) children accepted fewer items than their respective adults, whereas Dutch children did not differ from Dutch adults. Italian children also accepted fewer items than the respective adults, though the post-hoc comparison did not turn out to be significant ($p = .3$). Post-hoc comparisons also revealed that French, Hungarian and Italian adults significantly differed from Dutch adults, as the former were more likely to accept the target sentence than Dutch adults. Post-hoc comparisons also showed that children from different languages did not differ from each other, including Dutch children. Furthermore, French, Italian and Hungarian adults do not differ from each other, but they all differed from Dutch adults. Table A2, in the Appendix B, lists all post-hoc comparisons.

We then looked more in detail at children's pattern of response to the Silver medal condition. Figure 4 shows a histogram of children's individual responses for each language. It reports the number of children (y-axis) for each number of items accepted (x-axis). The histogram shows that most of the Dutch children never accepted the target sentence; none of them accepted 4 out of 4 target sentences. The same holds for French and Hungarian children, although a few children accepted the target sentence at different degrees. As is evident from Figure 4, Italian children's responses revealed a bimodal distribution: a group of Italian children consistently rejected the target sentence in the Silver medal condition while another group of Italian children consistently accepted it.

We furthermore investigated whether age was a significant predictor for the acceptance of the target sentence of French, Hungarian and Italian children. Figure 5 shows the distributions of age (in months) divided by responses score for Hungarian, French and Italian children. We ran a mixed-model logistic regression on the responses of French, Hungarian and Italian children with age as fixed

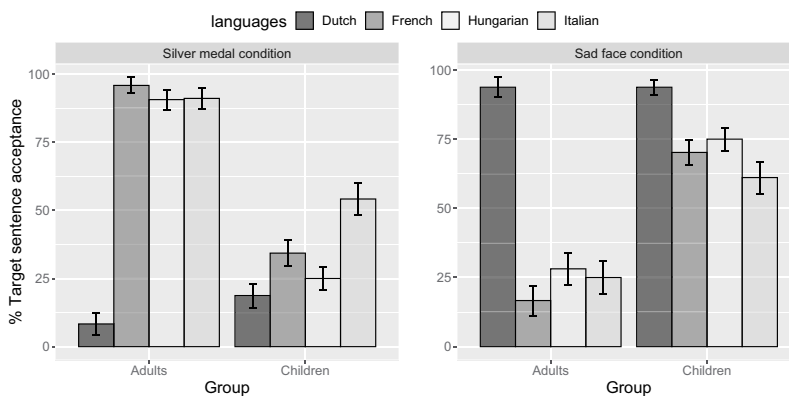


Figure 3. Proportion of target sentence acceptance by group and condition in the Silver medal condition (left panel) and in the Sad face condition (right panel). Vertical bars represent standard error.

Table 3. The best fitting model of the data for the Silver medal condition. Adults and Dutch were used as reference levels for group and language factors, respectively.

Predictor	Estimate	SE	Z Wald	<i>p</i>
(Intercept)	-8.24	2.21	-3.72	< .001
Group – Children	1.812	2.33	0.78	= .44
Language – French	16.18	3.36	4.81	< .001
Language – Hungarian	16.02	3.19	5.02	< .001
Language – Italian	15.94	3.22	4.94	< .001
Group-Children by Language-French	-13.93	4.32	-3.22	< .01
Group-Children by Language-Hungarian	-15.89	3.59	4.42	< .001
Group-Children by Language-Italian	-8.28	3.74	-2.21	< .05

Summary of fixed effects in the logit model (N = 578; log-likelihood = -187.2).

factor and participants and items as random intercepts. The results showed that age did not predict the responses of French, Hungarian and Italian children. Table 4 reports the estimated coefficients, their standard errors, Z-values, and associated *p*-values of the Wald test.

In addition to acceptance/rejection responses, we also collected justifications from each participant whenever they gave a 'no-response' to a test sentence. We coded the children's justifications for rejection of the target sentence in the Silver medal condition into eight categories. For each category, the justification code as well as four example justifications are shown in Table 5. The distribution of these different justification types across the languages is shown in Table 6. Across languages, the most frequent justifications are those coded as "one" and "only one," which are compatible with the "neither" interpretation.

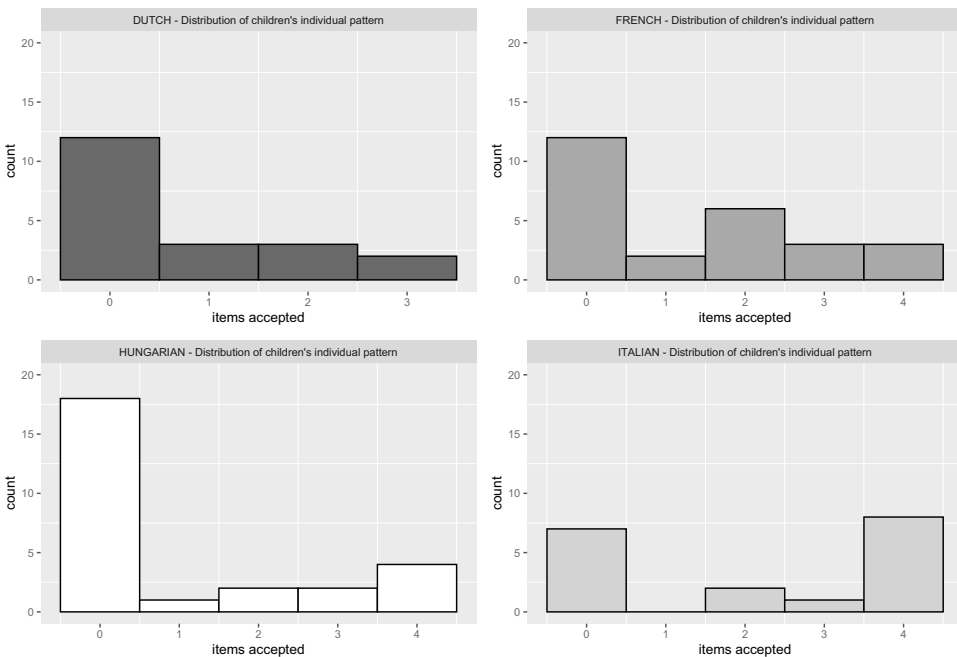


Figure 4. Distribution of children's individual patterns of responses in the Silver medal condition. The y-axis reports the number of children for each number of items accepted (x-axis). 0 stands for 0 items accepted; 1 stands for 1 item accepted; 2 stands for 2 items accepted; 3 stands for 3 items accepted; 4 stands for 4 items accepted.

