

## ***The bear wants a small green apple and a big one: Insights into anaphoric reconstruction in child and adult Romanian***

Adina Camelia Bleotu, Deborah Foucault & Tom Roeper\*

**Abstract.** We investigate how 4-year-old children reconstruct the anaphoric pronoun *unul* ‘one’ when modified by Color or Size adjectives in Romanian, an understudied Noun-Adjective language. In a Truth Value Judgment Task, in *Ursulețul vrea un măr verde mic și unul galben* ‘The bear wants a small green apple and a **yellow one**’, both adults and children accept *unul* ‘one’ to refer to *apple* or *small apple*. However, in *Ursulețul vrea un măr verde mic și unul mare* ‘The bear wants a small green apple and a **big one**’, children take *unul* ‘one’ to refer to *apple* or *green apple*, while adults only accept *green apple*. Based on these findings, we argue that while adults seem to be sensitive to hierarchical nesting in anaphoric reconstruction, children seem to operate on the basis of other reconstruction preferences at this developmental stage.

**Keywords.** Romanian; first language; anaphora; adjectives; anaphoric reconstruction

**1. Introduction.** Language makes use of multiple ambiguous situations, where the anaphor *one* can refer to N or an N’ (Pearl & Lidz 2006). In the current paper, we investigate how children reconstruct the anaphoric pronoun *unul* ‘one’ in Romanian when the referential noun is modified by Color *and* Size adjectives, and the anaphor is modified by a Color *or* a Size adjective.

- (1) a. Ursulețul vrea un măr verde mic și **unul galben.**  
 bear.the wants an apple green small and one.the.N.SG yellow  
 ‘The bear wants a small green apple and a **yellow one.**’
- b. Ursulețul vrea un măr verde mic și **unul mare.**  
 bear.the wants an apple green small and one.the.N.SG big  
 ‘The bear wants a small green apple and a **big one.**’

While multiple studies have been conducted on anaphoric reconstruction in other languages (such as English: Lidz, Waxman & Freeman 2003; German: Hubert 2009; Italian: Tasinato & Sanfelici 2022), our study is the first to explore anaphoric reconstruction of *unul* ‘one’ experimentally in child and adult Romanian. Our goal is to establish whether Romanian children and adults prefer anaphoric reconstruction to N or N’, and whether their preferences differ in any way. In (1a), for instance, where the pronoun *unul* ‘one’ is modified by the color adjective *galben* ‘yellow’, does *unul* ‘one’ refer to *un măr* ‘an apple’ or *un măr mic* ‘a small apple’? In (1b), where the pronoun *unul* ‘one’ is modified by the size adjective *mare* ‘big’, does *unul* ‘one’ refer to *un măr* ‘an apple’ or *un măr verde* ‘a green apple’? The answers to such questions have an important bearing on how we represent adjective modification syntactically (flat/hierarchically). Previewing the results, we show that adults prefer maximal anaphoric reconstruction constrained

---

\* We would like to thank the undergraduate students at the University of Bucharest. In addition, we would also like to give thanks to the audiences at the Language Acquisition Research Center Seminar at UMass and LSA 2024 for their valuable comments and suggestions. Authors: Adina Camelia Bleotu, University of Bucharest ([cameliabileotu@gmail.com](mailto:cameliabileotu@gmail.com)), Deborah Foucault, UMass Amherst ([dfoucaulteth@umass.edu](mailto:dfoucaulteth@umass.edu)), Tom Roeper, UMass Amherst ([roeper@linguist.umass.edu](mailto:roeper@linguist.umass.edu)).

by hierarchical nesting. That is, in (1b), they prefer the big apple to also be green, but in (1a), the yellow apple can be big or small. Children, however, are more variable in their behavior, sometimes reconstructing the anaphor to N, and other times to N'.

## 2. Background.

2.1. THE ACQUISITION OF ANAPHORIC *ONE*. As shown by Pullum & Scholz (2002), language has both deictic uses of *one* (2a) and anaphoric uses of *one* (2b). While the focus of our current study is on anaphoric *one*, deictic uses of *one* are quite frequent both in child-directed speech, as well as in child language.

- (2) a. The green one is mine. (Pullum & Scholz 2002: 32)  
 b. I'd rather teach linguistics to a student of mathematics than to one of any discipline in humanities. (Pullum & Scholz 2002: 32)

Moreover, various studies (e.g. Karmiloff-Smith 1980; Tasinato & Sanfelici 2009) suggest that young children may sometimes interpret anaphoric *one* deictically instead of linking it to the previously mentioned noun. As shown in (3), children seem to produce anaphoric *one* from very early on:

- (3) CHI: there was a frog (.) on the kitchen center (.) in Sams\_Club  
 CAR: whoa, there was?  
 CHI: yeah, he was a small **one** (Weist, Emily, 3;00.12)

The literature on the acquisition of anaphoric *one* has been centered on the question of how children reconstruct its reference. Some studies have claimed that (i) anaphoric *one* is initially interpreted deictically, others have claimed that (ii) it can refer to either N or N', but that there may be a preference for N'.

