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On the comprehension of relative clauses in child Catalan

The interpretation of *wh*- interrogatives and relative clauses has been the subject of wide cross-linguistic investigation. In particular, the research in various languages has revealed an asymmetry between subject and object interrogatives and relatives, with the first being earlier in language acquisition and more preserved in aphasia (see Arosio et al. 2006 for a summary). To our knowledge, however, there is no study on the interpretation of relative clauses in child Catalan. Here we present the results of an experiment on Catalan modeled on that on Italian by Adani (in prep). Catalan, like Italian, is a null subject language in which subjects may appear postverbally in main and embedded contexts:

- (1) a. Recordo l'arbre que el pintor dibuixava.
I-remember the tree that the painter drew
b. Recordo l'arbre que dibuixava el pintor.
I-remember the tree that drew the painter

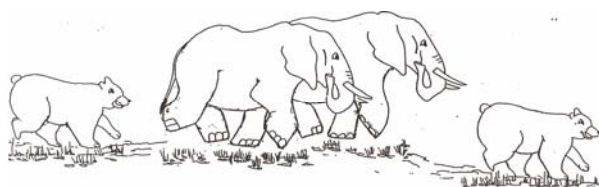
Crucially, an object relative like the one in (1b) is ambiguous when both object and subject coincide in person and number agreement (third person singular in our example) and the subject is postverbal. So, both word order and agreement are factors in the interpretation of relative clauses.

Method

Materials

The experiment replicates one of the experiments designed by Adani (in prep) for Italian. The task is an Agent selection task after the input provided by a sentence containing a relative clause. The experimental material was selected from those used by De Vincenzi (1996) for the assessment of subject/object *wh*-questions in Italian. Agents and themes are reversible in all cases. Children were presented with one picture of the kind exemplified in (2), for which the requests in (3) would be felicitous. In fact, following Hamburger and Crain's (1982) observation, two bears and two elephants are depicted in the picture.

(2)



- (3) a. Assenyala l'ós que persegueix els elefants.
Point to the bear that follows the elephants
- b. Assenyala l'ós que els elefants persegueixen.
Point to the bear that the elephants follow-pl
- c. Assenyala l'ós que persegueixen els elefants.
Point to the bear that follow-pl the elephants

The character referred to appears in all cases on the left or the right of the picture and the decision as to which one is the correct one depends solely on the linguistic input.

Each child was presented with a 20 item list (list 1), distributed as follows:

- (4) a. Subject relatives #6
- b. Object relatives, preverbal subject #6
- c. Object relatives, postverbal subject #5
- d. Distractors #3/4

The order of presentation of the items in (4) was pseudoaleatory.¹ Given this first list, another one was created by reversing the order of trials (list 2), in order to control for presentation order effects among trials. List 1 was used with half of the children while list 2 to the other half.

All experimental items involved transitive verbs with animate subjects and objects, and verbs belonging to the earliest vocabulary. The full list appears in (5) and corresponds to the set of verbs used by Adani (in prep).

- (5) *perseguir* 'to chase'
estirar 'to pull'
picar 'to peck'
seguir 'to follow'

¹ Adani (in prep) presented 24 experimental items (8 of each type) and 12 fillers.

rentar 'to wash'
mirar 'to look at'
mossegar 'to bite'
empènyer 'to push'

Fillers involved either intransitive verbs or transitive verbs with inanimate objects as illustrated in (6). The verb types and the contrasts in animacy of the referents have been shown to influence children's performance (Goodluck and Tavakolian, 1982; Correa, 1986; 1995), so we expect fillers to be easier.

- (6) Assenyala el nen que menja un gelat.
 Point to the boy that is eating an ice-cream



The full list of items the children were presented with appears in Appendix 1.

Subjects – The 33 children who took part in the experiment were recruited in three schools in Barcelona, L'Hospitalet de Llobregat and Prats de Lluçanès.² They were all native speakers of (Central) Catalan, as were the adult controls. The children were divided into three age groups of roughly the same size:

Table 1: Subjects

Group name	group	#	Age range	Mean age
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² We acknowledge the collaboration of children and teachers at the following schools: Escola Tibidabo in Barcelona; Presentació de la Mare de Déu – Dominiques de l'Anunciata in Prats de Lluçanès; Tecla Sala – Fundació per a les Escoles Parroquials in L'Hospitalet de Llobregat.