Analyses on the Sad face condition

We now move to the analysis of the Sad face condition. Again, we used a backward elimination procedure to compare the goodness-of-fit of the models, starting with the maximal structure that allowed the models to converge (Barr et al., 2013). For this analysis, the maximal structure contained two random intercepts – for participants and for items – and three fixed effects: Group (Adults vs. Children), Language (Dutch, French, Hungarian, Italian), and the interaction of Group-by-Language. As for reference level, “Adult” was the reference level for Group; “Dutch” was the reference level for Language. The use of likelihood-ratio tests to compare the models revealed that the interaction

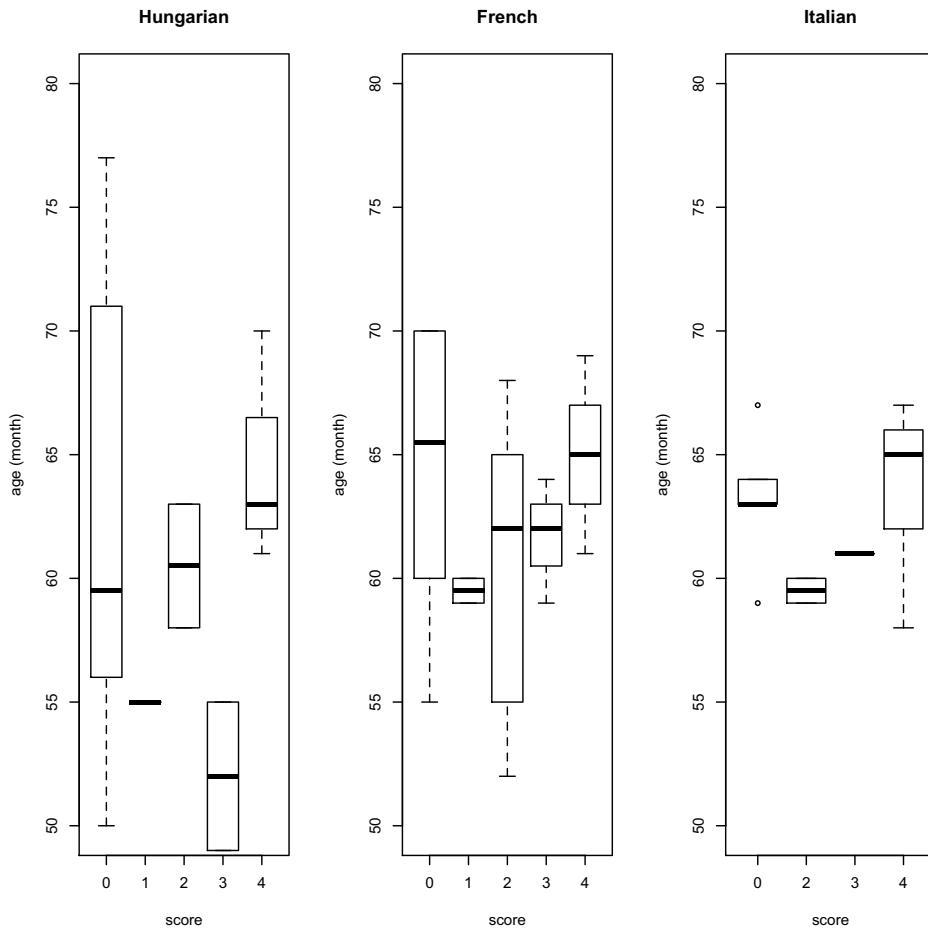


Figure 5. Distributions of age divided by responses' score to the Silver medal condition for Hungarian, French and Italian children. Dots represent outliers.

Table 4. Estimated coefficients, their standard errors, Z-values, and associated *p*-values of the logistic regression on French, Italian and Hungarian children data with Age as predictor.

Silver medal condition				
Predictor	Estimate	SE	Z Wald	<i>p</i>
(Intercept)	3.86	8.42	0.46	= 0.65
Age	-0.11	0.14	-0.772	= 0.44

Summary of fixed effects in the logit model (N = 282; log-likelihood = -124.3)

between the two fixed effects significantly contributed to the model ($\chi^2(3) = 11.21, p < .05$), as well the fixed effect of Group ($\chi^2(4) = 42.50, p < .001$) and the fixed effect of Language ($\chi^2(6) = 47.91, p < .001$) (when Group and Language were compared to a model with the interaction Group-by-Language). Therefore, we included the interaction Group-by-Language as well as the fixed effects of Group and Language. Estimated coefficients, their standard errors, Z-values, and associated *p*-values of the Wald test for the chosen model are reported in Table 7.

The results revealed a main effect of Language and a significant interaction Group-by-Language. Group was not significant. The main effect of Language was due to the fact that French, Hungarian and Italian participants were significantly less likely to accept the target sentence than Dutch participants (French and Italian vs Dutch Tukey post-hoc tests, $p < .001$; Hungarian vs Dutch, $p < .01$), whereas no significant difference was found among French, Hungarian and Italian (see Table A3, Appendix B for the complete list of post-hoc comparisons).

Tukey post-hoc comparisons of the Group-by-Language interaction revealed that French ($p < .05$) and Hungarian ($p < .05$) children were more likely to accept the target sentence than their respective adults, whereas Dutch children did not differ from Dutch adults. Italian children were also more likely to accept the target sentence than the respective adults, though the post-hoc comparison did not turn out to be significant ($p = .13$). Post-hoc comparisons also revealed that French, Hungarian and Italian adults significantly differed from Dutch adults, as the former were less likely to accept the target sentence than Dutch adults. Post-hoc comparisons furthermore showed that children from different languages did not differ from each other, including the Dutch children. Moreover, French, Italian and Hungarian adults did not differ from each other, but they all differed from Dutch adults. Table A4, in Appendix B, lists all post-hoc comparisons.

Table 5. Examples of the justification codes for the Silver medal condition.