Related to the first claim that children may interpret anaphoric *one* deictically, Avrutin & Coopmans (2000) have argued that children determine possible antecedents relying on the visual context, which makes grammatical connections unnecessary. Karmiloff-Smith (1980) found that, in a story context, children under the age of 6 prefer to interpret definite noun phrases and pronouns deictically rather than anaphorically. Moreover, Tasinato & Sanfelici (2022) have recently argued that Italian children are more accurate with the anaphor *one* in coordination NP ellipsis (4) than in discourse NP ellipsis (5), where they interpret anaphoric *one* deictically to a larger extent (see also Figure 1). Interestingly, this interpretation characterizes 3-year-olds but not older children.

- (4) The lion washed the red car and the blue one. (NP coordination ellipsis)  
 (5) The elephant washes the red car. The lion washes the blue one. (discourse ellipsis)

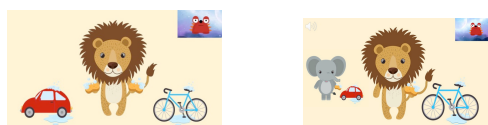


Figure 1. Examples of picture where the 2<sup>nd</sup> NP refers to a bicycle not a car (NP coordination ellipsis, discourse ellipsis)

Tasinato & Sanfelici (2022) explain this difference by arguing that ellipsis is a type of syntactic dependency whose resolution is strictly conditioned by locality, and that another DP (*the lion*) acts as an intervenor between the elided NP and its antecedent, thus blocking the anaphoric relation between *one* and *car*. Moreover, the acquisition picture seems to suggest that NP ellipsis in NP coordination is acquired before NP ellipsis in discourse.

In contrast to these studies, Wijnen, Roeper & van der Meulen (2003) showed that young children interpret nominal ellipses in an anaphoric manner, based on syntactic structure building principles. They tested young children's understanding of sentences containing nominal ellipsis marked by a bare cardinal, such as *two* in example (6), by evaluating them against three upside down pictures: one of two children inside the sandbox (target picture), one of two children outside the sandbox, and one of two adults outside the sandbox. 4-year-olds answered the target question in (6) with a yes more often for the target picture than for the other pictures.

(6) There are some kids playing in the sand box. Are two upside down? (Wijnen et al. 2003: 3)

Hubert (2009) also found that children reconstruct anaphoric *one* in an adult-like manner in both sentence coordination ellipsis contexts (*Ele is washing a car and Dino is washing one*) and in discourse ellipsis contexts (*Ele is washing a car. Is Dino washing one?*) from a very young age (3;8). Only 2 of 38 children interpreted *one* deictically as referring to a bicycle rather than a car. Putting these findings together, it seems that children sometimes reconstruct anaphoric *one* as deictic, but that this tendency mostly characterizes 3-year-old children.

Related to the second claim that anaphoric *one* can refer to either N or N', but that there may be a preference for N', it has been argued by Bryant (2006) that anaphoric *one* reconstructs to phrasal N' rather than N. This point of view has, however, been challenged by Pullum & Scholz (2002), who argued that *one* may reconstruct to either N or N' (see 2b).

Lidz et al. (2003) investigated whether children reconstruct *one* to N'. To evaluate the role of the input, they conducted a corpus analysis of parental speech (directed at two children) using the CHILDES database (MacWhinney 2000). Their study reveals that in most of the cases (95%), anaphoric *one* referred to a previously mentioned N or it was unclear whether it referred to N or a larger projection than N. Lidz et al. (2003) take these findings related to the child-directed input to suggest that children establish the reference of anaphoric *one* on the basis of innate syntactic principles. To see what their innate preference is, they conducted a looking time experiment with 18-month-old infants. After seeing a yellow bottle, infants heard *Now look. Do you see another one?* They then were presented with two bottles, an identical one of the same color, and one of a different color. Interestingly, infants showed longer looking times for the same color bottle. Pearl & Lidz (2006) argue that learners must already be equipped with the knowledge that *one* refers to N'. While the findings of the study by Lidz et al. (2003) are quite striking, a possible counterargument to their claims is that what they have shown is that children have knowledge of *another one* rather than of anaphoric *one* (Hubert 2009).

Hubert (2009) further investigated the anaphoric reconstruction of *one* in older German native children (4-6-year-old) in a modified version of the truth value judgement task (Crain & Thornton 1998), looking both at sentence coordination ellipsis and discourse ellipsis to test whether Bryant's (2006) hypothesis that sentence coordination ellipsis disfavors deictic interpretations of the anaphor and favors N'-reconstruction. Participants were presented with pictures and had to say whether they agree with certain sentences or not. Apart from cases where both the antecedent and the anaphor are unmodified, Hubert (2009) investigated multiple conditions (7, 8): where the antecedent is modified by a Color adjective and a Size adjective and the anaphor is

unmodified (see 7 a, b), and where the antecedent is modified by a Color adjective and the anaphor is modified by a Size adjective (see 8).

- (7) a. Ele is washing a red car/ a big red bike and Dino is washing one.  
 b. Ele is washing a red car/a big red bike. Is Dino washing one?  
 (8) Ele is washing a red car and Dino is washing a small one.



Figure 2. Example pictures for (7)



Figure 3. Example pictures for (8)

Hubert (2009) found that children prefer to reconstruct an antecedent that shares the features of the object of the previously mentioned sentence, and this tendency is more pronounced with coordination rather than discourse ellipsis. Interestingly though, when both the antecedent and the anaphor are modified by an adjective (see 8), children reconstruct to N.

