

A pilot study of quantification in child Catalan¹

Anna Gavarró & Linda Escobar
agavarro@seneca.uab.es / ilfh8@blues.uab.es

1. Background

The study of quantification in child language traces back to Inhelder and Piaget's (1964) work, when they found that children incurred a non-adult-like interpretation of universal quantification, with what was termed overexhaustive search: up to the age of six or seven, children would answer *no* to the question *Are all the circles blue?* if they saw blue objects other than circles. Inhelder and Piaget (1964) interpreted this fact as indicating that children assimilated the quantifier *all* to the predicate, and so that they understood the question above as asking if all the circles are all the blue things.

Another error in the child interpretation of universal quantifiers reported in the literature is that of underexhaustive search. In this case, suppose we had a set of circles, one of which was red; then the proposition *All the circles are blue* is false; if the child considers the proposition true, discarding the falsifying instance, we have underexhaustive search.

There is a considerable literature on the occurrence of such errors in the course of language acquisition, and its theoretical interpretation (see Drozd 2001 for a summary and references). The pilot study reported here is mainly directed at finding out facts of the interpretation of the universal quantifier *tots* in Catalan for children aged 3 to 7.

The paper proceeds as follows: first, we sketch the properties of quantification in the target language, adult Catalan; second, we describe the experiment and, finally, we present the results and discuss them.

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2. Quantification in Catalan

Although Catalan presents two universal quantifier determiners, *cada* ‘each’ and *tots* ‘all’, their use is different from that found in other languages such as English and Spanish, to mention two for which studies on child quantification are available. Thus while (1a) is wellformed, (1b) is not – in contrast with its English translation.

- (1) a. Tots els nens van portar berenar.
All the children PS bring tea
‘All the children brought tea.’
- b. */?Cada nen va portar berenar.
Each child PS bring tea
‘Each child brought tea.’

Cada is found when an element requiring binding appears in the immediate context, as in (2).

- (2) Cada nen_i ha de portar el seu_i berenar.

The peculiar distribution of *cada* in adult Catalan led us to design our experiment only with the quantifier *tots*, exemplified in (1.a).

Tots is a non-intrinsic universal quantifier, which allows a distributional and a collective interpretation in Catalan, as shown in (3), from Brucart and Rigau (to appear):

- (3) Tots els estudiants seran rebuts pel degà.
all the students be-FUT received by-the dean
- (i) ‘The dean will receive the students one by one.’
(ii) ‘The dean will receive all the students together.’

Morphologically, *tots* is inflected for number and gender; thus its full paradigm is *tot* (masc., sg.), *tota* (fem., sg.), *tots* (masc., pl.), *totes* (fem., pl.). Syntactically, it

adjoins to definite DPs to give projections of the same type; see the need for a definite DP by comparing (3) above with (4).

- (4) *Tots estudiants seran rebuts pel degà.
all students be-FUT received by-the dean

In fact, all determiners appear after *tots*, as in (5) (for this and further details on *tots*, see Bruccart and Rigau to appear).

- (5) Tots quatre estudiants es van presentar a l'examen.
all four students CL PS present to the exam
'All four students presented themselves at the exam.'

Finally, the distribution of quantifiers in the adult grammar displays asymmetries between subject and object positions, as illustrated in (6) for English *each*, and (7) for Catalan *cada*.

- (6) a. Each mother saw a child.
b. A mother saw each child.
(?? on the collective reading, ok on the distributive reading)
(cf. A mother saw all the children.)
- (7) a. Cada nen va portar-se el berenar.
each child PS bring-CL the tea
'Each child brought his tea.'
b. *El professor va portar cada berenar.
the teacher PS bring each tea

Although no such asymmetry in distribution (not in interpretation) is found, to our knowledge, with *tots*, we test the interpretation of *tots* in both positions: subject and object position.

3. *The experiment*²

3.1. Subjects

The subjects were 35 Catalan-speaking children in a kindergarten and primary school, ranging in age from 3;6 to 7;11, with a mean age of 5;3.

| (8) | Subjects | age | number of subjects |
|-----|----------|-----|--------------------|
| | | 3 | 3 |
| | | 4 | 15 |
| | | 5 | 6 |
| | | 6 | 4 |
| | | 7 | 7 |
| | total | | 35 |

In order to be able to draw generalisations about the developmental stages our subjects go through, and given the number of children interviewed of each age, we group 3- and 4-year olds in group 1 (total: 18 children), and 5-, 6- and 7-year olds in group 2 (total: 17 children).

