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Coloring disjunction in child Romanian

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Abstract. Romanian children have been shown to rarely interpret the complex disjunction *sau...sau* ‘either...or’ (as in *sau trenul sau barca* ‘either the train or the boat’) exclusively (that is, as ‘only one, not both’) in Truth Value Judgment Tasks. Instead, children often favor an inclusive interpretation (‘one or both’), or a conjunctive interpretation (‘both, not just one’) (Bleotu et al. 2023, 2024a). Such findings contrast with those from Romanian adults, who consistently interpret this disjunction exclusively. In this study, we investigate whether children interpret *sau...sau* more exclusively in a Coloring Book Task (CBT), given previous evidence that children’s performance is more adult-like in tasks involving coloring rather than in truth value judgment tasks. In line with this expectation, we observed an increase in the number of exclusive-responding children compared to previous findings for Romanian. However, it is important to highlight that most children still did not interpret the disjunction exclusively, indicating ongoing challenges with the interpretation of disjunction around the age of five years.

Keywords. First language acquisition; Romanian; disjunction; exclusivity; coloring task

1. Introduction. Children have been argued to be more logical than adults in their interpretation of quantifiers, modals, and disjunction (see, for instance, Noveck 2001, Papafragou & Musolino 2003). Recent studies show that children’s performance on implicatures may vary with the task: while children tend to find Truth Value Judgment Tasks (TVJT) more challenging, they perform more adult-like in act-out tasks (Pouscoulous et al. 2007), ternary reward tasks (Katsos & Bishop 2011), felicity judgment tasks (Chierchia et al. 2001, Foppolo et al. 2012), story-based tasks (Guasti et al. 2005), and, as shown more recently, in coloring and erasing tasks (Bleotu 2018, Nuninga et al. 2023). In the present study, we investigate disjunction in child Romanian using the Coloring Book Task (CBT) to determine whether children’s responses align more closely with an adult-like, exclusive interpretation (that is, understanding disjunction to be true when only one of the disjuncts, and not both, is true), compared to what has been reported in TVJT studies. For instance, in response to a disjunctive utterance such as (1), adult-like children should show the

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following behavior: if none of the objects has color, they should color just one of them, but not both; if one of these objects has color, they should do nothing; on the other hand, if both have color, they should erase the color of one of them, in line with exclusivity.

- (1) Aş vrea să aibă culoare **sau** triunghiul **sau** cercul.
 would.1SG like SBJV have.SBJV.3 color or triangle.DEF or circle.DEF
 ‘I would like either the triangle or the circle to have color.’

2. Background.

2.1. THE ACQUISITION OF DISJUNCTION. Previous studies show that adults interpret disjunctive utterances containing simple disjunctions (consisting of a single disjunctive morpheme *or*) exclusively and inclusively, while they interpret complex disjunctions (such as *either...or*) predominantly exclusively in most contexts (see Table 1) (Chierchia et al. 2001, Gualmini et al. 2001, Nicolae & Sauerland 2016, Nicolae et al. 2024, a.o.). In contrast, children interpret both disjunctions inclusively or conjunctively (see Singh et al. 2016, Tieu et al. 2017), but rarely exclusively (see, nevertheless, Sauerland & Yatsushiro 2018, for evidence that German children can be exclusive).

	<i>The hen pushed (either) the train or the boat.</i>
Inclusive	<i>The hen pushed one and possibly both.</i>
Exclusive	<i>The hen pushed only one, not both.</i>
Conjunctive	<i>The hen pushed both, not just one.</i>

Table 1: Possible interpretations for the disjunctive utterance
The hen pushed (either) the train or the boat

Children’s inclusivity is typically explained as a logical interpretation of disjunction (Noveck 2001). Children’s conjunctive interpretation, on the other hand, has received different explanations: (i) an implicature (Singh et al. 2016, Tieu et al. 2017), (ii) ambiguity between disjunction and conjunction (Sauerland & Yatsushiro 2018), and (iii) an experimental artifact (Huang & Crain 2020, Skordos et al. 2020).