Apart from these conditions, Hubert (2009) also conducted a pretest on monolingual adult German native speakers testing whether they do N'-reconstruction in contexts where the referential nominal antecedent was modified by two adjectives (a Color adjective and a Size adjective) and the anaphor is modified by an adjective (a Color adjective or a Size adjective). Participants were presented with pictures that (mis)matched the antecedent with respect to one or two properties. They were asked to respond with either 'yes' or 'no' to the question in (9).

- (9) Ele is washing a big red car. Is Dino washing a small one?



Figure 4. Examples of pictures tested for (9)

All subjects accepted the picture corresponding to *one* reconstructing to the N' (*red car*), and most of them (20/23) also accepted the picture corresponding to *one* reconstructing to N, mismatching the antecedent in color. In a posttest, Hubert (2009) also tested 8 4-year-olds on sentences such as those in (9) and found that all 8 children accepted a picture showing Dino washing a car with a different color. This suggests that, just as adults, children are able to reconstruct to N. While the small number of child participants might cast doubt on the generalizability of the findings, the fact that 8 children were able to reconstruct to N is telling with respect to the availability of minimal reconstruction in child language.

Overall, the findings about anaphoric *one* seem to suggest that children have a general preference for maximal reconstruction to N', particularly with coordination ellipsis. However, they are *also* able to reconstruct to N from a very young age. Of the contexts above, our current study focuses on contexts where the antecedent is modified by Color and Size adjectives and the anaphora is modified by a Color or Size adjective. To gain more insight into the possible

challenges related to anaphoric reconstruction, we delve into the domain of adjective orders in Romanian.

2.2. ADJECTIVE ORDERS IN ROMANIAN. A significant portion of adjective research has focused on adjective ordering restrictions (AORs), explored in various theoretical and experimental studies (Dixon 1982; Matthei 1982; Cinque 1994, 2005, 2010; Scott 2002; Bryant 2006; Scontras et al. 2017, 2019, among others). These discussions often revolve around whether speakers arrange adjectives based on cognitive dimensions and subjectivity or innate syntax. The prevailing view for English suggests a specific hierarchy (see 10), correlated with adjective subjectivity.

- (10) QUALITY > SIZE > SHAPE > COLOR > PROVENANCE  
a beautiful big round red British lamp

However, there seems to be crosslinguistic variation in how adjectives are ordered. Adjective orders have been argued to be more flexible in languages such as Greek (Leivada & Westergaard 2019), Hebrew (Trainin & Shetreet 2021) and even German (Grohe & Schulz 2021).

Our study focuses on Romanian, a language that shows a post-nominal adjective order (11c, d), unlike English, where adjectives are prenominal (11a).

- (11) a. big blue butterfly  
b. ??blue big butterfly  
c. fluture albastru mare  
butterfly blue big  
'big blue butterfly'  
d. fluture mare albastru  
butterfly big blue  
'blue big butterfly'

There is a longstanding debate in the literature regarding AORs in Romanian: some studies claim that adjective orders are fixed in Romanian (Cinque 1994, 2005, 2010), while others argue that adjective orders are flexible (Cornilescu & Giurgea 2013, Cornilescu & Nicolae 2016, Cornilescu & Cosma 2019). According to Cinque (1994, 2005, 2010), Romance languages, including Romanian, mirror the Germanic adjective in postnominal order. This order is explained through Roll-Up-of-N, a set of movement operations starting from the basic English order. To give an example (12), the NP moves out of its position to an outer specifier (Step 1) of  $FP_{color}$ , then the newly formed FP containing  $FP_{color}$  moves out of its position to the outer specifier of the projection hosting  $FP_{size}$  (Step 2).

Recently, however, Bleotu & Luciu (to appear) and Trușcă & Bleotu (to appear) have experimentally investigated whether Romanian adult speakers have different adjectival ordering preferences compared to British English speakers. They found that British English speakers tend to observe the hierarchy in (10), and that they prefer (11a) over (11b), placing the Color adjective closer to the noun than the Size adjective. In contrast, Romanian speakers accepted both orders alike (11c, d). This suggests that a more accurate way of capturing adjective orders in Romanian may be adjunction (Abels & Neeleman 2010, Kremers 2003), which successively merges adjectives to the left as modifiers of the noun (see 12).

Another area of research on adjectives has focused on ordering and interpreting adjectives in terms of sets and subsets. According to recent studies on both English and Romanian adults and children (Bleotu & Roeper 2021a, b; Bleotu & Roeper 2022a, b; Foucault et al. 2022, 2024; Bleotu, Foucault & Roeper 2023a, b), in a context where one wants to refer to a subset of objects



3.1. PREDICTIONS. Overall, given that we tested children older than 4, we do not expect to see many deictic errors, where the anaphor is interpreted as referring to a different referent. Rather, we expect children to be anaphoric in their reconstruction.

