THE ACQUISITION OF CATALAN RELATIVES: STRUCTURE AND PROCESSING

ANNA GAVARRÓ, ARNAU CUNILL, MÍRIAM MUNTANÉ, MARC REGUANT[1]

Abstract. Research in various languages indicates that children interpret subject relatives in an adult-like manner substantially earlier than they interpret object relatives. This asymmetry may be attributed to processing of the corresponding syntactic structures, as in Gibson (1998), Morrill (2000). We address this basic asymmetry by considering the acquisition of Catalan relatives, both for comprehension and production. The interpretation of Catalan relatives was investigated by Gavarró *et al.* (2012) and the results show the well-known asymmetry in comprehension between subject and object relatives. The elicitation experiment, designed by Friedmann *et al.* (in preparation), was run with twenty Catalan-speaking 5-year-olds. Children produced 98% of subjects as adults do, while they produced fewer object relatives. Briefly, for our results the parallelism between comprehension and production holds. We propose to account for the findings by adopting an analysis based on Morrill's (2000) metric of syntactic complexity, an implementation of Gibson's (1998) insight that processing difficulties increase as a function of the number of unresolved dependencies that the speaker must keep in memory. Gibson's and Morrill's proposals are neutral with respect to whether linguistic knowledge is put to use in production or comprehension: here we claim that, in fact, for the empirical domain considered, production and comprehension are equally taxed.

Keywords: Catalan, relative clauses, acquisition, production, comprehension, complexity metric, categorial grammar.

1. INTRODUCTION

Research in various languages indicates that children interpret subject relatives in an adult-like manner substantially earlier than they interpret object

[1] Universitat Autònoma de Barcelona. Address for correspondence: Departament de Filologia Catalana, Universitat Autònoma de Barcelona, Edifici B; 08193 Bellaterra (Cerdanyola del Vallès); anna.gavarro@uab.cat

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relatives. This asymmetry, while grounded in a grammatical contrast, may be attributed to processing of the corresponding syntactic structures, as in Gibson (1998), Johnson (1998), and Morrill (2000). One question that emerges is: if processing can be argued to be the source of poor performance in the interpretation of object relatives, does this carry over to production? Here we address this issue with the acquisition of Catalan; we present original results for relative clause elicitation and compare them with those of a relative clause interpretation experiment.

The paper proceeds as follows: first we provide the background to the present study, and we give an analysis for the subject/object relative asymmetry found in comprehension (Section 2). Then we describe the experiment for the elicitation of relative clauses carried out and provide the results (Section 3); finally, we compare production and comprehension and draw conclusions (Section 4).

2. BACKGROUND: RELATIVE CLAUSE COMPREHENSION IN CATALAN

2.1. An experiment on relative clause comprehension

The acquisition literature reports on work in numerous languages showing a contrast between the interpretation of subject and object relative clauses. This is attested for English (Brown 1971, de Villiers *et al.* 1979 and references therein), French (Frauenfelder *et al.* 1980), German (Schriefers *et al.* 1995), Italian (Arosio *et al.* 2009), Greek (Guasti *et al.* 2008), and Hebrew (Friedmann *et al.* 2009), among others. This asymmetry is, however, not universal, since languages with prenominal relative clauses such as Chinese and Basque are known to behave differently: see for example the work of Hsiao and Gibson (2003) on Chinese and that of Carreiras *et al.* (2010) on Basque. Nonetheless we will centre our attention here on the type of language mentioned first, namely, that of head-initial, postnominal relative clauses, and consider one particular language, Catalan, for which comprehension results are available, and then revisit prenominal relatives at the end of the paper.

Catalan relative clauses are postnominal and headed by the relative pronoun *que* that, unlike e.g. the Spanish relative pronoun, is not identical to a wh- word. *Que* introduces both subject and object relatives – only prepositional relatives present the alternative pronoun *qui* (*La nena a qui he enviat el llibre* 'The girl to whom I sent the book').

Gavarró *et al.* (2012) carried out an experiment on the comprehension of Catalan relative clauses, replicating the experiment of Arosio *et al.* (2009) and Adani (2010). The experiment was an agent identification task with picture support. Children had to identify a character in a picture when the experimenter requested it, as illustrated in (1).

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(1) a. Assenyala el camell que segueix els elefants!
point to the.SG camel that follows the.PL elephants
'Point to the camel that is following the elephants!'
b. Assenyala el camell que els elefants segueixen!
point to the.SG camel that the.PL elephants follow
'Point to the camel that the elephants are following!'
c. Assenyala el camell que segueixen els elefants!
point to the.SG camel that follow the.PL elephants
'Point to the camel that the elephants are following!'