As far as child Romanian is concerned, in several TVJTs, Bleotu et al. (2023, 2024a) have shown Romanian children to be inclusive with simplex *sau* ‘or’ and complex *sau...sau* ‘either...or’, but inclusive and conjunctive with the complex disjunction *fie...fie* ‘either...or’. Very few children interpreted either of these disjunctions exclusively. Bleotu et al. (2024b, 2024c) investigated whether children become more exclusive with a disjunctive utterance (such as *The hen pushed the train or the boat*) in the presence of access to the stronger conjunctive alternative (i.e., when hearing unrelated conjunctive utterances such as *The deer chose a cake and a salad*) or in contexts that make exclusivity relevant (such as after the non-conjunctive question *Did the hen push these two objects?*). The findings from Bleotu et al. (2024b, 2024c) suggest that neither mere access to stronger conjunctive alternatives, nor mere exposure to relevant non-conjunctive questions on their own lead to a boost in exclusive interpretations of implicatures. Children are, however, more adult-like with disjunctive utterances that represent answers to conjunctive questions (such as *Did the hen push the train and the boat?*). This suggests that both access to the conjunctive alternative and relevance of this alternative are needed to increase children’s exclusivity. These results are in contrast to those previously obtained by Skordos & Papafragou (2016) for quantifiers, where access to alternatives and relevance separately were found to lead to more implicatures. Overall, these findings suggest that the acquisition of disjunction may be more developmentally challenging than the acquisition of quantifiers. The current study expands the

previous investigation and explores another potential factor that may boost exclusivity, namely the nature of the task, focusing on a special type of Act-Out Task involving coloring items in such a way as to make the target sentences true.

2.2. ACT-OUT AND COLORING TASKS. Implicature rates in children vary significantly depending on the task. Binary TVJTs tend to be more challenging, while Act-Out Tasks – involving an action such as giving rewards or moving objects to make a sentence true – yield higher implicature rates (e.g., Pouscoulous et al. 2007). One argument could be that children’s varying engagement with a task can make implicatures more or less relevant in a context. Another argument could be that Act-Out Tasks are preference-based tasks, and children’s preferences may be different from what they may accept when making a forced choice judgment. For instance, reward tasks have been shown to enhance implicature production. Papafragou & Tantalou (2004) found that children derived more implicatures when rewarding an animal based on how accurately it described its actions. Similarly, Katsos & Bishop (2011) showed that children were sensitive to underinformativeness when giving strawberries as rewards. The authors argued that the results from binary TVJTs do not reveal children’s failure with implicatures but rather their pragmatic tolerance of underinformativeness. Additionally, Bleotu et al. (2021a, 2021b, 2022) found that, in a reward task in which they had to reward the best descriptions with the highest reward, adults derived more implicatures from utterances containing *poate* ‘maybe’ than in a TVJT, and, while not fully adult-like, children also performed well in this task.

Pouscoulous et al. (2007) also found quite high implicature rates with French quantifiers in various age groups in an Act-Out Task. They tested *quelques* ‘some’, *tous/toutes* ‘all’, *aucun(e)* ‘no’, and *quelques...ne...pas* ‘some...not’ utterances embedded under *Je voudrais* ‘I would like’ in three types of scenarios: a *Subset* Scenario, where 2 of 5 boxes had tokens, an *All* Scenario, where all 5 boxes had tokens, and a *None* Scenario, where 0 of 5 boxes had tokens. Depending on their interpretation, participants were expected to add tokens, remove tokens, or leave things as they were. For instance, in an *All* Scenario, a puppet uttered *Je voudrais que quelques boîtes contiennent un jeton* ‘I would like some boxes to contain a token’ in a scenario where each of five boxes already contained a token. If participants understood this utterance with a *some but not all* implicature, then they were expected to remove at least one token. If, on the other hand, they understood *some* as *some and possibly all* (that is, inclusively), they were expected to leave the boxes unchanged. Importantly, most children here removed at least one token, thus showing evidence of having derived the implicature. Given children’s relative success with quantifiers in this paradigm, we adapted it in our study to extend the investigation to disjunction. Importantly though, instead of using an act-out procedure involving adding, removing, or leaving objects in place, participants were asked to color certain images, erase, or do nothing.

The Coloring Book Task (CBT) was developed by Zuckerman et al. (2016) and Pinto & Zuckerman (2019). In this task, participants do not explicitly state their choices using words but rather indicate their preferences by coloring specific items on a coloring sheet. This methodological approach offers a notable advantage: participants do not need to verbalize their answers, but instead, their choices are reflected through their actions, which can often be more reliable than explicit verbal responses.