Nevertheless, children may exhibit different anaphoric reconstruction patterns than adults. As discussed in the previous section on adjective orders in Romanian, adjectives can be analyzed both under hierarchical approaches (cartographic or adjunction), where nouns modified by Color adjectives recursively embed Size adjectives, as well as under coordination approaches, where Color adjectives are coordinated with Size adjectives, and together they modify nouns. If we assume that adults are sensitive to nesting and anaphoric reconstruction is maximal, then *one* should reconstruct to the N' under the Size/Color adjective (see Table 1). In *Ursulețul vrea un măr verde mic și unul mare* 'The bear wants a small green apple and a **big one**', adults should accept *unul* 'one' to only refer to *măr verde* 'green apple', consisting of the adjective under the Size adjective and N. More specifically, adults substitute the size adjective *mic* 'small' modifying the antecedent with the size adjective *mare* 'big' and then maximally reconstruct *unul* 'one' to the noun *măr* 'apple', modified by color adjective *verde* 'green.' However, in *Ursulețul vrea un măr verde mic și unul galben* 'The bear wants a small green apple and a **yellow one**', *unul* 'one' should reconstruct to *măr* 'apple' under a hierarchical approach - both a big and a small apple should be allowed. When no structural preference constrains the interpretation, it might be the case, nonetheless, that other (possibly cognitive) biases are allowed to occur, e.g., some adults might still prefer to keep the previously mentioned property. For instance, they might prefer the second apple to also be small for parallelism reasons.

It is unclear how children will behave: they might opt (i) for maximal reconstruction (as in Lidz et al. 2003) or (ii) for minimal N reconstruction, accepting that the apple be a different color than green in *Ursulețul vrea un măr verde mic și unul mare* 'The bear wants a small green apple and a **big one**' (as in Hubert 2009). Children might also associate the two adjectives modifying the noun with a (flat) coordination analysis (Table 2), given that coordination has a privileged status in child language (Bleotu & Roeper 2021a, b; Foucault et al. 2022). This leads to reconstruction to N, given that anaphoric reconstruction only applies to constituents. In contrast, associating the Size and Color adjectives modifying the noun with a hierarchical, nested structure, where color adjectives are merged to the nouns first and size adjectives are merged afterwards, may lead to reconstruction to N'.

Regarding a possible difference between DP coordination ellipsis and sentence coordination ellipsis (*Ursulețul vrea un măr verde mic și unul mare* 'The bear wants a small green apple and a **big one**' vs. *Ursulețul vrea un măr verde mic și lupul vrea unul mare* 'The bear wants a small green apple and the wolf wants a **big one**'), it might be that participants prefer maximal reconstruction in both DP coordination ellipsis contexts and in sentence coordination ellipsis contexts, given that both contexts involve coordination (see Hubert 2009). However, it might also be that they prefer maximal reconstruction in DP coordination ellipsis contexts than in sentence coordination ellipsis contexts due to the closeness of the antecedent and the absence of an intervenor in the DP coordination ellipsis contexts (Tasinato & Sanfelici 2022).

Cartographic approaches	
<p style="text-align: center;">Step 2</p>	<p><i>unul mare</i> one.the big 'the big one'</p> <p><b>Substitution rule:</b> <i>unul</i> reconstructs as FPcolor or NP (N)</p>
<p style="text-align: center;">Step 1</p>	<p><i>unul galben</i> one.the yellow 'the yellow one'</p> <p><b>Substitution rule:</b> <i>unul</i> replaces NP (N)</p>
Adjunction approaches	
<p><i>măr verde mic</i> apple green small 'small green apple'</p>	<p><i>unul mare</i> one.the big 'the big one'</p> <p><b>Substitution rule:</b> <i>unul</i> reconstructs as N' APcolor (NP)</p>
	<p><i>unul galben</i> one.the yellow 'the yellow one'</p> <p><b>Substitution rule:</b> <i>unul</i> reconstructs as N, being compatible with both big/small apple</p>

Table 1. Hierarchical representations of nouns and anaphors modified by a Color and/or a Size adjective



Adjectival coordination approaches	
<pre>       NP      /  \     N'   AP    /  \  /  \   N   AP_color AP_size  /  \ /  \ măr verde mic apple green small           </pre>	<pre>       NP      /  \     N'   AP_color/size    /  \   N   mare/ galben  /  \ măr   big/ yellow apple           </pre> <p>Substitution rule: <i>unul</i> reconstructs as N</p>

Table 2. Coordinative representations of nouns and anaphors modified by a Color and/or a Size adjective

3.2. PARTICIPANTS. The test was conducted on 18 adult native speakers of Romanian (Age range:18–21, Mean: 19;6) and 18 monolingual Romanian-speaking children (Age range: 4–5, Mean: 4;8).

3.3. PROCEDURE. We employed a truth value judgment task containing 22 picture sets and utterances: 2 warm-ups, 4 controls and 16 test sentences. Participants heard an animal’s wish (i.e., what the animal wanted) and evaluated whether a boy called Mihai gave it the right object.

The warm-up sentences presented participants with two situations: (i) a situation where the boy gave the character the right object (see (14a), where the boy gives the Gorilla a banana), and (ii) a situation where the boy gave the character the wrong object (see (14b), where the boy gives the Kitty a bunny instead of a ball). This procedure familiarizes participants with both types of situations they encounter throughout the experiment.

(14) Warm up sentences:

- a. Maimuța vrea o banană și Gorila vrea o banană.  
 Monkey wants a banana and Gorilla wants a banana  
 ‘Monkey wants a banana and Gorilla wants a banana.’
- b. Cuțu vrea un os și Pisicuța vrea o minge.  
 Doggie wants a bone and Kitty wants a ball  
 ‘Doggie wants a bone and Kitty wants a ball.’

The control sentences tested participants’ reconstruction of the anaphoric pronoun *unul* ‘one.the.M/N.SG’/ *una* ‘one.the.F.SG’ when the antecedent was an unmodified nominal (see 15a), and of the pronoun *altceva* ‘something else’ (see 15b). The pronouns were each tested both in a situation where the boy gives the animal the right object, and in a situation where the boy gives the animal the wrong object.