(1a) includes a subject relative, (1b) an object relative with a preverbal subject in the embedded clause, and (1c) an object relative with a postverbal subject in the embedded clause. Object relatives of this last type are potentially ambiguous as Catalan has no overt Case marking and therefore postverbal subjects may be interpreted as subjects or objects, unless subject–verb agreement disambiguates the sentence. (This ambiguity is in fact found in all the Romance null subject languages.)

All sentences in the experiment were unambiguous and reversible, so that the interpretation rested on the linguistic input only. The materials were designed so that the questions would be pragmatically felicitous. The task was run with 33 children, 12 of whom were younger than 4;6 (mean age: 3;11,26), 11 of ages between 4;6 and 5;6 (mean age: 4;11,6), and 10 older than 5;6 (mean age: 6;0,12); the age range was 3;5,9–6;2,30 and the mean age 4;11,4. The results appear in Table 1.

Table 1

Results for relative clause comprehension: target comprehension by age

	SR		**OR**	
<4;6	57/72	79%	47/132	35%
4;6–5;6	64/66	97%	53/121	43%
5;6<	60/60	100%	63/110	57%
adults	131/132	99%	243/252	96%

SR: subject relative; OR: object relative

These results indicate how subject relatives are interpreted in an adult-like manner from early on (79% of the time in the younger group), while object relatives develop at a slower pace; in fact object relatives with postverbal subjects are misinterpreted for the whole period investigated. Very similar results are found in a related language, Italian (see Arosio *et al.* 2009, Adani 2010).

2.2. A categorial analysis

In Morrill and Gavarró (2010) we analyse these comprehension contrasts as the result of the relative processing load of the structures involved. We propose to

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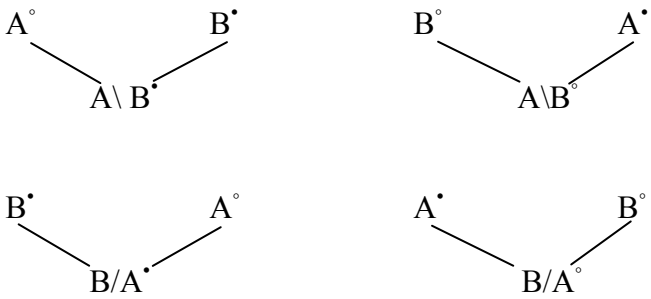
account for the findings by adopting an analysis based on Morrill's (2000, 2010) metric of syntactic complexity, an implementation of Gibson's (1998) and Johnson's (1998) insight that processing difficulties increase as a function of the number of unresolved dependencies that the speaker must keep in memory. Morrill (2000, 2010) proposes a metric of processing cost that can account for the relative difficulty of Catalan object relatives as opposed to subject relatives (notice that both are low in processing cost if compared to centre embedding, e.g. *the cheese that the rat that the cat saw ate stank*, for which adults are found to have difficulties).

Categorial grammar (Morrill 2010) classifies words and expressions by means of fractional types built over basic types such as sentence (S) and nominal (which we parameterise here with number singular, N(sg), plural, N(pl), or unspecified, N(_)). An expression of type A\B is one which concatenates with any expression of type A to the left to form an expression of type B. An expression of type B/A is one which concatenates with any expression of type A to the right to form an expression of type B. Formally:

(2) $A\backslash B = \{s|$ for all $s' \in A$, $s'+s \in B\}$
$B/A = \{s|$ for all $s' \in A$, $s+s' \in B\}$

Morrill (2000, 2010) describes a complexity metric founded on incremental categorial processing in terms of proof nets. In this view of processing, types are marked with input polarity ($^\bullet$), meaning that a resource is given, or output polarity ($^\circ$), meaning that a resource is wanted. Polar types are unfolded upwards into polar type trees as follows:

(3)



We refer the reader to the references above for the details, which are quite involved, but we illustrate the basic idea here with the processing of the sentence in (4):

(4) John loves Mary.