Silver medal condition	
Justification code	Example
One	(S)he ate one thing. (S)he likes one veggie. (S)he did eat one.
Only-one	(S)he ate only one. Because the silver medal means (s)he ate only one thing, instead she says she ate nothing.
Has-silver medal	S(he) has a silver medal.
Neg-and	(S)he did not eat the carrot and the pepper.
Neg-one	(S)he did not eat one. (S)he did not want one.
Neg-sad	Because (s)he doesn't have a sad face.
Nothing	(S)he didn't eat anything. (S)he did not eat.
Other	(S)he only likes carrot. (S)he doesn't want that. (S)he does like bell pepper and carrot.

Table 6. Count of justifications divided by language provided by child participants to justify no-responses to the target sentence in the Silver medal condition.

Silver medal condition									
	one	only-one	has-silver-medal	neg-and	neg-one	not-sad	nothing	other	total
Dutch	26	6	13	0	1	4	0	15	65
French	11	21	0	0	1	0	0	1	34
Hungarian	51	19	0	2	5	0	2	1	80
Italian	8	10	0	0	2	0	6	1	27

Table 7. The best fitting model of the data for the Sad face condition. Adults and Dutch were used as reference levels for Group and Language factors, respectively.

Sad face condition Predictor	Estimate	SE	Z Wald	<i>p</i>
(Intercept)	7.11	1.89	3.75	< .001
Group – Children	–0.44	2.08	–0.21	= .83
Language – French	–12.24	2.78	–4.40	< .001
Language – Hungarian	–10.29	2.78	–3.70	< .001
Language – Italian	–11.92	2.84	–4.20	< .001
Group-Children by Language-French	8.38	3.18	2.63	< .01
Group-Children by Language-Hungarian	8.21	3.31	2.48	< .05
Group-Children by Language-Italian	7.21	3.32	2.17	< .05

Summary of fixed effects in the logit model (N = 578; log-likelihood = –187.2).

We coded the children’s justifications for rejection of the target sentence in the Sad face condition into seven categories. For each category, the justification code as well as four example justifications are shown in Table 8. The distribution of these different justification types across the languages is shown in Table 9. When children rejected the target sentence in the Sad face condition in French, Hungarian and Italian, they most frequently provided justifications coded as “nothing,” which is consistent with the calculation of the exclusivity inference.

Discussion

Disjunctive negative sentences receive different interpretations across languages. In fact, the interaction of two logical operators in a sentence presents a potential semantic ambiguity depending on scope assignment. In the case at hand, disjunction can take wide scope over negation and be interpreted as “not this or not that,” or it can have narrow scope with respect to negation and be interpreted as “neither.” Following a suggestion by Szabolcsi (2002), Goro (2004) and Crain (2012) attributed the cross-linguistic variation in scope assignment of disjunction in simple negative sentences to a lexical parameter called the Disjunction Parameter. On the “plus” value of this lexical parameter, disjunction expressions in a language are analyzed as Positive Polarity Items (+PPI). On the alternative “minus” value, disjunction expressions are not Positive Polarity Items (–PPI). The present work presents a cross-linguistic comparison of the interpretation of negative sentences with disjunction that are assigned by adults and by children in Dutch, French, Hungarian and Italian.

Turning first to the findings for the adults, there are two main conclusions. The first conclusion is based on the fact that Dutch speakers rejected the target sentences uttered in the Silver medal condition (where only one disjunct was false) at a very high rate, whereas French, Hungarian and

Table 8. Examples of the justification codes for the Sad face condition.

Sad face condition	
Justification code	Example
Nothing	Because (s)he didn’t eat anything. (S)he ate nothing.
Neg-and	Because (s)he has the sad face and (s)he didn’t eat anything. (S)he did not eat the carrot and the pepper.
Neg-both	(S)he did not eat both. (S)he didn’t eat both of them.
Neg-eat	(S)he did not eat. (S)he did not want to eat.
Neg-one	(S)he did not eat one.
Only-one	Because he has the sad face and (s)he didn’t eat anything.
Other	(S)he was not hungry. The giraffe says that he likes one, but he doesn’t like both vegetables.

Table 9. Count of justifications divided by language provided by child participants to justify no-responses to the target sentence in the Sad face condition.

Sad face condition								
	nothing	neg-and	neg-both	neg-eat	neg-one	only-one	other	total
Dutch	2	0	0	0	0	0	3	5
French	12	0	4	0	1	0	1	18
Hungarian	11	4	4	4	3	0	1	27
Italian	21	0	0	0	0	1	1	23

Italian speakers accepted the target sentences at an equally high rate in the same condition. This invites the conclusion that negative sentences with disjunction were interpreted as “neither” in Dutch (with negation taking scope over disjunction), and they were interpreted as “not this or not that” in French, Hungarian and Italian (with disjunction taking scope over negation). This pattern of responses indicates that disjunction is a –PPI element in Dutch, whereas it is a +PPI element in French, Hungarian and Italian. This adds significantly to a growing body of systematic experimental studies that reveal robust crosslinguistic variation in the interpretation of negative disjunctive sentences by adult speakers.

A second conclusion can be derived from the results of the Sad face condition. This conclusion is based on the finding that French-, Italian- and Hungarian-speaking adults rejected the target sentences when both disjuncts were false, thus confirming that speakers of these languages computed the exclusivity inference associated with disjunction (30c). This supports the claim that in languages in which disjunction is +PPI (in our sample, French, Hungarian and Italian), it typically gives rise to an exclusivity implicature “either this or that but not both” (a type of scalar implicature), following the Maxim of Quantity by Grice (Grice, 21975). Sentences in which the disjunctive phrase has wide scope over negation are scopally equivalent to the paraphrase in (30a). The interpretation of (30a) is weaker than the alternative interpretation with conjunction in (30b). The fact that the stronger alternative statement was not produced by the speaker invites the hearer to infer that the speaker did not have sufficient evidence for the stronger statement, and therefore, the hearer infers that the speakers intended message is conveyed by (30c).