(15) Control sentences:

- a. Leul vrea o înghețată și Hipopotamul vrea una.  
 Lion wants an ice-cream and Hippopotamus wants one  
 ‘Lion wants an ice-cream and Hippopotamus wants one.’

- b. Șoricica vrea o rochie și Koala vrea altceva.  
 Mouse wants a dress and Koala wants something else  
 ‘Mouse wants a dress and Koala wants something else.’

The test sentences had the form *Animalul X vrea un N1 Color1 Size1 și (animalul Y vrea) unul Color2/Size2* ‘Animal X wants a Size1 Color1 N1 and (animal Y wants) a Color2/Size2 one’ (see (16) and (17)).

(16) **DP-coordination**

Ursulețul vrea un măr verde mic și **unul mare /galben.**  
 bear wants an apple green small and one big/ yellow  
 ‘The bear wants a small green apple and a **big/yellow one.**’

(17) **Sentence coordination**

Porcușorul vrea un măr portocaliu mare și Oița vrea **unul mic/roșu.**  
 Piggy wants an apple orange big and Sheepy wants one small/ red  
 ‘Piggy wants a big orange apple and Sheepy wants a **small/red one.**’

The objects given either matched the referential nominal in Color/Size, matched it partially in Color/Size, or mismatched the nominal referent altogether. Figure 5 exemplifies the procedure.

Ursulețul vrea un măr verde mic și unul mare.  
 Ce vrea Ursulețul?

The bear wants a small green apple and a big one.  
 What does the bear want?

Ursulețul vrea un măr verde mic și unul mare.  
 .

The bear wants a small green apple and a big one.

Uite! Mihai i-a dat un măr verde mic.  
 Ce crezi că ar trebui să îi dea Mihai Ursulețului acum?

Look! Mihai gave the bear a small green apple.  
 What do you think Mihai should give the bear now?

Mihai i-a dat Ursulețului asta!  
 Asta vrea Ursulețul?  
 Cum ai numi asta?  
 (Dacă da, continuai cu următorul slide.  
 Dacă nu, întrebați: Ce crezi că vrea Ursulețul?)

Mihai wants to give him this! (see arrow) Is this what the bear wants? What would you call this?  
 If answer is yes, continue to the next slide.  
 If answer is no, ask: What do you think the bear wants?

Figure 5. Example of items involving anaphoric *unul* ‘one’ modified by a Size adjective

Participants heard a sentence and were asked to repeat it. They were then introduced to an array of objects that had either the size/color of the antecedent or of the anaphor modifier. In this example, they were presented with two apples of the same color (as the antecedent): a small green one, a big green one, two apples of a different color from the antecedent (a small yellow one, a big yellow one) and four bananas (mis)matching the antecedent in size and/or color (a small green banana, a big green banana, a small yellow banana, a big yellow banana). Next, participants witnessed a scene where the boy, Mihai, gave the bear a small green apple, and then they were asked what else they thought the boy should give the bear. Participants then witnessed a scene where the boy gave the bear an object (in this example, the wrong object, i.e., a big green banana). Children were then asked to say whether the boy did the right thing, and to correct him if they thought he had not.

3.4. RESULTS. Both children and adults were quite accurate in the controls. Children were 100% accurate in handling *unul/una* ‘one’ when the antecedent was an unmodified noun, while adults were 90.62% accurate. Children were 66.7% accurate in handling *altceva* ‘something else’, while adults were 84.75% accurate. Interestingly, the lower accuracy in handling *altceva* ‘something else’ was due to participants preferring to give the character a different object than the one that had been given to them. Nonetheless, participants can be considered accurate even with *altceva* ‘something else’ given that the object they suggested was always a different one than the antecedent. The two controls establish a baseline for analyzing participant responses: children are anaphoric with *unul/una* ‘one’ and avoid co-reference with an antecedent for *altceva* ‘something else’.

Regarding the interpretation of the test sentences, we find that children are anaphoric in their reconstruction rather than deictic, as there were only 2 deictic errors where children accepted other referents in mismatch situations (i.e., where animals received the wrong objects).

However, looking at children’s and adults’ anaphoric reconstruction in match and partial match situations (where animals received objects that fully/partially matched the sentences they heard) reveals that children and adults differ in their anaphoric reconstruction preferences. (see Figure 6).