G1	>4;6	12	3;5,9-4;4,11	3;11,26
G2	4;6-5;6	11	4;6,10-5;3,25	4;11,6
G3	5;6<	10	5;10,5-6;2,30	6;0,12
	total	33	3;5,9-6;2,30	4;11,4

Controls # 22

Procedure

The experiment was administered to children in individual sessions in a separate, quiet room in their school. The input sentences were recorded, but one of the experimenters reverted to spoken input to better maintain the attention of the young children (the results did not indicate that resorting to non-recorded material had any effect on the answer). At the beginning of each session the details of the child were noted by the experimenter, as were the answers, although all sessions were also video-recorded (on DVD support). The experimenter repeated the input sentences at the request of the child.

Previous to the experiment, the children were familiarised with the characters in the pictures

The procedure followed with the adult controls was the same as with the children.

Scoring

Children's responses were scored into one of three categories, one of which is the target response and the other two are errors. For each correct response one point was given.

Results

The results of the picture selection task appear on tables 2 and 3.

Table 2: Results, children, subject relatives and fillers

group	SR				fillers	
	correct	object	other	correct		
>4;6	57/72 79%	12/72 16,5%	3/72 4%	44/44	100%	

4;6–5;6	64/66	97%	1/66	1,5%	1/66	1,5%	37/37	100%
5;6<	60/60	100%					45/45	100%
total	181/198	91%	13/198	7%	4/198	2%	126/126	100%

Fillers are interpreted by children in an adult-like manner from onset (100% correct), and answers in which relative clauses are not interpreted as either subject or object ('other' answers) diminish with age and are never very significant. There is a clear progression in the interpretation of subject relative clauses, which starts at a level of 79% of adult-like behaviour and reaches 100% for the oldest group.