- 30a. It is the pepper or the carrot that the cat did not eat. (Weak)
 b. It is the carrot and the pepper that the cat did not eat. (Strong)
 c. It is the carrot or the pepper, but not both, that the cat did not eat. (Exclusivity inference)

These two conclusions about the adult interpretation patterns form the basis for discussing the children’s results. In the previous literature, the finding that there is crosslinguistic variation in the interpretation of ambiguous sentences has led to several specific hypotheses about the course of language acquisition. In the case at hand, an ambiguity arises because negative sentences with disjunction can be assigned a “not this or not that” interpretation, or a “neither” interpretation. These alternative interpretations are in a subset/superset relation, such that the “neither” interpretation (the strong reading) asymmetrically entails the “not this or not that” interpretation (the weak reading). When child language learners are confronted with sentences that can be associated with more than one meaning, the child’s initial assumption is critical for language learnability. In the absence of negative evidence, the child language learners would confront a learnability dilemma if they initially hypothesize the superset language, where adult speakers prefer the subset language. As discussed in the Introduction, one account that has been proposed to resolve precisely such superset-subset learnability problems is the Semantic Subset Principle (SSP) (Crain et al., 1994). This principle instructs language learners to initially choose the interpretation which is true in the narrowest range of circumstances; if they are learning a language that allows the superset interpretation, they can learn about the existence of this weaker interpretation using positive evidence provided by

adult speakers of the language. In the case of negative sentences with disjunction, the SSP predicts that children will initially prefer the “neither” interpretation, even in languages where adults prefer the “not this or not that” interpretation instead. This prediction has been confirmed in several languages (e.g., Mandarin, Japanese, Turkish, Catalan). Experimental studies of these languages have reported that children and adults differed in the responses they gave to negative sentences with disjunction (Crain, 2012; Goro & Akiba, 2004a, 2004b; Geçkin et al., 2015; Geçkin et al., 2017; Pagliarini et al., 2021). While adults accepted the equivalent of (31) in a situation in which the cat did not eat the pepper but ate the carrot, children rejected it. Instead, children, but not adults, accepted the same sentence in a situation in which the cat ate neither.

31. The cat didn't eat the carrot or the pepper.

The main aim of the present study was to test a supplementary hypothesis to the SSP learnability account proposed by Pagliarini, Crain, Guasti (2018) in two other languages, French and Hungarian. Although some Italian preschoolers in the Pagliarini et al. study differed from adults, as observed in other studies, a subset of the children were reported to assign the adult-like “not this or not that” interpretation to negative sentences with disjunction. This latter finding suggested that these children had acquired the +PPI value of the Italian disjunction word *o* at an earlier age than the child language learners tested in previous studies. To explain why Italian-speaking children acquired the +PPI value of the Disjunction Parameter earlier than children acquiring other languages, Pagliarini et al. made the following proposal. In languages with a + PPI disjunction, the presence of an alternative lexical form which lexicalizes the $\neg A \wedge \neg B$ meaning unambiguously, conveying the “neither” interpretation (Italian *né né*), and distinct from the +PPI form (Italian *o*), helps children to give up their initial “neither” interpretation of negated sentences with disjunction with the +PPI form, once they acquire this designated form (*né né*) for the “neither” interpretation. In other words, the hypothesis tested here is that the presence of a lexical form such as recursive *né né*, which unambiguously conveys the “neither” meaning in the inventory of (negated) disjunction forms in a language, would lead children to converge earlier to the adult grammar as a result of the blocking effect of this recursive *né né* form. Like Italian, French and Hungarian have an alternative lexical form (French *ni ni*, Hungarian *sem sem*) which unambiguously conveys the “neither” reading. The present results with adults confirmed that the simple disjunction was indeed interpreted as “not this or not that” both in French and Hungarian. Therefore, the comparison among French, Hungarian and Italian learners – adding Dutch as a baseline – offered the ideal testing ground to test the account proposed by Pagliarini, Crain, Guasti (2018).

The results of the Silver medal condition revealed that the four groups of children did not differ from each other: in all languages children rejected this “not this or not that” interpretation. So, the first conclusion is that, regardless of the language, children across languages assumed the “minus” value of the Disjunction Parameter, as predicted by the SSP. When the children were compared to the respective groups of adults, the results showed, as predicted, that the Dutch children did not differ from the Dutch adults. Dutch negative sentences with disjunction were preferably interpreted as “neither” by both groups. In contrast, French and Hungarian children differed from the respective adult groups, confirming the prediction of the SSP. Contrary to our expectations, however, the French and Hungarian children were different from the Italian children, who did not differ from adults. The distribution of responses (Figure 4) revealed that only the pattern of responses by the Italian-speaking children was bimodally distributed. That is, while almost all French and Hungarian children consistently rejected the target sentences in the Silver medal condition, as predicted by the SSP, Italian children could be partitioned into two subgroups, with one Italian subgroup consistently rejecting the target sentence in the Silver medal condition, and another subgroup consistently

accepting them, like the Italian adults.¹³ So, in contrast to the Italian children, French and Hungarian children did not benefit from the specific properties of *ni ni* and *sem sem* respectively. This means that our prediction that French and Hungarian would pattern like Italian, which was based on the blocking principle described above, was not confirmed.

By looking at children's performance on the Sad face condition, we furthermore investigated whether children calculated the exclusivity inference in the languages in which disjunction is a +PPI. Previous findings in the literature on the acquisition of scalar implicatures showed that preschoolers generally struggle with scalar inferences (Chierchia et al., 2001; Foppolo et al., 2012; Noveck, 2001; Papafragou & Musolino, 2003; Tieu et al., 2016, among many others). Here, to be able to draw the exclusivity inference, children should assign disjunction wide scope (see examples in (30)). However, the French and Hungarian children were significantly more likely to accept the target sentence than the respective adults in the Sad face condition, suggesting that most of the French and the Hungarian children, in contrast to the adults, did not calculate the exclusivity inference. The comparison between Italian children and adults in the Sad face condition was not significant. This last result was arguably probably due to the subset of Italian children who were adult-like in the Silver medal condition, interpreting disjunction out of the scope of negation: they may have also been able to calculate the exclusivity inference.