3.2. Design

The conditions tested fall into five categories, corresponding to an input with the universal quantifier in object position (QO) or in subject position (QS), both of which getting an affirmative (J) or negative (N) answer in the target language. (See the full relation in the Appendix.) An affirmative answer to the input QS N constitutes an underexhaustive error. The fifth condition (QSX J) presents the quantifier in subject position and gets an affirmative answer in the target language but, if the overhausive error occurs, gets a negative answer. The five pictures appearing on each condition are schematically represented in (9) to (13):

- (9) Is an elephant carrying all the balloons? QO J
Adult: yes
- elephant₁ carries balloon₁, balloon₂ and balloon₃
elephant₂
elephant₃
boy₁

² We acknowledge the direction, teachers and children of the Escola Decroly de Barcelona for their kind collaboration in this experiment, carried out in May 1999 and June 2001. We would also like to thank our first experimenters Carlota Faixa (in May 1999), and Lena Morrill (in June 2001).

- (10) Is a giraffe carrying all the balloons? QO N
 Adult: no
 giraffe₁ carries balloon₁
 giraffe₂ carries balloon₂
 giraffe₃ carries balloon₃
 boy₁
- (11) Are all the elephants carrying a balloon? QS J
 Adult: yes
 elephant₁ carries balloon₁
 elephant₂ carries balloon₂
 elephant₃ carries balloon₃
 boy₁ carries balloon₄
- (12) Are all the children carrying an umbrella? QS N
 Adult: no
 boy₁ carries umbrella₁
 boy₂ carries umbrella₂
 boy₃ carries umbrella₃
 boy₄ carries balloon₁
- (13) Are all the children riding a horse? QSX J
 Adult: yes
 boy₁ rides horse₁
 boy₂ rides horse₂
 boy₃ rides horse₃
 mother₁
 horse₄

This design rests primarily on the work of Philip (1995), although its results turn out to be only partially interpretable according to his theoretical stances.³

3.3. Method

Each child was tested individually, in a school setting that was (relatively) free of distraction, by two experimenters who were native speakers of Catalan. The experiment was preceded by a single warm-up item, to confirm that the experimental task had been well understood and to familiarise the child with the objects of the pictures. The experiment consisted of a truth conditional task, where the children were asked to

³ This experimental design has been called into question by Crain et al. (1996) on the grounds that the task is problematic from a pragmatic point of view; however, as discussed by Gordon (1996) the implications of Crain et al.'s (1996) observations are inconclusive.

answer a yes/no question asked about the picture. Each question represented an example of the conditions previously discussed.

For each experimental item, there were some different trials presented in a pseudo-random (maximally varied) order. Each item consisted of a 21 x 29 cm colour picture. The objects in the picture were distributed in a thematically neutral fashion, and were presented to the child by Experimenter 1 in context-sentences such as *Hi ha tres globus i tres nens* ('(In this picture) there are three balloons and three children'). After each context-sentence, the child was asked the experimental yes/no question about the picture; this question was formulated by Experimenter 2, who could not see the picture. This made the question felicitous as a request of information – basically, the experiment was construed as a guessing game. (This avoids the putative methodological problems which Brinkmann (1995: 11) attributed to Philip (1995).)

In order to see the source of possible errors in interpretation, children were also asked to reason their answers with respect to those pictures containing an intruder. In each case, children were given the opportunity to point at the non-paired individual.

As the experiment was presented together with another experiment on referentiality, a large number of fillers were granted.

4. *Results and discussion*

The results from carrying out the experiment with all the children are reported in Table 1. No children were excluded as it was our intention to see what their behaviour was before establishing further a priori conditions.⁴ It is worth pointing out that, of the children who took part in our experiment, 20% had a fully adult-like behaviour (error-free); this raised to 57% of 7-year olds.

⁴ Our results do not differ dramatically from those obtained in a partially similar experiment carried out on Spanish speaking children by Linda Escobar, Sergio Baauw and Bill Philip: for 45 children with a mean age of 5;6, they found the following results:

| | | |
|-----------|-------|-----------------------|
| Condition | QS N | 74% correct responses |
| | QSX J | 78% |
| | QO J | 90% |
| | QO N | 89% |

| | Age group | 3-, 4-year olds | 5-, 6-, 7-year olds |
|-----------|-----------|-----------------|---------------------|
| Condition | | | |
| QS J | | 78% | 88% |
| QS N | | 56% | 94% |
| QSX J | | 72% | 59% |
| QO J | | 94% | 94% |
| QO N | | 94% | 100% |

Table 1: Percentage of correct answers⁵

The significance of these results is reflected in Table 2, which reports the t-tests performed on the results of the experiment.

| | |
|-----------|--------------|
| Condition | |
| QS J | 0.106 |
| QS N | 0.000 |
| QSX J | 0.133 |
| QO J | 0.936 |
| QO N | 0.047 |

Table 2: Significance of the difference between age groups ($p < 0.001$)

It can be inferred from Tables 1 and 2 that the incidence of overhaustive errors with the QSX J condition is relatively high and general for the two age groups considered.