The CBT satisfies two critical requirements for language comprehension tasks (Zuckerman et al. 2016). First, it provides alternatives without explicitly presenting them. This circumvents a key methodological issue found in the TVJT, namely, the explicit presence of alternatives. According to Zuckerman et al. (2016: 444), the explicit presence of alternatives forces the subject to

consciously consider potential interpretations that may not naturally arise, which can influence the selection process. The CBT avoids this by allowing participants to make choices through their actions rather than through explicit and metalinguistic answers. An additional advantage of the CBT, according to Zuckerman et al. (2016), is its engagement appeal, particularly for children. The activity of coloring is inherently engaging, often leading to higher levels of participation. This feature makes it a useful tool for studying language comprehension in younger populations.

Zuckerman et al. (2016) employed the CBT to investigate (a) passives and (b) Principle B of the Binding Theory, testing 58 Dutch-speaking children aged 3;11 to 8;07, and reported more adult-like performance compared to a traditional Picture Selection Task. Similarly, Gerard et al. (2017, 2018) and Gerard & Lidz (2018) examined children's performance on adjunct control using both a CBT and a TVJT, and found that children provided more adult-like responses in the CBT than in the TVJT. For example, participants were presented with sentences like (2):

(2) Dora washed Diego before PRO eating the red apple.

They were then asked to color the apple. Depending on whether they associated the apple with Dora or Diego, participants' responses reflected whether PRO was co-indexed with the subject (Dora) or the object (Diego).

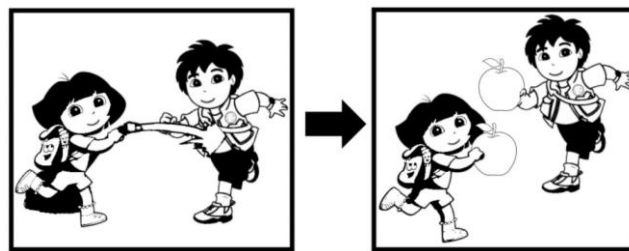


Figure 1: Example pictures from Gerard & Lidz (2018)

Bleotu (2018) further explored the potential of the CBT by testing 18 five-year-olds on implicature derivation using quantifiers, comparing it with three other methods: the TVJT, the Picture Selection Task, and the Erasing Task. The results showed that children mastered the meaning of existential quantifiers in the CBT and in the Erasing Task. Notably, while the CBT may be argued to show that children grasped the meaning of existential quantifiers, the Erasing Task confirmed that they were also pragmatically sensitive to scales, deriving scalar implicatures with existential quantifiers as early as five years old.

Bleotu (2024) also applied the CBT to test 25 Romanian-speaking five-year-olds on their understanding of modal statements, with results indicating that children understood the meaning of epistemic adverbs. Nonetheless, the CBT does not always elicit adult-like responses. For instance, Hall & Pérez-Leroux (2022) found that children's responses were at chance when tested on comitatives (e.g., *The dog with the bone is blue*) but more adult-like when tested on coordinated NPs (e.g., *The cup and the table are green*). This suggests that the CBT is able to reveal when children have a different understanding of a particular syntactic structure.

Thus, while the CBT generally leads to adult-like responses, particularly in the context of language comprehension, it can also highlight differences in children's understanding, making it a valuable tool for assessing linguistic development.

3. Current experiment. Previous TVJT studies reveal that children are mostly inclusive with the complex disjunction *sau...sau*, in contrast to adults, who are typically exclusive (see Bleotu et al.

2023, 2024a). The current study investigates whether children are (more) exclusive with the complex disjunction *sau...sau* in a Coloring Book Task.

3.1. PREDICTIONS. Considering that children are reported to be more adult-like in Act-Out Tasks (including coloring tasks), we expect to observe more evidence of exclusive interpretations of disjunction compared to what has previously been reported in TVJT studies (Bleotu et al. 2023, 2024a). Nevertheless, given previous findings that Romanian children are primarily inclusive with *sau...sau* and often struggle with deriving exclusivity (they are more adult-like only in the presence of both explicit alternatives and relevance), children might experience challenges in deriving implicatures with disjunction more so than what has been reported for quantifiers.

3.2. PARTICIPANTS. We tested 34 five-year-old monolingual Romanian-speaking children (5;00-5;11, M=5;06) and 40 adult controls.