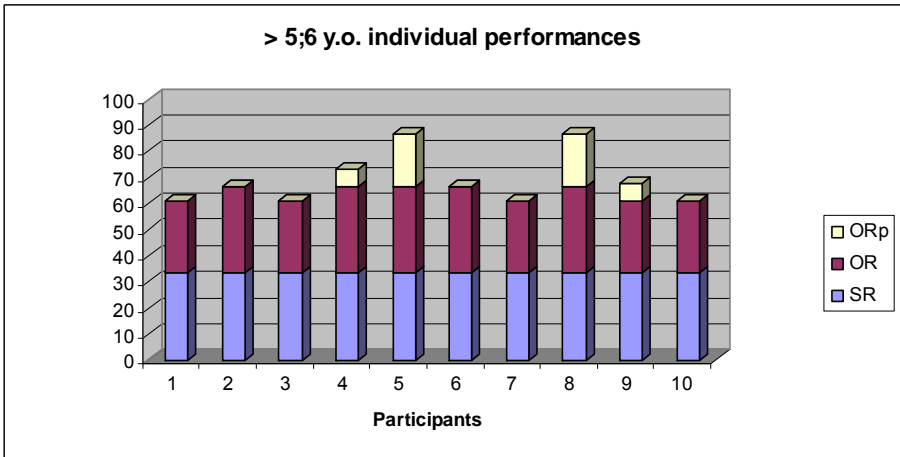
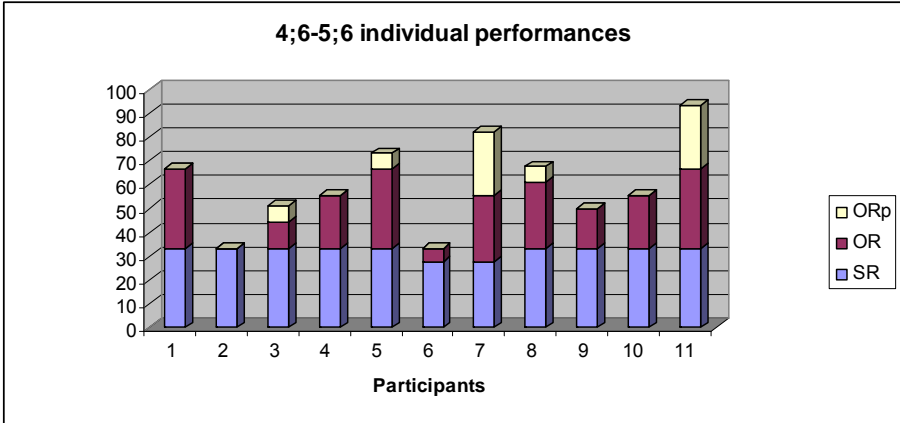
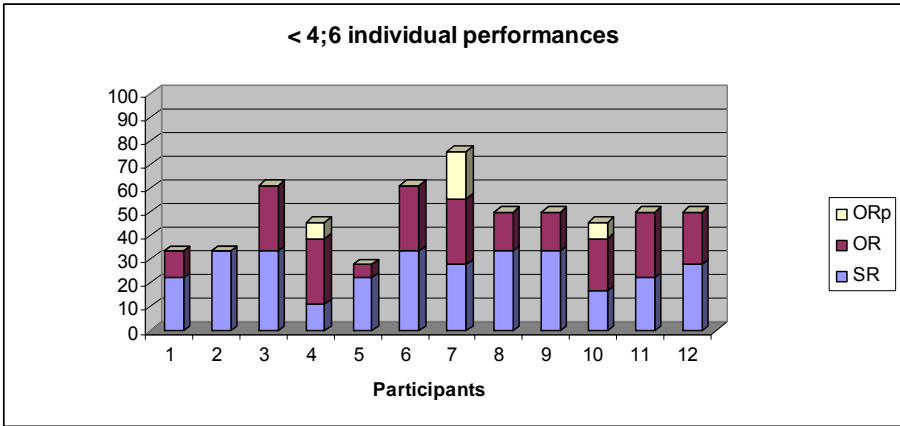
In the case of object relatives, those with preverbal subjects achieve almost adult-like levels in the oldest group of children (92%), starting at a lower point than with subject relative clauses (58%). There is a linear progression, as with subject relatives. However, with object relatives with a postverbal subject, there is no progression visible for the period investigated; object relatives with postverbal subjects are preferably interpreted as subject relatives (on average in 83% of cases), in spite of the fact that the subject agreement indicates unambiguously that the clauses can only be interpreted as object relatives.

Table 3: Results, children, object relatives

group	OR			ORp		
	correct	subject	other	correct	subject	other
>4;6	42/72 58%	21/72 29%	9/72 12,5%	5/60 8%	51/60 85%	4/60 6,5%
4;6–5;6	42/66 64%	20/66 30%	4/66 6%	11/55 20%	44/55 80%	
5;6<	55/60 92%	3/60 5%	2/60 3%	8/50 16%	42/50 84%	
total	139/198 70 ^c	44/198 22%	15/198 7,5 ^y	24/165 14,5	137/165 83 ^c	4/165 2,5%

There is considerable individual variation in this pattern, with some children almost converging to the adult grammar at a much earlier age than others, as can be seen from the individual results, and Appendix 3.

Individual performance within each age group is represented in the following graphs:



These results are to be compared with those of adults, which appear on tables 4 and 5. From these it can be observed that the interpretation of fillers, subject relative clauses and object relative clauses with preverbal subjects is fully target-like, while there are a few errors in the interpretation of object relatives with postverbal subjects. Furthermore, the experimenters noted when repetitions were required by the adult subjects and when hesitations occurred, and that always with the sentences containing object relatives with postverbal subjects.

Table 4: Results, adults, subject relatives and fillers

group	SR			fillers		
	correct	object	other	correct		
total	131/132 99%	1/132 0.7%	0	71/71 100%		

Table 5: Results, adults, object relatives

group	OR			ORp		
	correct	subject	other	correct	subject	other
total	132/132 100%	0	0	111/120 92%	9/120 7%	0

Statistical analysis: Design and Target Response Analysis

First, we wanted to make sure that no difference in performance yielded between those children that were exposed to list 1 and those who were exposed to list 2. Hence, a repeated measure ANOVA was carried out with correct response as the Dependent Variable and List as between subject factor. As expected, the factor list did not yield any significant effect [$F(1,31)=0,932$, $p=0,342$].

