

Out of Sight, Not Out of Mind: Unexpressed Features Impact Children’s Comprehension of Relative Clauses

Stephanie Durrleman, Anamaria Bentea, and Maria Teresa Guasti

1. Introduction

Research on acquisition has established a clear asymmetry between subject (1) and object (2) A³-dependencies, with the former being mastered earlier than the latter (Avrutin, 2000, de Villiers, de Villiers, Hoban, 1994, Goodluck & Tavakolian, 1982, for English; Corrêa, 1995, Costa et. al, 2011, for Portuguese; Arnon, 2005, 2010, Friedmann & Novogrodsky, 2004, for Hebrew; Adani et al., 2010, Adani, 2011, Arosio, Adani & Guasti, 2011, for Italian).

1. Show me the girl [that ___ is hugging the lady]



2. Show me the lady [that the girl is hugging ___]



At first glance, it seems that the length of the dependency in (2), which also leads to non-canonical word ordering, may be the source of the problem. However, such an explanation cannot account for the fact that object dependencies formed with a wh-operator (3) are relatively easy for children to comprehend in many languages¹, contrary to object dependencies formed with a full DP (as in (2)):

3. Show me who [the girl is hugging ___]



The difference between ‘headed’ object dependencies (2) and ‘free’ object dependencies (3) has been captured in terms of intervention effects reminiscent of Relativized Minimality or RM (Rizzi 1990, 2004; Starke 2001). RM states

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¹ We should point out that object dependencies of the kind in (3) are difficult for Italian children (Guasti, Branchini and Arosio, 2012) and for Dutch children (Metz, Van Hout and van der Lely, 2012).

expression in the verbal inflection of the finite verb would be an indication that the feature is active (Belletti et al. 2012). This view has been proposed given the sharp ameliorating effect in Hebrew children (aged 3;9 – 5;5 years) when parsing object RCs with gender mismatch as compared to those with gender match, while Italian children (of exactly the same age) did not perform better with the gender mismatch. Indeed, when comparing Hebrew and Italian, we see that in Hebrew the verb agrees in gender with the subject, which is expressed on the inflected verb, while in Italian it does not, as gender is not expressed on the finite verb:

- | | | | |
|----|--|-------------------------------|--|
| | +R+NP+Fem | +NP +Masc | |
| 6. | Tare li et ha-yalda | she-ha-rofe mecayer . | |
| | Show to-me ACC the-girl(fem) that-the-doctor(masc) draws-masc | | |
| | ‘Show me the girl that the (male)doctor draws.’ | | |
| | | | |
| | +R+NP+Masc | +NP +Fem | |
| 7. | Mostrami il dottore | che la bambina disegna | |
| | Show-to-me the doctor(masc) that the girl(fem) draws | | |
| | ‘Show me the (male)doctor that the girl draws.’ | | |

In other words, gender in Hebrew is active, as it triggers movement of the subject to the inflectional head, where gender is morphologically expressed. Notice that number in (5) meets the condition of being active in the relevant sense, as claimed by Belletti et al. (2012): it triggers movement of the subject to the inflectional head, where number is morphologically expressed.

Number and gender mismatches in (5) and (6), respectively, have an impact on an intervention configuration and create a situation in which the feature of the moved element and those of the intervener are no longer in an inclusion relation, but in an intersection relation. Under the featural based RM approach, the improvement in the comprehension of object RCs in number and gender mismatch configurations means that children have the computational resources to process an intersection relation.

As summarized in Table 1, children understand movement derived structures in which the features of the intervener and of the moved element are in a disjunction relation (Table 1, d) or in an intersection relation (Table 1, c), provided these features are active and thus morphologically expressed on the inflectional head hosting the finite verb (Belletti et al. 2012). In contrast, they may rule out as ungrammatical sentences in which the features of the intervener and of the moved element are in an inclusion relation (Table 1, b), because they may fail to compute this relation (unlike adults). Like adults, they also rule out as ungrammatical those sentences in which the features of the intervener and of the moved element are identical (Table 1, a).