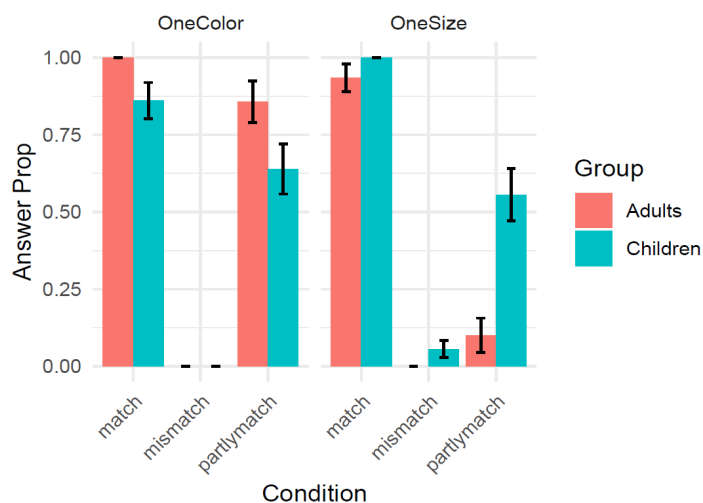


Figure 6. Acceptance rates per Condition and Anaphora across Groups

In *Ursulețul vrea un măr verde mic și unul mare* ‘The bear wants a small green apple and a **big one**’, adults maximally accept *one* as *green apple*, rejecting reconstruction to *apple* of a different color. In *Ursulețul vrea un măr verde mic și unul galben* ‘The bear wants a small green apple and a **yellow one**’, adults accepted *one* to refer to either *big apple* or *small apple*. In contrast, children split into four groups. Group 1 (N= 2 children) behaved like adults. Group 2 (N=4) rejected reconstruction of *unul* ‘one’ to an apple of a different color in *The bear wants a small green apple and a big one*, as well as to an apple of a different size in *The bear wants a small green apple and a yellow one*. Group 3 (N=7) accepted that *unul* ‘one’ can refer to an apple of a different size/color in both structures. Group 4 (N= 5) displayed mixed non-adult-like behavior, taking *unul* ‘one’ to refer to an apple of a different color/size exactly 50% per anaphora type (color or size).

Using R Studio (2021), we fitted the data into a generalized linear model (glm) with Answer as a dependent variable, the fixed effects Anaphora (Color vs Size one), Group (Children vs. Adults), and Condition (Match/Mismatch/Partly Match). Firstly, we observed a marginal significance regarding the effect of group on our response variable ( $F(1, 34) = 3.222, p = 0.0732$ ). Additionally, the effect of condition emerged as highly significant ( $F(2, 34) = 623.947, p < 2e-16$ ), indicating a robust impact of the conditions on our response variable. Moreover, the presence of distinct anaphora types significantly affected our response variable ( $F(1, 34) = 9.024, p = 0.0028$ ). In addition to these main effects, we uncovered several significant interaction effects. The interaction between group and condition proved to be statistically significant ( $F(2, 34) = 3.996, p = 0.0190$ ), suggesting that the influence of condition on our outcome might vary across different groups. Similarly, we found a significant interaction between group and anaphora ( $F(1, 34) = 28.393, p = 1.49e-07$ ), indicating that the effect of anaphora types on our response might differ depending on the group. Furthermore, the interaction between condition and anaphora emerged as highly significant ( $F(2, 34) = 32.703, p = 4.29e-14$ ). Lastly, a significant three-way interaction among group, condition, and anaphora was observed ( $F(2, 34) = 15.608, p = 2.63e-07$ ). We then computed multiple pairwise t-tests to calculate pairwise comparisons between groups with corrections for multiple testing. Among other significant differences, the results confirmed significant differences between children and adults in the partly match condition for anaphora modified by size adjectives.

Regarding a possible difference between anaphoric reconstruction in DP-coordination ellipsis and in sentence coordination ellipsis, for each condition, we fitted a model with Answer as a DV and Anaphora (Color vs Size one), Group (Children vs. Adults), and Sentence (Same/Different) as fixed effects. The model revealed no effect of Sentence, no interaction between Group and Sentence, no interaction between Anaphora and Sentence, and no interaction between Group, Anaphora and Sentence. Thus, there seems to be no difference between DP-coordination ellipsis and sentence coordination ellipsis. However, a study with more statistical power and more items per condition might reveal a different picture.

**4. Discussion.** Our findings show that children have the ability to reconstruct *unul/una* as anaphoric rather than deictic as early as age 4. This is in line with our expectations given that Tasinato & Sanfelici’s (2022) study showed that deictic errors tended to occur primarily with 3-year-olds.

Interestingly, while children are able to reconstruct *unul/una* as an anaphor, they seem to resort to different anaphoric reconstruction strategies than adults. Adults’ anaphoric reconstruction is consistently sensitive to nesting. Adults seem to prefer **maximal reconstruction**, reconstructing to the highest element under the AP that is substituted: to the NP *măr verde* ‘green apple’ in

*Ursulețul vrea un măr verde mic și unul mare* ‘The bear wants a small green apple and a **big one**’ and to the N *măr* ‘apple’ in *Ursulețul vrea un măr verde mic și unul galben* ‘The bear wants a small green apple and a **yellow one**’. Contrastively, except for two children who are adult-like, most of the children (N=16) differ from adults in their anaphoric reconstruction. Four children reject *unul* ‘one’ as a referent to a noun modified by a different property (*yellow apple*, *big apple*), reconstructing to an NP/N’ that includes the antecedent and the previously mentioned property: the color property in the case of anaphors modified by Size adjectives, the size property in the case of anaphors modified by Color adjectives. Seven children accept *unul* ‘one’ to refer to different properties in both structures, operating in terms of **minimal reconstruction**, therefore avoiding adjective recursion. Reconstruction to N leaves the other properties unspecified, allowing children to express their own preference (possibly influenced by pragmatic biases). The remaining children reconstruct both minimally and maximally. The results thus show that children’s reconstruction preferences are different from adults. This may suggest that children do not nest adjectives in the same hierarchical manner as adults. Instead, they could treat the Color and Size adjectives as coordinated such that they are both reconstructed together alongside N (but one of the properties is substituted), or both ignored in favor of the simpler N. Another possibility is that children may nest adjectives hierarchically but they do not have a fixed preferential hierarchy at this stage, i.e. they place the Color adjective closer to the noun than the Size adjective or they place the Size adjective closer to the noun than the Color adjective. If this is the case, then children who prefer to keep the same property as mentioned before could be argued to operate in terms of **maximal reconstruction** to the NP/N’ nested immediately under the adjective modifying the anaphor.