A second goal of the present study was to determine whether age plays a role in predicting parameter resetting in languages where disjunction is a +PPI element. Our results showed that age was not a significant predictor of the responses (see Pagliarini et al., 2021 for similar findings from Catalan). It is known that, at the ages tested here, there is substantial variation in the linguistic development of children of the same age (Huttenlocher et al., 2002; Jackson & Roberts, 2001). Thus, it is possible that the individual children in each of the language groups were at different points in their language development. Indeed, one limitation of the present study is that we did not include an independent measure to control the level of linguistic development to make sure that children matched linguistically. Hence, one possible explanation for the unexpected cross-linguistic difference among the children is that the Italian-speaking children happened to be generally more advanced linguistically than the French- and Hungarian-speaking children. This option remains open since it cannot be confirmed with the present data. Indeed, recent results in Catalan seem to confirm the role of linguistic proficiency (Pagliarini et al., 2021): children who displayed the adult interpretation pattern for negated disjunction (the same task was used as in the present study), accepting the Silver condition, were linguistically more advanced than children who accepted the Sad face condition. Another possible factor that may point in the same direction, as it may be related to the level of children's linguistic competence, is Socio-Economic-Status (SES), which is another variable we did not control for. Vasilyeva et al. (2008) showed that there were no SES-related differences among children in the production of simple sentences (Subject Verb Object), but differences were evident when more complex aspects of grammar were considered. Thus, children with higher SES produced more complex and more varied structures than children with lower SES which suggests that the children with higher SES had a more developed linguistic competence. Notice that our sentences included coordination and negation, two features of complexity. Therefore, in light of the results by Vasilyeva and colleagues, it is possible that differences in SES can explain the discrepancies in our results. Further investigation is needed to clarify this issue.

Let us return now to our main hypothesis about the blocking effect of an alternative lexical form which unambiguously conveys the "neither" interpretation in the inventory of disjunction forms in

¹³As suggested by an anonymous reviewer, the performance of the Italian children might be just due to sampling bias, given our modest data set. The bimodal distribution of responses together with the high rate of accuracy on the filler sentences, suggest that children understood the task. Nevertheless, further replications with bigger sample size are needed in order to be able to generalize to other Italian-speaking children. Indeed, our recent new set of data (which was presented at 46° Incontro di Grammatica Generativa as Silleresi, S., Pagliarini, E. & Guasti, M. T. *When the interpretation of disjunctive negative sentences varies between two languages: a study on Italian-English bilingual children*) replicates the same pattern of results presented in Pagliarini, Crain, Guasti (2018).

a given language. The present set of results did not indicate that such forms boosted children's resetting of the value of the Disjunction Parameter in all three of the relevant languages, contrary to the experimental hypothesis. In fact, the blocking effect, or its equivalent, could only be found in the study of Italian. This raises the question as to why Italian *né né* had a facilitative effect in acquisition, while French *ni ni* and Hungarian *sem sem* did not.

We think that a possible explanation for this variation lies in the differences between the available alternative constructions across the three languages. In what follows we will speculate that it may be necessary to consider a combination of factors simultaneously: (i) the degree of surface similarity between the negative sentences with disjunction and the alternative constructions that can act as a “blocker”; (ii) the number of competing forms in the set of elements all expressing disjunction, measured by the number of morpho-syntactically different synonymous constructions in this set. We then show how these differences might affect the strength of the blocking effect.

In Italian the NEG ... *né né* and the NEG ... *o* constructions have distinct meanings, but they differ only in one respect (one contains *né né* and the other contains *o*), thus straightforwardly forming a minimal pair at surface level. In French, negation is expressed by two discontinuous expressions, a clitic negation, “*ne*”, which optionally occurs in preverbal position and adverbial negation “*pas*”, which obligatorily occurs in postverbal position, as in (32a). Like other neg-words in French, the pair *ni ni* can occur both with and without the negation “*pas*”, but this gives rise to different readings. Without “*pas*” there is a single negation reading (32b), while with “*pas*” there is a double negation reading (32c). In both cases the clitic “*ne*” is optional.

- 32a. Marie (n') a pas mangé la pomme ou la banane.
 Mary (CL) has NEG eaten the apple or the banana
 ‘Mary didn’t eat the apple or the banana.’
- b. Marie (n') a mangé ni la pomme ni la banane.
 Mary (CL) has eaten nor the apple nor the banana.
 “Mary ate neither the apple nor the banana.”
- c. Marie (n') a pas mangé ni la pomme ni la banane.
 Mary (CL) has NEG eaten nor the apple nor the banana.
 “It is not the case that Mary ate neither one” (so, she ate both).

So, in French, unlike Italian, the construction NEG ... *ou* and the *ni ni* construction do not form a minimal pair at surface level. This suggests that merely having an alternative form that unambiguously conveys the “neither” meaning is not sufficient for the blocking effect to work. It is possible that what matters is the degree of surface similarity between the negative sentences with disjunction and the competing constructions in the set of alternatives. In Italian, both recursive *né* and *o* are c-commanded by negation, and form a minimal pair at surface level with different scope properties. On this basis the child can conjecture that while they both express the same underlying logical operator \vee , they convey different meanings. This might be a required property for the blocking effect to work at an early age. Indeed, recent results in Catalan replicated the bimodal pattern of results in Italian (Pagliarini et al., 2021). Catalan has recursive *ni* licensed by negation which unambiguously expresses the “neither” interpretation and forms a minimal pair with negative sentences with disjunction *o*. In Catalan, disjunction *o* was interpreted as +PPI in negative sentences with disjunction by the adults (“not this or not that” reading). As for Catalan children, a subset behaved like adults, consistently accepting negative sentences with disjunction when just one disjunct was false (Silver medal).

This brings us to Hungarian. While the Italian *né né* construction has a straightforward and syntactically uniform use, in Hungarian, the *sem sem* construction varies quite a bit across

different syntactic contexts. In one case, the *sem sem* pair of negative particles obligatorily co-occurs with clausal negation NOT, both when *sem sem* particles are post-verbal and when they are pre-verbal (33a,b). In (33a,b) the correlative negative particles *sem sem* relate the two phrases (XP and YP in the pattern SEM XP, SEM YP) without any overt coordinator.¹⁴

33a. János **nem** ette meg **sem** az almát **sem** a körtét.

John NEG ate PRT nor the apple nor the pear

b. János **sem** az almát **sem** a körtét **nem** ette meg.

John nor the apple nor the pear NEG ate PRT

“John ate neither the apple nor the pear.”

In another case, Hungarian has the *sem sem* pair of negative particles with an overt conjunction as the coordinator (34a,b). In this case, *sem* immediately follows the coordinated phrases (rather than immediately precede them, as in (33) above). A further important difference is that in this case if *sem sem* is post-verbal, the clausal negation NEG must appear before the verb, while when *sem sem* is pre-verbal, then clausal negation NEG must be absent.