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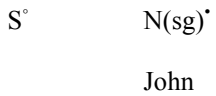
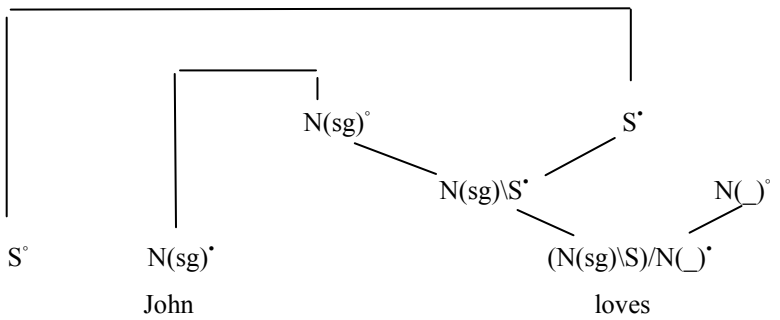
Initially, a sentence is sought and after hearing the first word its type is given:

(5)



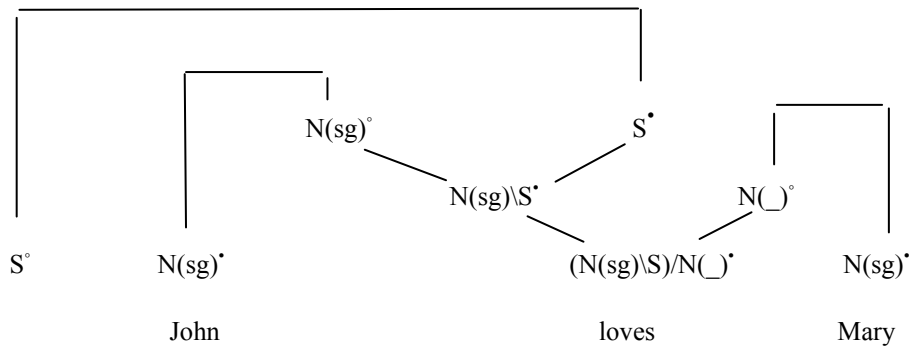
When the second word is heard, its unfolded type is connected by two dependencies: the subject sought is given by the first word *John* and the sentence projected is matched by the initial expectation of a sentence. We represent this as follows:

(6)



When the final word is heard, the parse is completed thus (the unspecified object number on the verb type becomes instantiated by unification with the type with which it is matched):

(7)



The derivations proposed for a subject relative and an object relative in Catalan appear in (8) and (9) respectively.

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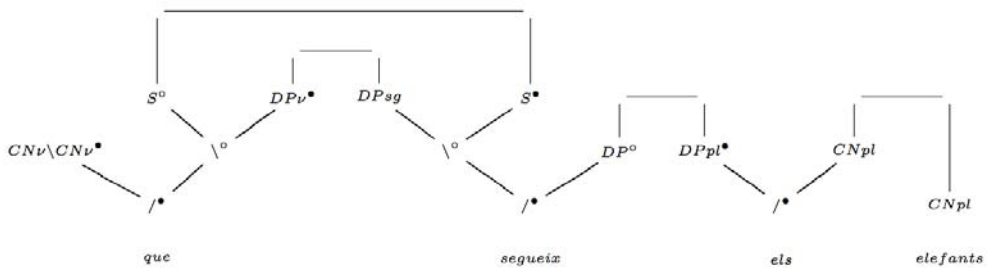
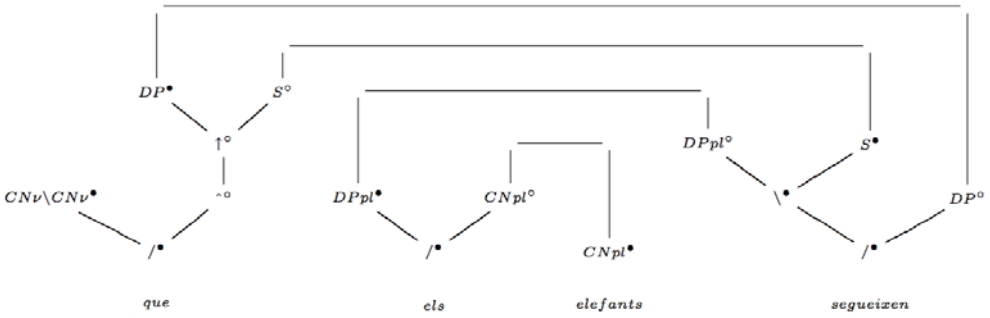
(8) Derivation of sentence (1a), from Morrill and Gavarró (2010)



(9) Derivation of sentence (1b), from Morrill and Gavarró (2010)



The relative pronoun *que* seeks to the right a category in turn seeking a DP, and this is satisfied earlier in the subject relative clause (in subject position) than in the object relative clause. The processing load at each point in the sentence is mechanically worked out by the metric. The complexity profile of a sentence describes the incremental load at each word boundary by counting the syntactic dependencies that are unresolved at each point (where syntactic dependencies include major categories and feature values, both counting for 1). When the last word of the sentence has been heard, all dependencies are resolved and the profile reaches 0. We can observe the differences in the number of dependencies to be resolved in the subject and object relatives exemplified above. The complexity profiles are read as follows: the Y-axis represents the load on memory at a point; the character *a* represents the load level in the example after you hear one word and before you hear the next. The load level corresponds to the number of lines overarching across in the derivation of the sentence. The complexity profile of (1b) in (11) is higher than that of (1a) in (10), thus predicting lower acceptability, which by hypothesis results in higher comprehension problems.