In order see how children belonging to different age groups performed on different sentence types, we performed an additional repeated measure ANOVA with correct responses as dependent variable and Sentence type and Age as factors. The factor Sentence type had 3 levels (SR, OR and ORp) and the factor Age had also 3 levels (G1; G2 and G3)

The following table summarises mean accuracy percentages for each group on each sentence type:

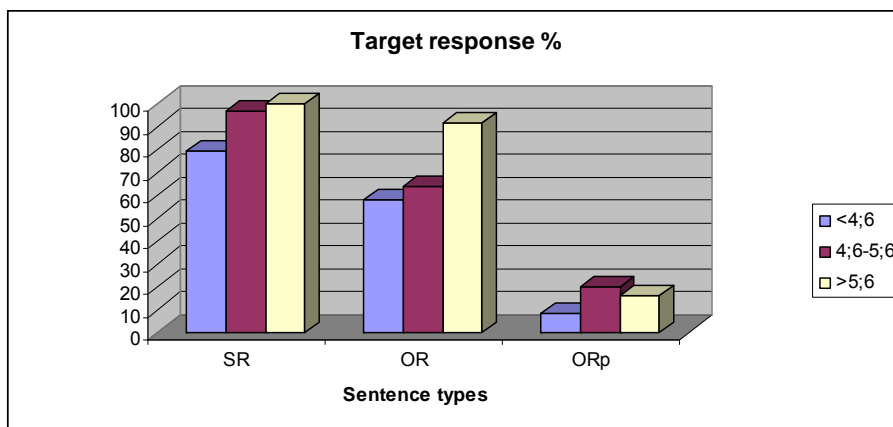
Table 6: Mean accuracy

	SR %	OR %	ORp %
G1	79	58	8
G2	97	64	20
G3	100	92	16

We found main effects of Age [$F(1,2)=6,086$, $p=0,006$, $\pi^2= 0,288$], Sentence type [$F(2,60)=138,1$, $p<0,001$, $\pi^2=0,82$] and the Sentence x Group interaction failed to be significant [$F(4,60)= 2,139$, $p=0,087$]³.

Follow ups (pairwise comparisons using Bonferroni correction) confirms that $G1 < G3$ ⁴ ($p=0,009$) whereas, as far as Sentence is concerned, $SR > OR$ ($p<0,001$), $SR > ORp$ ($p<0,001$) and $OR > ORp$ ($p<0,001$).

The overall results are represented in the graph:



What the correct response analysis (and the corresponding graphs) do not reveal is the fact that the erroneous interpretation of object relatives with postverbal subjects is always one in which the clause is interpreted as a subject relative clause and the postverbal subject is the object, overriding the subject-verb agreement. The source of such an asymmetry, as well as the comparison of our results with those by Adani (in prep) and Arosio et al. 2006 (very similar in fact to ours) remain a topic for future research^h.

³ Partial eta squares values (π^2) indicates that 82% of our overall effect is accounted by a variation in the Sentence type factor, 29% by the Age factor .

⁴ "<" stands for significantly less accurate, whereas ">" significantly more accurate

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Appendix 1

(D, distractor; SR, subject relative; OR, object relative; ORp, object relative with postverbal subject)

Assenyala ...

Point to...

- | | | |
|----|---|----|
| 1. | el nen que mira/està mirant la televisió.
the boy who watches/is watching the tv | D |
| 2. | el camell que els elefants segueixen/estan seguint.
the camel that the elephants follow-pl/are following | OR |
| 3. | el gos que les nenes miren/estan mirant.
the dog that the girls look at/are looking at | D |
| 4. | el nen que estira/està estirant les fades.
the boy who pulls/is pulling the fairies | SR |
| 5. | els nens que porten la motxilla.
The boys who carry the rucksack | D |