Table 1. RM featural relations

	Intervener			<i>Adults</i>	<i>Children</i>
	<i>X</i>	<i>Z</i>	<i>Y</i>		
a. Identity	A	A	<A>	*	*
b. Inclusion	A,B	B	<A,B>	ok	*
c. Intersection	A,C	C,D	<A,C>	ok	ok
d. Disjunction	A	B	<A>	ok	ok

The research presented above suggests two main findings regarding the acquisition of object RCs: (i) a match in lexical NP restriction may disrupt comprehension and (ii) a mismatch in fine features alleviates difficulties, so long as the relevant features are active in triggering syntactic movement and this is evident if the features are realized on the inflectional head.

It is worth noting that (i) is based on studies, which compared dependencies involving a lexical restriction with similar morphosyntactic features (of number or gender), as in (2), to those without any lexical restriction, as in (3). In order to disentangle the role of lexical restriction and of morphosyntactic features, we need to extend the investigation to cases where there is no such restriction but nonetheless the relevant items bear similar morphosyntactic features. If children still experience difficulties, the lexical NP restriction per se could not be the source of comprehension problems. What would matter instead is exclusively the matching of fine-grained features (e.g. number, gender, person), which have simply been confounded with lexical NP restriction in previous work.

Regarding (ii), clearly a feature's realization on the clausal inflectional head is a sufficient condition for its relevance in the computation of locality, but is it a necessary condition? Some features arguably play a role in syntactic movement despite absence from the clausal head, e.g. animacy in non-animacy based languages (see Bianchi 2006). Given this, it would seem relevant to extend the investigation to cases where the mismatch involves such features. If this kind of featural manipulation impacts performance, then their realization on the clausal inflectional head would not be a necessary condition.

This leads us to two research questions we will be concerned with in this work: Do intervention effects in object RCs arise in the absence of a lexical NP feature on the moved element, i.e., with demonstrative pronouns? Can features such as animacy, not overtly realized on the verb but computed in the featural array of nominals, impact comprehension? In order to answer these questions, we assessed the comprehension of French object RCs headed by the demonstrative pronoun *celui/celle* (this+masc/this+fem) and including a lexically restricted animate NP subject.

Celui/celle do not contain a lexical NP restriction and thus they occur in a configuration similar to that in (3). If lexical restriction is relevant for the computation of intervention (see (i)), then children should perform well once there is a mismatch in lexical restriction, such as created by *celui/celle* object

RCs (8). Indeed in these instances, no lexical noun with descriptive content heads the RC, while the subject is lexically restricted:

8. Voici deux dames. Montre-moi *celle* que la fille embrasse.

Here are two ladies. Show-me *the-one-Fem* that the girl is kissing.

If however children experience difficulty with these sentences, this would imply that intervention effects arise in the absence of a match of the lexical NP feature on the moved element and the intervening subject.

Celui/celle also offer a good testing ground for the role of animacy, because these elements can have antecedents which are either animate or inanimate DPs (9 - 10):

9. Context: John is hurt by one of his playmates and his mother wants to see who the child was. She says to John:

Montre-moi *celui* qui t'a frappé.
'Show me the one that hit you.'

10. Context: Peter wants to buy a new painting from an up and coming artist. So he tells him:

Montre-moi *celui* que tu as peint le plus récemment.
'Show me the one that you painted most recently'.

If the relevant features are those which are syntactically active in the sense of Belletti et al. (2012) (see (ii)), we expect no effect of animacy on *celui/celle*: this feature is not expressed morphologically, neither on the featural composition of the clausal inflectional head nor within the demonstrative pronoun. If, however, intervention effects can be alleviated by a mismatch in features that are unrealized on the verb, children should perform better in instances of an animacy mismatch.