34a. János **nem** ette meg az almát **sem** és a körtét **sem**.

John NEG ate PRT the apple nor and the pear nor

b. János az almát **sem** és a körtét **sem** (***nem**) ette meg

John the apple nor and the pear nor (*NEG) ate PRT

“John ate neither the apple nor the pear.”

All four sentence forms in (33a,b) and (34a,b) above are practically synonymous, despite looking syntactically different (the deeper difference lies between (33a,b) and (34a,b)). The pattern in (33) and the one in (34) are parallel to two different syntactic patterns observed with neg-words in Negative Concord, thus they form part of the overall hybrid nature of the Hungarian system of Negative Concord (Surányi, 2006). In one pattern, the neg-word is not followed by the particle *sem*, and sentential negation is obligatory independently of whether the neg-word is fronted or not (35a,b), while in the other pattern, in which the neg-word is followed by the particle *sem*, negation is obligatory when the neg-word is post-verbal, while it must be absent when the neg-word is fronted to a pre-verbal position (36b).

35a. János **nem** evett meg **semmit**.

John NEG ate PRT nothing

b. János **semmit nem** evett meg.

John nothing NEG ate PRT

“John ate nothing.”

36a. János **nem** evett meg **semmit sem**.

John NEG ate PRT nothing nor

b. János **semmit sem** (***nem**) evett meg.

John nothing nor (*NEG) ate PRT

“John ate nothing.”

This suggests that it may be hard for Hungarian learners to form the set of competing disjunctive forms in Hungarian given these different constructions in which *sem sem* occurs. Thus, the complexity of the hybrid pattern involving *sem sem* might have contributed to the

¹⁴PRT stands for verbal particle. The verbal particles in the Hungarian examples in this paper have a telicizing function and are independent of Negative Concord.

difference in the acquisition of negative sentences with disjunction between Italian and Hungarian. While this remains speculative at the moment, and deserves a systematic investigation in the future, the idea that the syntactic and semantic complexity of an alternative lexical form that unambiguously conveys the “neither” meaning matters in the acquisition of the regular disjunction form in negative sentences can be applied to Turkish. As discussed in the Introduction, Turkish adults have a “not this or not that” interpretation, but children assign a “neither” interpretation to negative sentences with disjunction (Geçkin et al., 2015; Geçkin et al., 2017). Turkish is also a negative concord language and has an NPI OR form like Italian *né né*, exemplified in (38). However, in Turkish, the system of negative concord is hybrid, with negative words behaving one way and *ne ne* in another way. In fact, negative words must always co-occur with negation, as seen in (37), whereas, with *ne ne* (38), negation is optional. And when it is present, the sentence is ambiguous: both a negative concord and a double negation reading is available (Jeretič, 2017).

37. **Hiç** kimse gel-*(**me**)-di.

Nobody come-*(NEG)-PAST.

Nobody came.

38. **Ne Ali ne Best** gel-(**me**)-di

NOR Ali NOR Best come-NEG-PAST

Neither Ali nor Best came/Neither Ali nor Best didn't come.

Furthermore, in Turkish, disjunction is expressed by two distinct morphemes, *ya ya da* and *veya*. Both expressions can occur with disjoined phrases whether they are case-marked or not, as seen in (39).¹⁵ When the disjunction phrases are case marked (and thus definite), the sentence has a ‘not this or not that’ reading; when they are not case marked (and thus non-definite) the sentence has a ‘neither’ meaning (Geçkin et al., 2015).¹⁶

39a. Domuz-cuk *ya* havuc-u *ya da* biber-i ye-*me*-di.

This animal-DIM either carrot or pepper eat-NEG-PAST.

Meaning ‘It was either a certain carrot or a certain pepper that this animal didn't eat’.

b. Domuz-cuk *ya* havuc *ya da* biber ye-*me*-di.

This animal-DIM either carrot or pepper eat-NEG-PAST. Meaning:

‘This animal didn't eat carrots and this animal didn't eat peppers’.

Turkish-speaking children and adults both assigned the “neither” reading when the disjunctive phrases were not case marked. But when the disjunctive phrases were case marked, adults assigned the “not this or not that” reading, while children still assigned the “neither” meaning (Geçkin et al., 2015). Therefore, in Turkish, the syntax (optional negation) and semantics (definiteness associated with accusative case) of the inventory of disjunction forms is more complex than in Italian. Like for Hungarian children, it is possible that it is harder for

¹⁵DIM stands for diminutive affix.

¹⁶One possible way to conceptualize this situation is to say that OR is +PPI in Turkish. When nouns are accusative marked, they are definite and OR can scope out (along with the NPs it occurs with). When nouns are not accusative case marked they are not definite. Wide scope is not possible, because these NPs have to be licensed by negation. A similar situation occurs in Italian. When one of the disjuncts includes a NPI, the “not this or not that” reading is no longer available (the “neither” reading becomes available), as the disjunctive phrase must be licensed by the negation for the NPI to be licensed. This is seen in (i):

(i) Da quel giorno Mario non lesse alcun giornale o settimanale.

From that day Mario NEG read any journal or weekly publication.

This explanation is different from that in Geçkin et al. (2015)

Turkish children to acquire the full set of competitors and apply the blocking principle.¹⁷ Therefore, a second required property for the blocking effect to work at an early age seems to be the limited number of simple alternative forms in the set of disjunctions.

Clearly, the results of the present study alone are not sufficient to support such a complex speculation. Yet, they offer an indication that the blocking effect as proposed by Pagliarini, Crain, Guasti (2018) is too simplistic to capture the earlier convergence to the adult grammar.

Conclusion

In this study we investigated the interpretation of negative sentences with disjunction in Dutch, French, Hungarian and Italian in both child and adult language. The main aim was to test the hypothesis raised by Pagliarini, Crain, Guasti (2018) according to which the availability of a lexical form that expresses “neither” in a language (French: *ni ni*; Hungarian: *sem sem*; Italian: *né né*) effectively blocks the “neither” interpretation of negative sentences with disjunction – when disjunction is a +PPI – and leads children to converge earlier to the target value of the disjunction parameter. We demonstrated experimentally that disjunction in negative contexts is interpreted differently by adults speaking Dutch, on the one hand, and adults speaking French, Italian and Hungarian, on the other. We also found evidence from two new languages, French and Hungarian, that children start with assuming the “neither” reading, in contrast to adults. We did not find support for the hypothesis that children can reset the Disjunction parameter to the +PPI value earlier in all languages that have a dedicated alternative lexical form that expresses the $\neg A \wedge \neg B$ (“neither nor”) meaning.