3.3. METHODOLOGY. The experiment employed a Coloring Book Task, drawing largely on the Act-Out Task conducted by Pouscoulous et al. (2007), testing children's interpretation in multiple scenarios that required addition, removal, or no action whatsoever. Participants were introduced to a puppet named Bibi whose wishes they had to fulfill by coloring objects, erasing the color of objects, or taking no action. They saw displays of vehicles/fruits/shapes/vegetables in which *none*, *some*, or *all* of the objects were colored (Figure 2a-c).

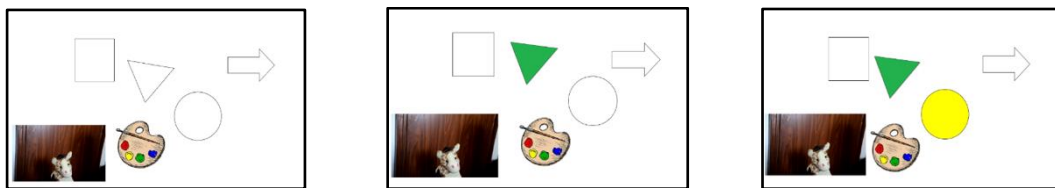


Figure 2: (a) 0-Object Scenario vs. (b) 1-Object Scenario vs. (c) 2-Object Scenario

They then heard a recorded statement left by Bibi on WhatsApp as in (3), and they had to fulfill her wish. The materials consisted of 6 warm-up statements balanced for action (coloring/erasing/doing nothing), 36 critical sentences, and 15 fillers (also balanced for action). The experiment tested disjunctive sentences containing the complex disjunction *sau...sau*, such as (3a), in three kinds of scenarios: the 0-Object Scenario (containing no colored objects, see Figure 2a), the 1-Object Scenario (containing one colored object, see Figure 2b), and the 2-Object Scenario (containing two colored objects, see Figure 2c). We also tested conjunctive (3b) and negative (3c) sentences as controls in these three scenarios.

- (3) a. Bibi: Aș vrea să aibă culoare **sau** triunghiul **sau** cercul.
would.1SG like SBJV have.SBJV.3 color or triangle.DEF or circle.DEF
'I would like either the triangle or the circle to have color.'
- b. Bibi: Aș vrea să aibă culoare triunghiul **și** cercul.
would.1SG like SBJV have.SBJV.3 color triangle.DEF and circle.DEF
'I would like the triangle and the circle to have color.'
- c. Bibi: Aș vrea să nu aibă culoare **nici** triunghiul **nici** cercul.
would.1SG like SBJV NEG have.SBJV.3 color neither triangle.DEF nor circle.DEF
'I would like neither the triangle nor the circle to have color.'

3.4. PREDICTIONS. For disjunctive *sau...sau* statements, we expected adults to color one object in the 0-Object Scenario, do nothing in the 1-Object Scenario, and erase the color of an object in the 2-Object Scenario, while we expected more variability in children's answers given previously reported inclusive/conjunctive behavior (Table 2). Nevertheless, given the CBT's success in eliciting adult-like performance in children, we expected some proportion of exclusive responses.

Scenario <i>Initial situation</i>	Inclusive Participants <i>A or B, possibly (A and B)</i>	Exclusive Participants <i>(A or B) but not (A and B)</i>	Conjunctive Participants <i>A and B</i>
0-Object	Color 1 or 2 objects	Color 1 object	Color 2 objects
1-Object	Do nothing or color 2 nd object	Do nothing	Color 1 object
2-Object	Do nothing	Erase 1 object	Do nothing

Table 2: Predicted responses for disjunctive statements per participant type in the three scenarios

3.5. RESULTS. Adults generally behaved as predicted, that is, they consistently preferred the exclusive interpretation (96.3%). Turning to children, we observed generally strong performance on the conjunctive controls (89%) and the negative controls (83.3%). For the disjunctive statements, however, more non-adult-like responses were observed overall. Importantly, there was variation depending on the scenario. In the 0-Object Scenario, 86% of children's responses were adult-like (coloring one object); the remaining responses involved coloring two objects instead of one. In the 1-Object Scenario, 52.2% of responses were adult-like (doing nothing); the remaining responses involved coloring a second object. In the 2-Object Scenario, 44.1% of responses were adult-like (erasing the color of one object); the remaining responses involved leaving both objects colored. These results are summarized in Table 3.

Scenario	% adult-like responses
0-Object	86
1-Object	52.2
2-Object	44.1

Table 3: Percentage of adult-like responses from children on target disjunctive trials

An individual analysis revealed that 10/34 children were consistently exclusive, 3/34 were consistently conjunctive, and the remaining 21 children showed mixed (inclusive, and/or conjunctive, and/or exclusive) behavior. A binominal test revealed that the observed proportion of exclusive children (10/34) was significantly different from chance ($p < .05$).