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(10) Complexity profile of sentence (1a)

```
3                    a
2                                a
1                            a
0                                        a
   Assenyala el camell que   segueix   els   elefants.
   point-to   the camel that  follow-3s  the-pl elephants
```

(11) Complexity profile of sentence (1b)

```
7                        a
6
5                                a
4
3                    a
2
1
0                                        a
   Assenyala el camell que   els   elefants   segueixen.
   point-to   the camel that  the-pl elephants  follow-3pl
```

To summarise, we have shown how a categorial metric of complexity can be put to use to account for differences between subject and object relative comprehension. What we set out to do next is consider the production of relative clauses under the same analysis.

3. AN EXPERIMENT OF RELATIVE CLAUSE PRODUCTION

3.1. Experimental design

In order to test the production of relative clauses in child Catalan, we ran an elicitation experiment, our version for Catalan of the elicitation task designed in the context of COST Action A33, in turn based on Novogrodsky and Friedmann (2006). Children were asked for their preferences, given a choice: ‘A boy drinks milk, and a boy drinks water. Which child would you rather be?’ and were requested to start their answers with ‘I’d rather be…’. The prompts crucially induced the production of relative clauses, and the method proved to be very effective. This elicitation method is exemplified for subject relatives and object relatives for Catalan in (12).

(12) a. Hi ha dos nens. Un nen beu llet i un altre nen beu aigua. Quin nen t’agradaria ser?
CL have two children A child drinks milk and another child drinks water which child CL like to-be
‘There are two children. One child is drinking milk and the other child is drinking water. Which child would you rather be?’

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b. Hi ha dos nens. Un pare abraça un nen i un pare gronxa un nen. Quin nen t'agradaria ser?
CL have two children A father hugs a child and a father swings a child. Which child CL like to be
'There are two children. A father is hugging a child and a father is swinging a child. Which child would you rather be?'

There were a total of twenty items, of which ten corresponded to subject relatives and ten to object relatives. The verbs in the embedded sentence were all transitive. Of each ten subject and ten object relatives, six were reversible (both referents involved could fulfil the Agent and Theme theta role, as in 12b), while four were irreversible (like 12a above). Reversibility will not be considered in the analysis.

The children were all native speakers of Catalan (in particular Central Catalan) recruited at the Lloriana primary school in Sant Vicenç de Torelló and at the Maria Borés primary school in La Pobla de Claramunt; adult controls also came from the same area. The relevant age information about child and controls subjects appears in Table 2.

Table 2

Subjects

subjects	#	age range	mean age
5-year-olds	20	5;0,11–5;11,24	5;5,15
Adults	10		

Children were tested individually in a quiet room in their schools. The input was not recorded, but rather produced by the experimenters, who also transcribed the answers. Only sentences with a relative pronoun were considered to be relatives, and the authors judged whether a relative clause was well-formed or not.

3.2. Results

For subject relatives, the response types relevant for Catalan were (i) adult-like subject relatives with a gap (13a), headless relatives (13b), and fragments without a relative clause (13c).

(13) a. M'agradaria ser el nen que beu llet.
CL would-like to-be the child that drinks milk
'I would like to be the child who is drinking milk.'

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b. M'agradaria ser el que beu llet.
CL would-like to-be the that drinks milk
'I would like to be the one who is drinking milk.'
c. M'agradaria ser el de la llet.
CL would-like to-be the of the milk
'I would like to be the one of the milk.'

In the case of object relatives, the strategies that Catalan speakers can adopt are more diverse, and likewise the errors found are also diverse. Answers included: (i) adult-like object relatives with a gap (14a), (ii) relatives with a postverbal argument, possibly the subject (object relative) or the object (subject relative) (14b), (iii) object relatives with a resumptive pronoun (14c), (iv) object relatives with a reflexive resumptive (14d), (v) object relatives with a resumptive full DP (14e), and fragments and inappropriate subject relatives.