This is one of the few existing systematic experimental studies of crosslinguistic variation in the interpretation of negative disjunctive sentences. Moreover, the experiments reported here are, to our knowledge, the first to demonstrate the +PPI value of disjunction in three different languages. Certainly, these findings will need to be further confirmed by larger scale crosslinguistic and experimental studies including more languages that show that these tendencies do in fact hold across contexts and linguistic environments. Recently, Lungu et al., (2021) reported experimental findings showing that narrow scope reading of disjunction in negative sentences is also available in Italian and French, thus suggesting that the parametric distinction between plus and minus PPI is less robust than commonly assumed. It is possible that, in French and Italian, both readings exist but the OR>NEG interpretation is favored under discourse conditions that were satisfied in our study. Future studies might also investigate cross-linguistically the role of intonation in the interpretation of negative disjunctive sentences. A recent study by Larralde et al. (Larralde et al., 2020) showed that when the disjunct is prosodically focused in negative sentences, French adult speakers prefer the OR>NEG interpretation whereas when the sentences were prosodically neutral, they preferred the NEG>OR interpretation. As for languages where disjunction is a –PPI element, the wide-scope reading of disjunction might also be obtained by using a specific intonation contour, for instance, by stressing the disjunction element itself, a suggestion that deserves adequate future empirical investigation.

Acknowledgments

We would like to thank all the children who participated in the study, their teachers and their parents. The Dutch part of the project was done in close collaboration with Jack Hoeksema. We gratefully acknowledge his input as well as the feedback from the Acquisition Lab participants at the Center for Cognition and Language Groningen. We are very grateful to Florent Roul and Caroline Plet, who helped collecting the French data, and Mieke Slim and Annika van Wijk for collecting the Dutch data. Thanks also to Dorothy An, for providing the pictures used in the experiment.

The work of L. Pintér and B. Surányi was supported by grant no. KH 130558 of the Hungarian National Research, Development and Innovation Fund.

¹⁷It is also possible that Turkish-speaking children may not have been sensitive to case-marking (definiteness) in addition to the fact that they may be puzzled by the existence of two patterns depending on case marking. Further investigation is needed to establish whether Turkish-speaking children are indeed sensitive to case marking.

We gratefully acknowledge support from the Netherlands Organization for Scientific Research NWO (GraMALL, Grasping Meaning across Languages and Learners, 2014-2017, PI A. van Hout)."

Authors' contributions

E.P. and M.T.G. conceived the project, E.P. designed the experiment, A.v.H. O.L., L.P., B.S. adapted the material to the respective languages; A.v. H, O.L., E.P., L.P. collected the data, E.P. analyzed the data, E.P. wrote and revised all the sections of the paper, A.v. H., O.L., L.P., B.S., S.C and M.T.G. revised various sections of the paper.

Disclosure statement

The authors declare that they have no competing interests.

ORCID

Elena Pagliarini  <http://orcid.org/0000-0002-8644-0984>
 Angeliek van Hout  <http://orcid.org/0000-0002-4971-7243>
 Lilla Pintér  <http://orcid.org/0000-0002-3930-2327>
 Balázs Surányi  <http://orcid.org/0000-0003-2818-9872>
 Stephen Crain  <http://orcid.org/0000-0002-6370-7447>
 Maria Teresa Guasti  <http://orcid.org/0000-0002-4470-4187>

References

- Barr, D. J., Levy, R., Scheepers, C., & Tily, H. J. (2013). Random effects structure for confirmatory hypothesis testing: Keep it maximal. *Journal of Memory and Language*, 68(3), 255–278. <https://doi.org/10.1016/j.jml.2012.11.001>
- Chierchia, G., Crain, S., Guasti, M. T., Gualmini, A., & Meroni, L. (2001). The acquisition of disjunction: Evidence for a grammatical view of scalar implicatures. A.H.-J Do, L Dominguez, A Johansen (Eds.), *Proceedings of the 25th Boston University Conference on Language Development*, Cascadilla Press, Somerville, MA (2001), pp. 157–168
- Crain, S., Ni, W., & Conway, L. (1994). Learning, parsing and modularity. In C. Clifton, L. Frazer, & K. Rayner (Eds.), *Perspective on sentence processing* (pp. 443–467). Lawrence Erlbaum.
- Crain, S. (2012). *Emergence of meaning*. Cambridge University Press.
- Crain, S., & Khlentzos, D. (2010). The logic instinct. *Mind & Language*, 25(1), 30–65. <https://doi.org/10.1111/j.1468-0017.2009.01380.x>
- Crain, S., & Thornton, R. (1998). *Investigations in universal grammar*. MIT Press.
- Dalrymple, M., Kanazawa, M., Kim, Y., Mchombo, S., & Peters, S. (1998). Reciprocal expressions and the concept of reciprocity. *Linguistics and Philosophy*, 21(2), 159–210. <https://doi.org/10.1023/A:1005330227480>
- Dalrymple, M., Kanazawa, M., Mchombo, S., & Peters, S. (1994). What do reciprocals mean? M. Harvey L. Santelmann (Eds) *Proceedings of Semantics and Linguistics Theory 4* Cornell University Ithaca, N.Y 61–78 <https://doi.org/10.3765/salt.v4i0.2466>
- De Hoop, H. (1992). *Case configuration and NP interpretation*. Doctoral dissertation, University of Groningen. Published in 1996 by Garland Publishing.
- Foppolo, F., Guasti, M. T., & Chierchia, G. (2012). Scalar implicatures in child language: Give children a chance. *Language Learning and Development*, 8(4), 365–394. <https://doi.org/10.1080/15475441.2011.626386>
- Geçkin, V., Crain, S., & Thornton, R. (2015). The interpretation of logical connectives in Turkish. *Journal of Child Language*, 43(04), 784–810. <https://doi.org/10.1017/S0305000915000306>
- Geçkin, V., Thornton, R., & Crain, S. (2017). Children's interpretation of disjunction in negative sentences: A comparison of Turkish and German. *Language Acquisition*, 25(2), 197–212. <https://doi.org/10.1080/10489223.2017.1280796>
- Giannakidou, A. (2006) N-words and negative concord. In M. Everaert and H. van Riemsdijk (Ed.), *The Blackwell companion to syntax*, volume III, 327–391. Oxford: Blackwell.
- Goro, T. (2004). Japanese disjunction and the locality of positive polarity. In *Poster presented at Georgetown university round table*. Washington DC.
- Goro, T., & Akiba, S. (2004a). Japanese disjunction and the acquisition of positive polarity. In Y. Otsu (Ed.), *Proceeding of the 5th Tokyo conference on psycholinguistics* (pp. 137–162). Hituzi Shobo.
- Goro, T. (2007). *Language-specific constraints on scope interpretation in first language acquisition*. Unpublished doctoral dissertation, University of Maryland.