Moreover, it is not excluded that other biases may interfere in anaphoric reconstruction. For instance, it could be that while doing reconstruction to N some children nonetheless prefer to keep previously mentioned properties in virtue of a property conservation cognitive bias.

While our experiment cannot untangle the variety of possible theoretical accounts, overall, the data from Romanian 4-year-olds suggests a hybrid stage in anaphoric reconstructions, where multiple reconstruction strategies are used. This is in contrast to the adult data, showing a consistent preference for maximal reconstruction that is constrained by hierarchical structure.

## References

- Abels, Klaus & Ad Neeleman. 2010. Linear asymmetries and the LCA. *Syntax* 12(1). 25–74. <https://doi.org/10.1111/j.1467-9612.2011.00163.x>.
- Avrutin, Sergey & Peter Coopmans. 2000. ‘Children who build bridges.’ In S. Catherine Howell, Sarah A. Fish & Thea Keith-Lucas (eds.), *Proceedings of the 24<sup>th</sup> Annual Boston University Conference on Language Development*, 80–91. Somerville, MA: Cascadilla Press.
- Bleotu, Adina Camelia & Tom Roeper. 2021a. ‘Small big flowers’ or ‘small and big flowers’? Simple is better and roll-up is too complex for Romanian 5-year-olds. In Danielle Dionne & Lee-Ann Vidal Covas (eds.), *Proceedings of the 45<sup>th</sup> Annual Boston University Conference on Language Development* (vol. 1), 66–79. Somerville, MA: Cascadilla Press.
- Bleotu, Adina Camelia & Tom Roeper. 2021b. Roll-up is too complex for Romanian 5-year-olds. Evidence from recursive adjectives. *Proceedings of the Linguistic Society of America* 6(1). 133–143. <https://doi.org/10.3765/plsa.v6i1.4953>.
- Bleotu, Adina Camelia & Tom Roeper. 2022a. The recursive set-subset ordering restriction overrides adjective ordering restrictions. Evidence from Romanian 4-year-olds and adults. In Ying Gong & Felix Kpogo (eds.), *BUCLD 46: Proceedings of the 46<sup>th</sup> Annual Boston*

- University Conference on Language Development* (vol. 1), 62–75. Somerville, MA: Cascadilla Press.
- Bleotu, Adina Camelia & Tom Roeper. 2022b. Children are more sensitive to the recursive set-subset ordering than to adjective ordering restrictions. *Proceedings of the Linguistic Society of America* 7(1). 5267. <https://doi.org/10.3765/plsa.v7i1.5267>.
- Bleotu, Adina Camelia, Deborah Foucault & Tom Roeper. 2023. Long short leaves are ‘leaves that are short that are long’: The Recursive Set Subset Principle orders both adjectives and relative clauses. In Lucas Fagen, Sam Gray, Quain, Stephanie Reyes & Irene Tang (eds.), *Proceedings of the 58<sup>th</sup> Annual Meeting of the Chicago Linguistic Society*, 13–29. Chicago: The Chicago Linguistic Society.
- Bleotu, Adina Camelia, Deborah Foucault & Tom Roeper. 2023. The recursive Set Subset Ordering Principle orders adjectives and relative clauses in visual context. *Proceedings of the Linguistic Society of America* 8(1). 5535. <https://doi.org/10.3765/plsa.v8i1.5535>.
- Bryant, Doreen. 2006. *Koordinationsellipsen im Spracherwerb: Die Verarbeitung potentieller Gapping-Strukturen. (Studia Grammatica 64)*. Berlin: Akademie Verlag.
- Cinque, Guglielmo. 1994. On the evidence for partial N-movement in the Romance DP. In Guglielmo Cinque, Jan Koster, Jean-Yves Pollock, Luigi Rizzi & Raffaella Zanuttini (eds.), *Paths towards Universal Grammar. Studies in honor of Richard S. Kayne*, 85–110. Washington DC: Georgetown University Press.
- Cinque, Guglielmo. 2005. Deriving Greenberg’s Universal 20 and its exceptions. *Linguistic Inquiry* 36(3). 315–332. <https://doi.org/10.1162/0024389054396917>.
- Cinque, Guglielmo. 2010. *The syntax of adjectives. A comparative study*. Cambridge, MA: MIT Press.
- Cornilescu, Alexandra & Ruxandra Cosma. 2019. Linearization of attributive adjectives in Romanian. *Revue Roumaine de Linguistique* LXIV(3). 307–323.
- Cornilescu, Alexandra & Ion Giurgea. 2013. *The adjective*. In Carmen Dobrovie-Sorin & Ion Giurgea (eds.), *A reference grammar of Romanian* (vol. 1), 355–530. Amsterdam: John Benjamins.
- Cornilescu, Alexandra & Alexandru Nicolae. 2016. Romanian adjectives at the syntax–semantics interface. *Acta Linguistica Hungarica*. 63(2). 197–240. <https://doi.org/10.1556/064.2016.63.2.3>.
- Dixon, Robert M. W. 1982. *Where have all the adjectives gone?: And other essays in semantics and syntax*. Berlin: Mouton de Gruyter. <https://doi.org/10.1515/9783110822939>.
- Foucault, Deborah, Adina Camelia Bleotu, Usha Lakshmanan, Emma Merritt, Roehl Sybing & Tom Roeper. 2022. Relative gradable adjective recursion is more challenging for acquisition than possessive recursion. *Proceedings of the Linguistic Society of America* 7(1). 5294. <https://doi.org/10.3765/plsa.v7i1.5294>.
- Foucault, Deborah, Adina Camelia Bleotu, Usha Lakshmanan & Tom Roeper. 2024. Development of small big ideas through scaffolding story contexts: Evidence from set-subset recursive adjectives in child English. Talk presented at *2024 LSA Annual Meeting*
- Grohe, Lydia & Petra Schulz. 2021. *Big round clocks and blue square tables*: Adjective ordering preferences in elicited child and adult production. In Ying Gong & Felix Kpogo (eds.), *Proceedings of the 46th Annual Boston University Conference on Language Development* (vol. 1), 242–255. Somerville, MA: Cascadilla Press.
- Hubert, Anya. 2009. *The acquisition of ellipsis and the structure of the noun phrase*. Universität Potsdam MA thesis.