(14) a. M'agradaria ser el nen que el pare gronxa.
CL would-like to-be the child that the father swings
'I would like to be the child that the father is swinging.'
b. M'agradaria ser el nen que gronxa el pare.
CL would-like to-be the boy that swings the father
'I would like to be the boy who is swinging the father'
or 'I would like to be the child who the father is swinging.'
c. M'agradaria ser el nen que *el* desperta la música.
CL would-like to-be the boy that him wakes-up the music
'I would like to be the child that the music wakes up.'
d. M'agradaria ser el nen que em desperten.
CL would-like to-be the child that REFL wake up-3pl
'I would like to be the child they are waking up.'
e. M'agradaria ser el nen que el veí pentina *el nen*.
CL would-like to-be the boy that the neighbour combs the boy
'I would like to be the child that the neighbour is combing.'

While all the options encountered amongst the productions of subject relatives were well-formed, not all the productions of object relatives were so; resumptive pronouns are grammatical in colloquial Catalan, but first person resumptives (14d) and resumptive full DPs (14e) are not well-formed.

The total number of answers by the children was 400, of which only 13 were not relative clauses. The results for 5-year-olds and adults for subject and object relatives appear in Tables 3 and 4:

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Table 3

Results for subject relative production

	5-year-olds		**adults**
target relative	173/200	86.5%	97.5%
headless	23/200	11.5%	2.5%
fragment	3/200	1.5%	0%
other	1/200	0.5%	0%

Table 4

Results for object relative production

	5-year-olds		**adults**
target unambig	15/200	7.5%	16%
ambiguous	76/200	38%	19%
resumptive pron	34/200	17%	53%
reflexive resumpt	6/200	3%	2%
null subject	9/200	4.5%	0%
subject relative	26/200	13%	0%
DP filled gap	25/200	12.5%	0%
passive		0%	10%
fragment & other	9/200	4.5%	0%

The first table shows that children produce subject relatives straightforwardly and, although they produce more headless relatives than adults, the pattern of production is very adult-like. While at age 5 children produced 98% of subject relatives, just like adults (including headed and headless relatives), they produced fewer object relatives, as shown in the second table. Only 7.5% of relatives were object relatives with a gap, and 38% corresponded to ambiguous relatives (compared to the 19% ambiguous responses produced by adults). The difference between subject and object relatives is striking.

Object relatives with resumptive pronouns deserve special mention; they occurred in 17% of cases in the children's production, but constituted 53% of adult

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production (although these resumptives are considered substandard in Catalan, they are widely used and identified in the literature; see Solà 2002). Children, unlike adults, produced relatives with a full DP copy of the relativised element. Child production of resumptives has also been noted for languages which disallow it in the adult grammar, such as English and French (data from Pérez-Leroux 1995 and Labelle 1990 respectively):

(15) the one that he lifted *it* (Lia; 4;5)
(16) sur la balle qu'il *l*'attrappe.
over the ball that he it catches (LE, 3;8)

Pérez-Leroux (1995) ran a relative clause elicitation experiment with Spanish- and English- speaking children (26 Spanish-speaking children, aged 3;5 to 6;8, mean age 5;3; eleven English-speaking children aged 3;5 to 5;5; mean age 4;10); based on her results, she argued that resorting to resumptive pronouns should be considered a strategy analogous to DP filled gaps in relatives, as in (17)–(18), and was found across languages in a systematic way.

(17) the one that the cowboy is pulling *the horse* (Thomas, 3;7)
(18) sur la balle qu'il lance *la balle* (M, 5;0, from Labelle 1990)
on the ball that he catches the ball

In Catalan we found resumptives with object relatives only, consistent with Pérez-Leroux's findings for English and Spanish, and produced 17% of the time; DP filled gaps were found in 12.5% of cases; taken together, these two sets thus represent 29.5% of answers. Pérez-Leroux found that the percentage of resumptives in a broad sense (including resumptive pronouns and DP filled gaps) was 36.2% in Spanish, 25% in English and 40.9% in French (French data from Labelle's 1990 study); she also found the difference in the production of resumptives in the different languages not to be significant. Our results are clearly in line with those of Pérez-Leroux, and this is particularly relevant given that Catalan adults produce more resumptives than English adults (other than with relatives involving *such that*, English speakers appear not to commonly resort to resumptive pronouns). So we can conclude that our results are consistent with the claim by Pérez-Leroux that, in acquisition, the proportion of resumptives does not differ substantially across languages.[2]

[2] To our knowledge there is no published work in the type logical categorial framework here on the grammar of resumptives or their processing.

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As for the general outcome of the experiment reported, there is a sharp contrast between subject and object relatives in their production by 5-year-olds. It remains to be seen at what age the behaviour of children attains adult levels.