- Goro, T., & Akiba, S. (2004b). The acquisition of disjunction and positive polarity in Japanese. In *Proceedings of the 23rd West Coast conference on formal linguistics* (pp. 251–264). Summerville, MA: Cascadilla Press.
- Grice, H. P. (1975). Logic and conversation. In *Speech acts* (pp. 41–58). Brill.
- Hoeksema, J. (2014). De plaats van het voorzetselvoorwerp. *Nederlandse Taalkunde*, 19(2), 221–244. <https://doi.org/10.5117/NEDTAA2014.2.HOEK>
- Huttenlocher, J., Vasilyeva, M., Cymerman, E., & Levine, S. (2002). Language input and child syntax. *Cognitive Psychology*, 45(3), 337–374. [https://doi.org/10.1016/S0010-0285\(02\)00500-5](https://doi.org/10.1016/S0010-0285(02)00500-5)
- Jackson, S. C., & Roberts, J. E. (2001). Complex syntax production of African American preschoolers. *Journal of Speech, Language, and Hearing Research*, 44(5), 1083–1096. [https://doi.org/10.1044/1092-4388\(2001\)086](https://doi.org/10.1044/1092-4388(2001)086)
- Jeretić, P. (2017). *Turkish 'neither . . . nor' and optional negative concord*. Ms., New York University.
- Jing, C. (2008). *Pragmatic computation in language acquisition: Evidence from disjunction and conjunction in negative context*. University of Maryland.
- Larraalde, C., Konradt, A., & Szendrői, K. E. (2020). Information structure and scope interactions: disjunction wide scope induced by focus. *Frontiers in Communication*, 5, 131.
- Larson, R. K. (1985). On the syntax of disjunction scope. *Natural Language & Linguistic Theory*, 3(2), 217–264. <https://doi.org/10.1007/BF00133841>
- Lungu, O., Falaus, A., & Panzeri, F. (2021). Disjunction in negative contexts: A cross-linguistic experimental study. 38 (2), 221–247.
- Moscatti, V., & Crain, S. (2014). When negation and epistemic modality combine: The role of information strength in child language. *Language Learning and Development*, 10(4), 345–380. <https://doi.org/10.1080/15475441.2014.880640>
- Noveck, I. A. (2001). When children are more logical than adults: Experimental investigations of scalar implicature. *Cognition*, 78(2), 165–188. [https://doi.org/10.1016/S0010-0277\(00\)00114-1](https://doi.org/10.1016/S0010-0277(00)00114-1)
- Pagliarini, E., Bill, C., Romoli, J., Tieu, L., & Crain, S. (2018). On children's variable success with scalar inferences: Insights from disjunction in the scope of a universal quantifier. *Cognition*, 178, 178–192. <https://doi.org/10.1016/j.cognition.2018.04.020>
- Pagliarini, E., Crain, S., & Guasti, M. T. (2018). The compositionality of logical connectives in child Italian. *Journal of Psycholinguistic Research*, 47(1), 1–35. <https://doi.org/10.1007/s10936-018-9596-1>
- Pagliarini, E., Reyes, M. A., Guasti, M. T., Crain, S., & Gavarró, A. (2021). Negative sentences with disjunction in child Catalan. *Language Acquisition*, 28(2), 153–165. <https://doi.org/10.1080/10489223.2020.1860055>
- Papafragou, A., & Musolino, J. (2003). Scalar implicatures: Experiments at the semantics--pragmatics interface. *Cognition*, 86(3), 253–282. [https://doi.org/10.1016/S0010-0277\(02\)00179-8](https://doi.org/10.1016/S0010-0277(02)00179-8)
- Shimada, H., & Goro, T. (2020). On the source of children's conjunctive interpretation of disjunction: Scope, strengthening, or both? *Language Acquisition*, 28(2), 98–130. <https://doi.org/10.1080/10489223.2020.1803330>
- Spector, B. (2014). Global positive polarity items and obligatory exhaustivity. *Semantics and Pragmatics*, 7(11), 1–61. <https://doi.org/10.3765/sp.7.11>
- Surányi, B. (2006). Quantification and focus in negative concord. *Lingua*, 116(3), 272–313. <https://doi.org/10.1016/j.lingua.2004.08.007>
- Szabolcsi, A. (2002). Hungarian disjunctions and positive polarity. In I. Kenesei, & P. Siptár (Eds.), *Approaches to Hungarian 8*. Budapest: Akadémiai Kiadó. .
- Tieu, L., Yatsushiro, K., Cremers, A., Romoli, J., Sauerland, U., & Chemla, E. (2016). On the role of alternatives in the acquisition of simple and complex disjunctions in French and Japanese. *Journal of Semantics*, 34(1), 127–152. <https://doi.org/10.1093/jos/ffw010>
- Van Bergen, G., & De Swart, P. (2010). Scrambling in spoken dutch: Definiteness versus weight as determinants of word order variation. *Corpus Linguistics and Linguistic Theory*, 6(2), 267–295. <https://doi.org/10.1515/cllt.2010.010>
- Vasilyeva, M., Waterfall, H., & Huttenlocher, J. (2008). Emergence of syntax: Commonalities and differences across children. *Developmental Science*, 11(1), 84–97. <https://doi.org/10.1111/j.1467-7687.2007.00656.x>
- Zanuttini, R. (1997). *Negation and clausal structure: A comparative study of romance languages*. Oxford University Press.
- Zeijlstra, H. H. (2004). *Sentential negation and negative concord*. Doctoral dissertation, University of Amsterdam.