2. Participants

Eighty typically developing children (ranging in age from 5;0 to 11;8, mean age 8;3) participated in the study. Table 2 gives the details of the four age groups included in the experiment. All children were recruited from a primary school in the Geneva area, Switzerland, and all were native French speakers.

Table 2. Participant data per age group (total number, age range, mean age and standard deviation)

Age group	No. of participants	Age range	Mean Age (S.D.)
5 y.o.	20	5;0 – 5;9	5;5 (0.14)
7 y.o.	20	6;7 – 7;4	7;0 (0.21)
9 y.o.	20	8;7 – 9;6	9;1 (0.25)
11 y.o.	20	10;8 – 11;11	11;1 (0.33)

3. Materials

Children were tested on 12 object relatives, all headed by *celui* or *celle*. The main factor manipulated in the experiment was animacy of the object. The embedded subject was always an animate, lexically restricted nominal element (e.g. *la fille*). Participants saw 6 object relatives with a match in animacy between the relative clause head and the intervening subject (of the type illustrated in (11)) and 6 object relatives with an animacy mismatch between the two DPs (see example in (12)). The verbs used described transitive reversible actions, the head of the relative and the subject were both singular and matched in gender (half of the experimental trials contained feminine nouns and the other half masculine nouns).

11. Voilà deux grenouilles.
look, two frogs.

Montre-moi *celle* que la princesse arrose.
show-me *this/that+her* that the.F.SG princess splashes
'Here are two frogs. Show me the one that the princess is splashing.'

12. Voilà deux tuyaux.
look two hoses.

Montre-moi *celui* que le garçon arrose.
show-me *this/that+him* that the.M.SG boy splashes
'Here are two hoses. Show me the one that the boy is splashing.'

As the examples above show, the lead-ins introduced the two possible referents for *celui/celle*. Sentences were accompanied by an image representing the two referents to make the use of *celui/celle* as anaphoric pronouns felicitous. The target items were interspersed with 12 fillers (sentences such as "Touch the duck with the ice-cream.") used in order to maintain children's interest and ensure that they remained attentive throughout the task. Consequently, each child saw a total of 24 sentences and the experiment lasted 10 to 15 minutes.

4. Method

The experiment was preceded by a warm-up task that familiarized children with the characters and with precise pointing via pictures similar to those used in the experimental trials. The experimenter explained to the children that they would see characters/objects on each sheet and that, after listening, they would have to point to one of them. In the rare event that children's responses were ambiguous (e.g. pointing to the whole image), the experimenter encouraged the child to be more accurate and to identify the precise character/object. During the test phase, the experimenter first gave the child a short lead-in: "Look! There are two frogs in this picture!". This was then followed by a request prompting participants to choose the correct character out of 4. Given that we only tested object dependencies, the target answer for all the experimental items consisted of pointing to the patient of the action expressed by the verb. Each test sentence was used only once and was associated with a picture which depicted either four animate characters for the animacy match condition (figure 1) or two animate characters and two objects for the animacy mismatch condition (figure 2)

Figure 1. Example of pictures used in the animacy match conditions

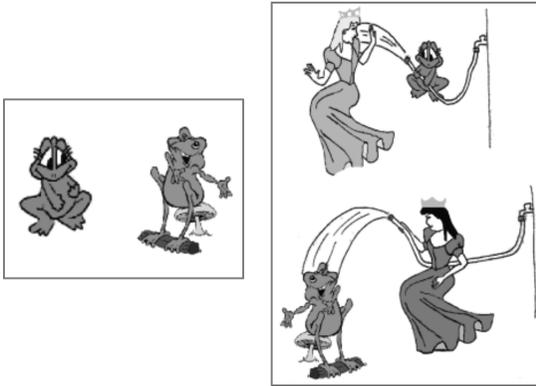
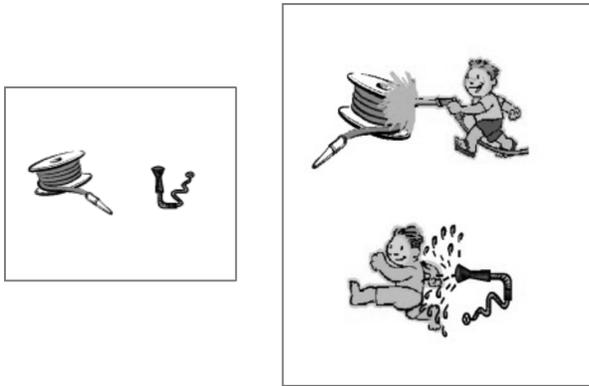