Philip (1995) proposes to interpret overexhaustive search according to an “event quantificational account”. For him, a sentence such as *Every boy is riding a horse* can be interpreted by the child as ‘In every minimal event /situation in which a boy is

⁵ Unsurprisingly, consideration of standard deviation of the results of Table 1 indicates high variation amongst individuals for the conditions QSN (for the younger group) and QSXJ:

| | 3 and 4-year olds | 5, 6 and 7-year olds |
|------|-------------------|----------------------|
| QSJ | 0.43 | 0.33 |
| QSN | 0.51 | 0.24 |
| QSXJ | 0.46 | 0.51 |
| QOJ | 0.24 | 0.24 |

participating or which is a possible subevent of a minimal event/situation of a boy riding a horse, a boy is riding a horse'. Since in the setting depicted in (13) we encounter a possible subevent of a minimal event/situation (with the presence of horse₄), when asked if all the boys ride a horse the child may answer negatively. This is termed "symmetrical interpretation". This is the result, in the child, of an "overgeneralisation of an adult event quantificational interpretation –which in adult grammar is normally only associated with adverbs of quantification such as always" (Philip 1996). From the availability to the child of a symmetrical interpretation and the standard quantificational reading in the acquisition of distributive universal quantifiers, a 50% correct answer pattern is predicted by Philip.

Our results are in line with Philip's (1995) predictions with regard to the Q_{SX} J condition, even more so if we take into account that overexhaustive errors seem to be more likely with *every* than with *all* (see Freeman and Stedmon 1986).

It is also worth noting that a relatively high number of errors occurred with the younger group of children in the Q_S J condition, where children were asked *Are all the elephants carrying a balloon?*, and they answered correctly only in 81,5% of cases. This is the behaviour that corresponds to what Philip (1995) calls the "perfectionist child", who is meant to have a less mature procedure of the interpretation of quantification than the "symmetric child". For the perfectionist child, a boy carrying a balloon constitutes conflicting evidence for the assertion *All the elephants are carrying a balloon*. Philip's (1995) account of the so called perfectionist child has been called into question for lack of consistency with the event account proposed for symmetrical interpretation errors; we refer the reader to Brinkmann (1995). At this point, we only stress the possibility that our results corroborate the empirical facts found in other languages.

On the other hand, there is a highly significant fact in our results: the occurrence of underexhaustive search in nearly half of the cases in the Q_S N condition, although only for the 3- and 4-year olds, in fact the only statistically significant difference between the two age groups (see Table 2). Underexhaustive errors are not accounted for by Philip (1995), on the grounds that they are unsystematic, although they have been argued to occur systematically by other authors (see Freeman 1985, Drodz 1999?). Furthermore, it has been found for English that underexhaustive errors are more likely occur with the universal quantifier *all* than with the distributive quantifier *every*

| | | |
|-----|------|------|
| QON | 0.24 | 0.00 |
|-----|------|------|

(although this finding is not corroborated by all experiments; cf. Philip 1995). This disparity in behaviour between different quantifiers, if true, is unexpected in Philip's (1995) framework, as pointed out by Brinkmann (1995); thus this remains a topic for future research.

In conclusion our pilot study shows the developmental stages that children go through in acquiring a fully adult-like interpretation of the universal quantifier *tots*: from an early stage with a relatively high incidence of underexhaustive errors (in the group of 3- and 4-year olds) to a later stage in which underexhaustive errors disappear, but overexhaustive errors persist in many subjects. Any theoretical attempt at explaining these facts should be make the occurrence of one and the other independent.

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Appendix: Experimental Items

- QO N Una girafa porta tots els globus?
Is a giraffe carrying all the balloons?
- QO N Un nen porta tots els paraigües?
Is a boy carrying all the umbrellas?
- QO N Un elefant porta tots els globus?
Is an elephant carrying all the balloons?
- QO N Una girafa porta tots els globus?
Is a giraffe carrying all the balloons?
- QO J Un nen porta tots els paraigües?
Is a boy carrying all the umbrellas?
- QO J Un elefant porta tots els globus?
Is an elephant carrying all the balloons?
- QS N Tots els nens porten un paraigües?
Are all the children carrying an umbrella?
- QS N Tots els nens beuen una llimonada?
Are all the children drinking a lemonade?
- QS N Tots els dinosaures porten un globus?
Are all the dinosaurs carrying a balloon?
- QS J Tots els elefants porten un globus?
Are all the elephants carrying a balloon?
- QS J Totes les girafes porten un globus?
Are all the giraffes carrying a balloon?
- QSX J Tots els nens munten a cavall?
Are all the children riding a horse?
- QSX J Tots els nens munten un elefant?
Are all the children riding an elephant?

Departament de Filologia Catalana
Universitat Autònoma de Barcelona
Facultat de Lletres, Edifici B
08193 Bellaterra