4. COMPREHENSION AND PRODUCTION COMPARED

In some domains of language acquisition, the observation has been made that discrepancies emerge between production and comprehension of grammatical constructions. In some of these cases the discrepancy may be just apparent, so that children appear to comprehend a construction, and fail to produce it, yet under closer scrutiny it is found that their comprehension is also delayed. In other cases, such as the one of agreement production and comprehension, to which we turn later, the discrepancy still needs to be accounted for. Here we deal with an instance of this general issue. In particular, the research question which we address here is: Does the production of relative clauses parallel comprehension in acquisition? As a first step, let us compare the results available involving comprehension to those for production obtained in the present study. It should be noted that the age range of the two groups of children compared does not coincide in its span, since in the comprehension experiment the age groups were children younger than 4;6, children 4;6 to 5;6, and children older than 5;6. Still, given that the pace of development in relative clause comprehension is gradual, it seems legitimate to compare a large group of 5-year-olds with two groups of children spanning 6 months in the older and younger range.

Table 5

Subject and object relative clause comprehension and production

comprehension				
	SR		**OR**	
4;6–5;6	64/66	97%	53/121	43%
5;6<	60/60	100%	63/110	57%
total	124/126	98%	116/231	50.2%
production				
5-y-o		98%		62.5%

Target object relatives in production here include: object relatives with a gap, relatives with a resumptive pronoun and ambiguous relatives; inclusion of this last type may overestimate the percentage of correct answers (since it may include some or many disguised subject relatives). With this caveat, comprehension and production are graphically represented in (19).

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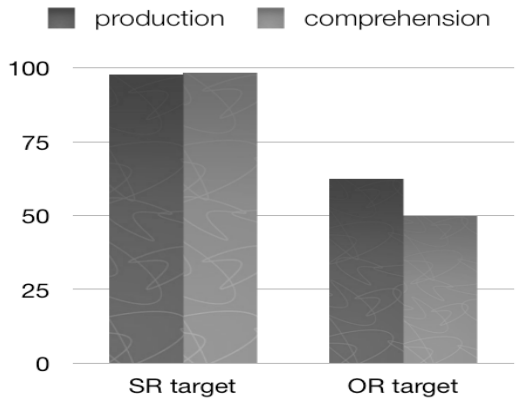
(19) Percentage of correct production and comprehension of relative clauses



The similarity between comprehension and production is notable, even more so if we take into account that the production of object relatives may have been overestimated. Here we will argue that, far from being accidental, this parallelism is to be expected under our approach.

There are some differences which the graph does not portray, namely the way in which miscomprehension of object relatives requires that children sometimes ignore the disambiguating morphology in the embedded verb (as found also in Arosio *et al.* 2009 in Italian), while children never produce errors in agreement in relative production; this contrast actually extends beyond relatives: subject-verb agreement is sometimes disregarded by children in comprehension, but not in production: see Johnson *et al.* (2005), Pérez-Leroux (2005) for main clauses.

Gibson's and Morrill's proposals are neutral with respect to whether linguistic knowledge is put to use in production or comprehension, but, as pointed out by an anonymous reviewer, the parallelism between production and comprehension is expected, given that the speaker has one underlying grammar. For the empirical domain considered, relative clauses, production and comprehension are equally taxed. It makes sense to think that if comprehension of a sentence is more taxing to the speaker when there is a higher number of syntactic dependencies that s/he must keep in mind, building such a structure would also be more taxing.[3]

The fact that we are analysing the children's difficulties in comprehending and producing object relatives in Catalan as a processing effect implies that the grammar that we are attributing to them is fully adult-like: we do not claim that children have any problem with relativisation *per se*, with *wh*- movement, or any

[3] The discrepancy in the production and comprehension of number agreement documented by Johnson *et al.* (2005), Pérez-Leroux (2005) is one of those cases in which the expected parallelism between production and comprehension does not seem to hold, and remains a puzzle.

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other basic syntactic operation. Indeed, they do not always fail with object relatives, which is what we would expect if their grammars were immature to handle them. If we analyse the individual performance of the children tested, we see that all of them produced adult-like relatives at least some of the time. No child produced less than 7 adult-like subject relatives out of 10, and for object relatives one child produced only one adult-like relative, another child produced 3, and the rest of children produced 5 or more.

Briefly, we claim that processing resources may be more limited in children than in adults, as shown by the results here, and such limitations have a gradual impact on performance. Equally, in adult populations the same gradual effect of processing load can be found: Catalan-speaking adults also produced more errors with object relatives than with subject relatives, and under pressure we would expect that to become more visible.