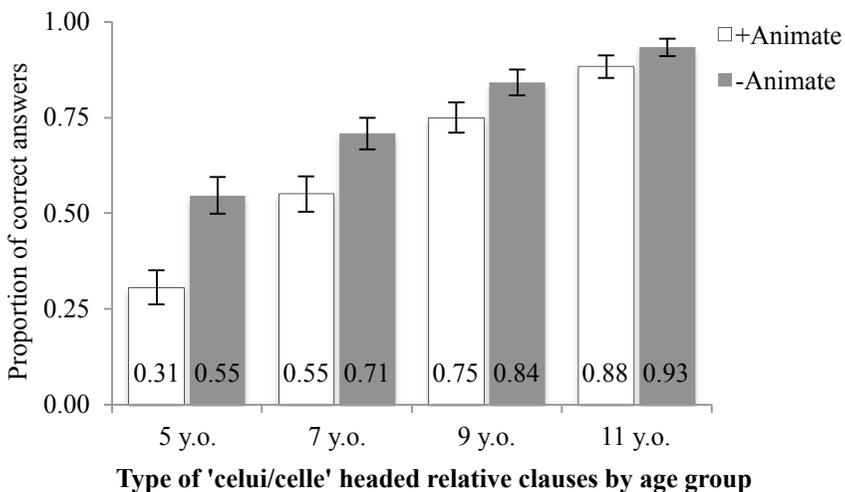
Figure 2. Example of pictures used in the animacy mismatch conditions



5. Results

Figure 3 summarizes the results obtained and represents the overall proportion of correct answers for trials with and without a mismatch in animacy between the moved object and the intervening subject. An answer was coded as correct when children identified the right Patient of the action among the four competing characters present in the display. The bars indicate the standard error to the mean.

Figure 3. Overall proportion of correct answers for object relative clauses headed by +Animate or -Animate *celui/celle* in French-speaking children from age 5 to 11



Children's responses to the comprehension task revealed a difference in performance between the +Animate and the -Animate conditions: comprehension accuracy improved in the presence of an animacy mismatch. In other words, children comprehended better object relatives in which the antecedent of the *celui/celle* relative clause head was an inanimate noun, as compared to cases in which *celui/celle* referred back to animate entities. Although these findings were robust across the four age groups tested, we see that the difference between the +Animate and the -Animate trials was greatly reduced with age. The 9 year-old and the 11 year-old children performed better than the younger groups not only with the -Animate, but also with the +Animate conditions. Their improved comprehension of *celui/celle* object relative clauses with a match in animacy thus contributed to diminishing the contrast between the +Animate and the -Animate trials.

The results were fitted to a logit mixed model (Jaeger 2008) and analyzed using the *lme4* package (Bates, Maechler, Bolker, & Walker 2014) in the R environment (R Development Core Team, 2014). Response accuracy was the dependent variable; Object Animacy was introduced as a fixed predictor in the model and Age as a covariate. The fixed predictor was coded with a sliding contrast specification. This means that the coefficient for the fixed factor indicates the difference between the mean of the dependent variable at each level of the factor (+Animate vs -Animate). The maximal random effect structure justified by the data included by-subject and by-item intercepts only.