- Karmiloff-Smith, Annette. 1980. Psychological processes underlying pronominalization and non-pronominalization in children's connected discourse. In Jody Kreiman & Almerindo E. Ojeda (eds.), *Papers from the Parasession on Pronouns and Anaphora*, 222–250. Chicago: The Chicago Linguistics Society.
- Kremers, Joost Merijn. 2003. *The Arabic noun phrase: A minimalist perspective*. University of Nijmegen dissertation.
- Leivada, Evelina & Marit Westergaard. 2019. Universal linguistic hierarchies are not innately wired. Evidence from multiple adjectives. *PeerJ* 7. e7438. <https://doi.org/10.7717/peerj.7438>.
- Lidz, Jeff, Sandra Waxman & Jennifer Freedman. 2003. What infants know about syntax but couldn't have learned: Evidence for syntactic structure at 18-months. *Cognition* 89. B65–B73. [https://doi.org/10.1016/s0010-0277\(03\)00116-1](https://doi.org/10.1016/s0010-0277(03)00116-1).
- Luciu, Amalia & Adina Camelia Bleotu. To appear. How are size, age, shape and color adjectives ordered in English and Romanian? An experimental investigation. *Bucharest Working Papers in Linguistics*.
- MacWhinney, Brian. 2000. *The CHILDES Project: Tools for analyzing talk* (3rd edn.). Mahwah, New Jersey: Erlbaum.
- Matthei, Edward M. 1982. The acquisition of prenominal modifier sequences. *Cognition* 11. 201–332. [https://doi.org/10.1016/0010-0277\(82\)90018-X](https://doi.org/10.1016/0010-0277(82)90018-X).
- Pullum, Geoffrey & Barbara Scholz. 2002. Empirical assessment of stimulus poverty arguments. *The Linguistic Review* 19. 9–50. <https://doi.org/10.1515/tlir.19.1-2.9>.
- Roeper, Tom. 2011. The acquisition of recursion: How formalism articulates the child's path. *Biolinguistics* 5(1–2). 57–86.
- R Core Team. 2021. R: A language and environment for statistical computing. R Foundation for Statistical Computing. Vienna, Austria. Available online at <https://www.R-project.org/>.
- Scontras, Gregory, Judith Degen & Noah D. Goodman. 2017. Subjectivity predicts adjective ordering preferences. *Open Mind* 1. 53–65. [https://doi.org/10.1162/OPMI\\_a\\_00005](https://doi.org/10.1162/OPMI_a_00005).
- Scontras, Gregory, Judith Degen & Noah D. Goodman. 2019. On the grammatical source of adjective ordering preferences. *Semantics and Pragmatics* 12(7). 1–21. <https://doi.org/10.3765/sp.12.7>.
- Scott, Gary-John. 2002. Stacked adjectival modification and the structure of nominal phrases. In Guglielmo Cinque (ed.), *Functional structure in the DP and IP: The cartography of syntactic structures* (vol. 1), 91–120. Oxford and New York: Oxford University Press.
- Tasinato, Caterina & Emanuela Sanfelici. 2022. When locality matters: On the acquisition of nominal ellipsis in Italian. Talk at *Generative Approaches to Language Acquisition (GALA) 15*. Goethe University Frankfurt.
- Trainin, Nitzan & Einat Shetreet. 2021. *It's a dotted blue big star*: On adjective ordering in a post-nominal language. *Language, Cognition and Neuroscience* 36(3). 320–341. <https://doi.org/10.1080/23273798.2020.1839664>.
- Truşcă, Daniela & Adina Camelia Bleotu (to appear). An experimental investigation of the ordering of quality, size and color adjectives in English and Romanian. *Bucharest Working Papers in Linguistics*.
- Wijnen, Frank, Tom Roeper & Hiske van der Meulen. 2004. Discourse binding: Does it begin with nominal ellipsis? In Jacqueline van Kampen & Sergio Baauw (eds.), *Proceedings of Generative Approaches to Language Acquisition (GALA) 2003*. Utrecht: LOT.