As we have argued, the processing load of subject relatives and object relatives is structure dependent, and therefore may vary across languages, and the analysis here extends to those cases. As mentioned above, prenominal relatives have been shown to behave quite differently, with subject relatives being more costly than object relatives in terms of processing: Hsiao and Gibson (2003) show in a self-paced reading task that object relatives are processed faster than subject relatives. Guasti (2002) references the work by Lee (1992) on the acquisition of Chinese relatives and reports that both object and subject relatives were well comprehended by Chinese speaking children at age 4 under certain circumstances.

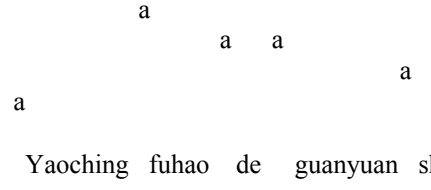
The sentences in (21), taken from Hsiao and Gibson (2003), exemplify subject and object relatives:

(20) a. Yaoching fuhao de guanyuan shinhuaibugui danshi shanyu yintsang.
invite tycoon gen official have bad intentions but good at hiding
'The official who invited the tycoon had bad intentions but is good at hiding them.'

b. Fuhao yaoching de guanyuan shinhuaibugui danshi shanyu yintsang.
tycoon invite gen official have bad intentions but good at hiding
'The official who the tycoon invited had bad intentions but is good at hiding.'

The derivation of the two sentences appears in (21) on the next page; the complexity profiles of the two sentences are those in (22) and (23).

(22) Complexity profile for (20a)



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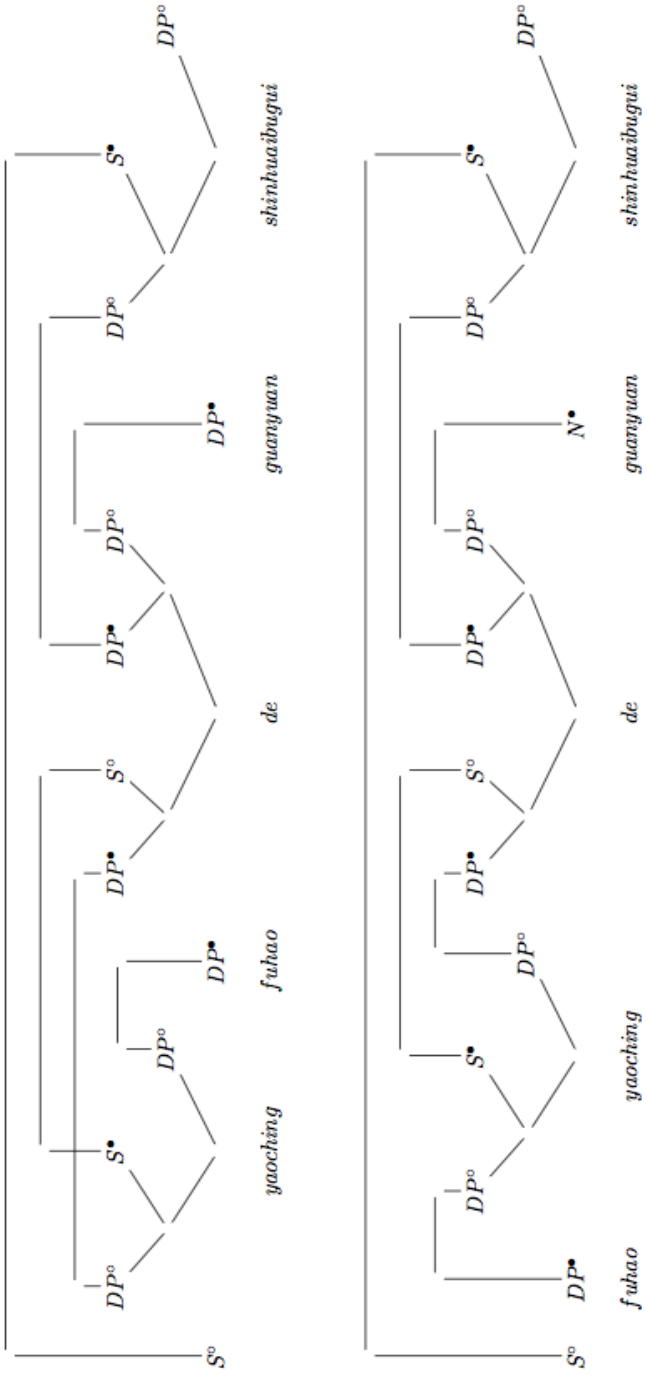

(21) Derivations of (20a) and (20b)

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(23) Complexity profile for (20b)

3				a	a		
2		a				a	
1	a						
0							
	Fuhao	yaoching	de	guanyuan	shinhuaibugui…		

In terms of the complexity metric here, the subject relative in (20a) represents a higher processing load than the object relative in (20b): in (20a) the complexity reaches 4, and 3 at two points; in (20b) it reaches 3 at two points, but never 4. The results of the psycholinguistic experimental work by Hsiao and Gibson can be thus accounted for.