- | | | |
|-----|---|------|
| 6. | el lleó que segueix/està seguint els óssos.
the lion that follows/is following the bears | ORp? |
| 7. | l'oca que els conills persegueixen/estan perseguint.
the goose that the rabbits follow/are following | OR |
| 8. | la gallina que pica els pollets.
the hen that pecks the chicks | SR |
| 9. | els senyors que porten barret.
the men who wear hat | D |
| 10. | el gos que mosseguen/estan mossegant els gats
the dog that bite/are biting the cats | ORp |
| 11. | la pantera que espeny/està empenyent els elefants.
the panther that pushes/is pushing the elephants | SR |
| 12. | l'ovella que les zebres persegueixen/estan perseguint.
the lamb that the zebras chase/are chasing | OR |
| 13. | la tortuga que miren/estan mirant els conills.
the tortoise that watches/is watching the rabbits | ORp |
| 14. | el camell que persegueixen/estan perseguint els porcs.
the camell that chase-pl the pigs | ORp |
| 15. | la tortuga que persegueix els peixos.
the tortoise that follows the fish | SR |
| 16. | la nena que salta/està saltant
the girl who jumps/is jumping | D |
| 17. | els cigne que els pollets piquen/estan picant
the swan that the chicks peck/are pecking | OR |
| 18. | la mona que renta/està rentant els óssos.
the monkey that washes/is washing the bears | SR |
| 19. | l'ós que empenyen/estan empenyent els elefants.
the bear that push-pl/are pushing the elephants | ORp |
| 20. | la gallina que segueix/està seguint les tortugues.
the hen that follows/is following the turtoises | SR |
| 21. | la vaca que les ovelles empenyen/estan empenyent.
the cow that the lambs push/are pushing ⁵ | OR |

Appendix 2

Subjects (total: 33 children, 21 girls, 12 boys)

⁵ Verbs appear as present or present continuous (a compound tense in Catalan) because they were produced as present by two of the experimenters and as present continuous by the other; this had, however, no impact on the results.

Mariona	3;5,9
Roger	3;5,11
Carlos	3;9,23
Nil	3;10,30
Xavier	4;0,11
Albert	4;0,11
Núria	4;0,12
Marta	4;2,6
Paula	4;2,11
Paula	4;2,14
Núria	4;2,21
Júlia	4;4,11
Judit	4;6,10
Paula	4;6,27
Nil	4;7,5
Marc	4;10,4
Anna	4;10,14
Jordi	4;11,24
Sara	5;0,9
Jordi	5;1,7
Emma	5;2,0
Lucia	5;3,10
Maria	5;3,25
Marc	5;10,5
Aketza	5;10,11
Aina	5;10,22
Jordi	5;10,24
Pablo	5;11,13
Laura	6;1,3
Gemma	6;1,18
Paula	6;1,19
Lucia	6;2,19
Mònica	6;2,30

Appendix 3

Individual results for the children

(g1: age group 1; g2: age group 2; g3: age group 3; Sc: subject relative correct; So: subject relative interpreted as object; oth: other; Oc: object relative correct; Os: object relative interpreted as subject; Opc: object relative with postverbal subject correct; Ops: object relative with postverbal subject interpreted as subject; fillc: filler correct)

child	Sc	So	oth	Oc	Os	oth	Opc	Ops	oth	fillc	oth
g1	6				4	2		5		4	
g1	4	2		2	4			5		4	
g1	2	4		5	1		1	4		4	
g1	6			5		1		5		4	
g1	4		2	1	3	2		3	2	3	
g1	6			5	1			5		3	
g1	6			3	3			5		3	
g1	5	1		5	1		4	1		3	
g1	6			3	2	1		5		3	
g1	3	3		4		2	1	3	1	3	
g1	5	1		4	1	1		4	1	3	
g1	4	1	1	5	1		5			3	
g2	6				5	1		5		4	
g2	6			2	4		1	4		4	
g2	6			4	2			5		4	
g2	6			6			1	4		4	
g2	5		1	1	3	2		5		3	
g2	6			6				5		3	
g2	6			5	1		1	4		3	
g2	5	1		5	1		4	1		3	
g2	6			3	2	1		5		3	
g2	6			4	2			5		3	
g2	6			6			5	1		3	
g3	6			6				5		4	
g3	6			5	1			5		4	
g3	6			6			1	4		4	
g3	6			5	1			5		4	
g3	6			6			3	2		4	
g3	6			6				5		3	
g3	6			5	1			5		3	
g3	6			6			3	2		3	
g3	6			5		1	1	4		3	
g3	6			5		1		5		3	

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