As expected, a main effect of Object Animacy was observed (coef = 0.99, $SE = 0.39$, $z = 2.48$, $p < .01$). This shows that response accuracy improved with -Animate trials, so children performed better whenever the relative clause head *celui/celle* referred back to an inanimate antecedent thus creating an animacy mismatch between the moved A'-object and the intervening subject. The effect of Age on the comprehension of object relatives headed by *celui/celle* was also significant (coef = 0.06, $SE = 0.009$, $z = 7.14$, $p < .001$): older children gave more correct responses than the younger children in the experimental task. The interaction between Object Animacy and Age was not significant ($\chi^2(1) = 0.68$, $p = .40$), which suggests that the impact of the Object Animacy factor does not depend on Age. In other words, although comprehension improves with age, the difference between the +Animate and the -Animate trials is preserved across the ages tested.

6. Discussion

The aims of this study were to investigate whether children's parsing of object RCs (i) show an intervention effect in the absence of a lexical NP feature on the moved element i.e. with a demonstrative pronouns as the relative head, and (ii) if this effect can be alleviated by a mismatch in features that are unrealized on the verb, although computed in the featural array of the nominal expression (i.e. animacy). In order to tackle these issues, we assessed the comprehension of French object RCs headed by the demonstrative pronoun

celui/celle with a lexically restricted animate NP subject. *Celui/celle* are suited to examining these issues because, on the one hand, they do not contain a lexical NP restriction. On the other hand, whereas animacy is straightforwardly expressed in the nominal element in constituents like *la fille* ‘the girl’ or *le ballon* ‘the ball’, there is no such apparent distinction in the form of *celui/celle* demonstrative pronouns, which can be used to refer to both animate and inanimate antecedents in the discourse. The present study made use of these properties of French to test children’s comprehension of object relatives headed by *celui* and *celle* and whose referents were either animate or inanimate. Although these demonstrative pronouns also encode morphosyntactic features like gender and number (i.e. *celui* is masculine singular and *celle* is feminine singular), children could not have drawn on these features for interpretation as the embedded subjects always matched in gender and number features with the antecedents of the two referential elements *celui* and *celle*. As such, the animacy of the antecedent was the most reliable disambiguating cue that children could exploit in order to arrive at the correct interpretation for the object RC.

Regarding our first goal, results revealed that the comprehension of *celui/celle* object RCs is difficult for children, although it improves with age. Thus, effects such as those reported for A’-dependencies involving a lexical restriction arise in the absence of such a restriction. At first sight, our results seem to contradict those obtained by Friedmann et al. (2009) for Hebrew and which revealed that the presence of a subject pronominal intervener in object RCs with a lexically restricted head facilitates comprehension to the point that children perform as good as with subject RCs (with 90% accurate comprehension). However, looking closely at the relevant construction in Hebrew, one can observe that the intervening element is an arbitrary pronoun with plural features, as becomes apparent from inspecting the verbal inflection. Thus, it differs in terms of number specifications from the head of the chain, i.e., the relative head. In this respect, this structure is similar to that in (5) above and represents a configuration in which number mismatch is responsible for improved comprehension. In turn, our results show that demonstrative pronouns (referring to 3rd person) do not improve comprehension when the relative head shares the same morphosyntactic features with the intervener.

Our conclusion is in line with recent research on object RCs showing that 3rd person personal pronoun interveners do not improve performance despite differing from the head in lexical DP restriction. Haendler et al. (2015) found that German object relative clauses with a lexically restricted head and a 3rd-person pronoun as embedded subject (13) are harder for children to process than object RCs with two lexically restricted DPs (1).

13. Welche Farbe hat der Hase, den es jagt?
 what color has the bunny who it chases
 ‘What colour is the bunny that it is chasing?’

In contrast to 3rd person pronouns, they reported that the presence of 1st person pronouns as subject of an object RC, as in (14), improves children's comprehension (see also Arnon 2010).