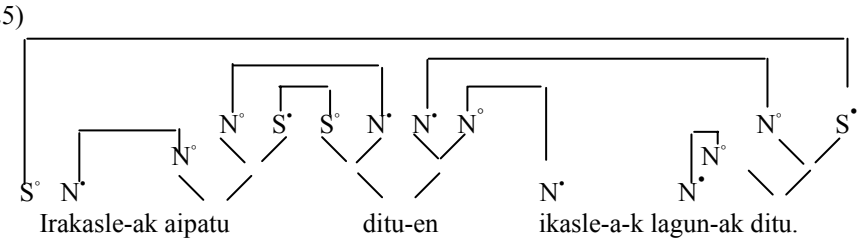
In Basque, a head-final language with prenominal relative clauses, Carreiras *et al.* (2010) ran a self-paced reading task and an ERP experiment, and showed that Basque subject relative clauses are not easier to process than object relatives. Let us compare a subject relative (24a) with an object relative (24b) (examples from Carreiras *et al*. 2010):

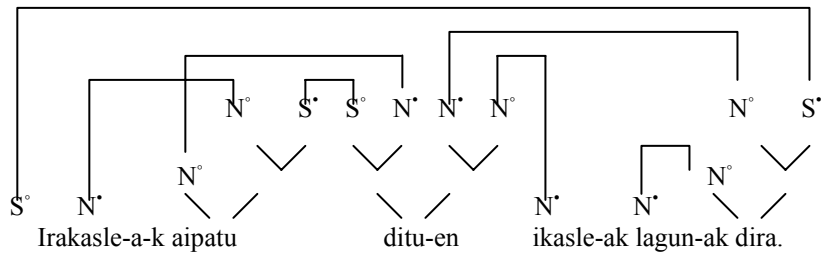
(24) a. Irakasle-ak aipatu ditu-en ikasle-a-k lagun-ak ditu.
teacher-pl mentioned has-rel student-sg-S friend-pl has
'The student that mentioned the teachers has friends.'

b. Irakasle-a-k aipatu ditu-en ikasle-ak lagun-ak dira.
teacher-sg-S mentioned has-rel student-pl friend-pl are
'The students that the teacher mentioned are friends.'

The derivations of (24a,b) appear in (25).

(25)





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The complexity profile in (26) corresponds to the subject relative in (24a), that in (27) to the object relative in (24b); as can be observed, the number of dependencies to be resolved is the same, and therefore the prediction here is that, based on complexity, both subject and object relatives represent the same processing load.

(26) Complexity profile for (24a)

3		a	a		a		
2				a		a	
1	a						
0							a

Irakasle-ak aipatu ditu-en ikasle-a-k lagun-ak ditu.

(27) Complexity profile for (24b)

3		a	a		a		
2				a		a	
1	a						
0							a

Irakasle-a-k aipatu ditu-en ikasle-ak lagun-ak dira.

Carreiras *et al.* (2010) reported longer reading times for subject relatives than for object relatives; this implies that reading time is not only limited by the processing constraints considered here, but by other factors as well.

Recently, Gutierrez-Mangado (2011) carried out an experiment on the comprehension of relatives with Basque-speaking children and adults. Her results for the control SOV condition and for subject and object relatives appear in Table 6.

Table 6

Mean percentage correct by groups and sentence type

	SOV	**SR**	**OR**
4-year-olds (# 14)	92%	58%	79.3%
5-year-olds (# 14)	95.2%	75.7%	87.85%
Adults (# 20)	98.4%	90%	97.25%

The statistical analysis of these results revealed better performance for OR than for SR for all age groups, in line with the results of Carreiras *et al.* (2010). Their experimental findings are consistent with our predictions, and not with analyses building solely on the contrast between subject and object relatives irrespective of their specific linguistic structure.

To summarise, we have presented new results on the production of relative clauses by Catalan-speaking children, and shown that the asymmetry previously found in comprehension between subject and object relatives also holds in production. We have argued that a categorial metric of processing can account for this asymmetry in a precise, non-stipulative way, and that the analysis extends to other typologically different languages.

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