3.6. DISCUSSION. Here we discuss three points with regards to our main findings: the differences in patterns of interpretation that we observe between adults and children, as well as within children; possible explanations for the observed patterns of interpretation; and the methodological implications of our findings.

First, all adults responded in a manner consistent with exclusive interpretations of the disjunctive targets. Interestingly, while most children colored one object in the 0-Object Scenario, they varied in their behavior in the other scenarios: they would sometimes color nothing or color one more object in the 1-Object Scenario, and they would erase one object or simply leave the two objects colored in the 2-Object Scenario. Thus, we observe three subgroups of children: exclusive (10 children), conjunctive (3 children), mixed (21 children). We take this behavior to suggest that some children may be at a developmental stage where they oscillate between inclusive and exclusive interpretations for the complex disjunction *sau...sau*, in contrast with adults, who consistently favor the exclusive interpretation.

Based on the relatively high accuracy on the controls, we assume that children's coloring responses essentially reflect their linguistic understanding of disjunction. That is, they deploy their semantic/pragmatic meaning for disjunction to carry out their coloring actions, to make Bibi's request true on this meaning. There are, however, two alternative non-linguistic cognitive preferences or constraints that might drive participants' behavior in such a task, which we think can nevertheless be ruled out as explanations for the data. The first is that children might wish to *color as much as possible*, simply because coloring is fun (and indeed we observed that children liked coloring and even tried to use many different colors to carry out Bibi's request). The opposing strategy is to *color as little as possible*, in order to minimize effort. Teasing apart the role of non-linguistic preferences is difficult when they push in a similar direction as following the linguistic meaning of disjunction: in the 0-Object Scenario and in the 1-Object Scenario, having only one colored object is not only in line with inclusive/exclusive meanings of disjunction, but it is also in line with deploying *minimal effort*. However, in the 2-Object Scenario, the adult-like response (to erase the color of one object) involves both more effort and fewer colored objects than the non-adult-like response (which is to do nothing), i.e. it clashes both with deploying *minimal effort* and *maximizing color*, yet, even in this condition, a non-trivial proportion of children provided exclusive answers, i.e. they erased the color of one object. We thus argue that our results reflect children's linguistic understanding and cannot be accounted for on non-linguistic grounds.

We would like to end with the methodological implications of our study. We found that children seemed to be more adult-like with disjunction in this task compared to previous studies which used the TVJT (Bleotu et al. 2023, 2024a). Moreover, we found that Romanian children tended to be inclusive in their interpretation of the complex disjunction *sau...sau*. A possible explanation for this difference could be related to the fact that the binary TVJT actually reveals that children are more pragmatically tolerant than adults (Katsos & Bishop 2011), rather than that they are more logical than adults.

In contrast to the TVJT, the CBT is a preference-based task, which shows that at least some children in this age range prefer to interpret disjunction exclusively. While the TVJT can reveal the *existence* of certain interpretations, the CBT can reveal *preferences* for certain interpretations. The two tasks thus complement each other, shedding light on different aspects of children's comprehension of disjunction. Interestingly, there seems to be an asymmetry between preference and acceptance: children are more adult-like in their interpretive preferences than in their evaluation of the truth of sentences in context.

4. Conclusion. The present findings support the use of the CBT as a method for eliciting adult-like interpretations in children. Unlike the TVJT, which may simply show that children are more pragmatically tolerant than adults (Katsos & Bishop 2011), the CBT is a preference-based task, combining linguistic comprehension with non-linguistic production. In line with previous studies (Zuckerman et al. 2016, Zuckerman & Pinto 2018, Gerard et al. 2017, Gerard et al. 2018, Gerard & Lidz 2018, Bleotu 2018, 2019, Nuninga et al. 2023), preference-based tasks like the CBT elicit more adult-like responses from children. Our findings also suggest that at least some children in this age range can interpret disjunction exclusively – contra many findings from TVJT-based studies (Bleotu et al. 2023, 2024a, among others), which show that Romanian children are inclusive in their comprehension of the complex disjunction *sau...sau*. We leave for a future study a more direct comparison of children's behavior on the CBT and a parallel TVJT, which may further shed light on how exclusivity is affected by the employment of different tasks.

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