14. Show me the bunny that **I** am chasing.

Under the approach we have been assuming here, the data on pronouns can be integrated once finer features than NP are considered as proposed by the underlying abstract configurations in (11), (13) and (14) would be (15a,b,c).

- | | | | | | |
|-----|----|-------------------------|-----|----------------------|----------|
| 15. | a. | <i>celle</i> | que | la princesse | arrose. |
| | | +R +sg +3 rd | | +sg +3 rd | |
| | b. | der Hase, | den | es | jagt |
| | | +R +sg +3 rd | | +sg +3 rd | |
| | c. | the rabbit that | | I am | watching |
| | | +R +sg +3 rd | | +sg +1 st | |

As the feature specifications reveal, (15a) and (15b) instantiate cases of inclusion relations between the features of the intervener and those of the relative head, which, we know, is challenging for children. (15c), instead, instantiates a case of feature intersection, which, we know, is less problematic for children.

As for our second goal, the findings confirm that participants successfully use animacy in the comprehension of object relatives headed by *celui/celle*. They showed better performance with trials in which the referent of *celui/celle* was –Animate, such that a mismatch in animacy between the RC head and the embedded subject had a facilitating role on children's processing of object RCs. The fact that –Animate object relatives were comprehended better than +Animate object relatives brings support to the idea that the animacy feature is relevant for the computation of intervention (see also Garraffa and Grillo 2008), despite not being realized on the overt inflectional head of the verb. Animacy has been argued on independent grounds to be relevant for triggering syntactic movement even in non-animacy based languages (see Bianchi 2006) and this would appear to be the crucial property rendering a feature visible for the computation of intervention, rather than its morphological expression on V.

Based on our and previous findings, we thus arrive at the conclusions in (16b, c) for the RM configuration in (16a):

16. a. X Z Y

b. when X includes all of the morphosyntactic features of Z, we have an inclusion relation, which is problematic for children

+R +Anim + 3 rd +sg	+Anim + 3 rd +sg
The lady	the girl
Celle	la fille (the one the girl)
The rabbit	it

c. when X only includes some of the morphosyntactic features of Z, we have an intersection relation, which can be relatively easily computed by children

+R +Anim + 3 rd +sg	+Anim + 3 rd +pl
The lady	the girls/arb pro
+R +Anim + 3 rd +sg	+Anim +1 st +sg
The lady	I
+R -Anim + 3 rd +sg	+Anim + 3 rd +sg
The ball	the girl
Celle	la fille (The one the girl)

7. Conclusion

The first research question that motivated our study was: Does the object RC penalty disappear when there is no lexical restriction? The answer is no. Our findings indicate that the demonstrative pronoun *celui/celle* triggers intervention in object RC comprehension when both the moved object and the subject are animate. This instantiates the effects of lexical restriction in the absence of a noun from the contentive lexicon, arguably because of the parallelism in other morphosyntactic features between the two DPs, i.e. gender, number, person (Adani et al., 2010; Haendler et al., 2015).

The second question we aimed to answer was: Do features matter even when they are not realized on the finite verb, in that they improve performance in the instance of a mismatch? The answer is yes. *Celui/celle* with an inanimate antecedent, crossing over an animate subject, improves object RC processing: an animacy mismatch thus modulates comprehension even in the absence of any obvious syntactic reflex on the inflectional head or on the relativized element. It is plausible that animacy plays a crucial role in triggering movement also in languages where this feature is not realized on the clausal inflectional head, as argued by Bianchi (2006) when accounting for ordering restrictions in clitic sequences in Romance. As such, the relevance of animacy for the calculation of RM is expected independently of its overt realization. Interestingly, *celui/celle*

with an inanimate referent improve comprehension difficulties, however do not eliminate them completely, suggesting that a mismatch in semantic features cannot entirely override syntactic intervention.

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