The acquisition of control crosslinguistically: structural and lexical factors in learning to licence PRO*

HELEN GOODLUCK

University of Ottawa, Canada

ARHONTO TERZI

Technological Educational Institute of Patras, Greece

AND

GEMA CHOCANO DÍAZ

Universidad Autonoma de Madrid, Spain

ABSTRACT

Rules for interpreting empty category (EC) subjects of complement clauses vary crosslinguistically across structural and lexical dimensions. In adult Greek, a distinction is made between the verbs meaning WANT and TRY, the former but not the latter permitting the EC subject of its subjunctive complement to refer outside the sentence. The EC is pro for WANT and PRO for TRY. In adult Spanish, both the verbs meaning WANT

and TRY require the EC subject (pro) to refer outside when the complement is in the subjunctive, and require the EC subject (PRO) to refer to the main clause subject when the complement is in the infinitive. Twenty-three Greek-speaking four- to five-year-olds and 10 adults, 29 Spanish-speaking four- to five-year-olds, 18 six- to seven-year-olds and eight adults took part in act-out experiments. The results indicate an awareness of language-particular distinctions governing the interpretation of EC complement subjects. However, child speakers of both languages experience difficulty in giving sentence external reference, leading to error in the case of subjunctive sentences for Spanish-speaking children. We argue that the data overall is most compatible with children having access to the empty category PRO by age four, and that failure to give external reference of an EC when required can plausibly be treated as performance error. A picture verification task produced less clear results, but points to the need for data from younger children to establish whether there is an early stage in which lexical semantics dominates children's interpretation of ECs.

INTRODUCTION

The acquisition of the interpretation of empty subjects in infinitival clauses has been the focus of several studies on the acquisition of English. In the linguistic literature (Chomsky, 1981 and thereafter), a sentence such as (1) is standardly analysed as having an empty category (EC) in embedded subject position, which is interpreted as coreferential with (CONTROLLED by) the

(1) Maria tries to sing.

(2)

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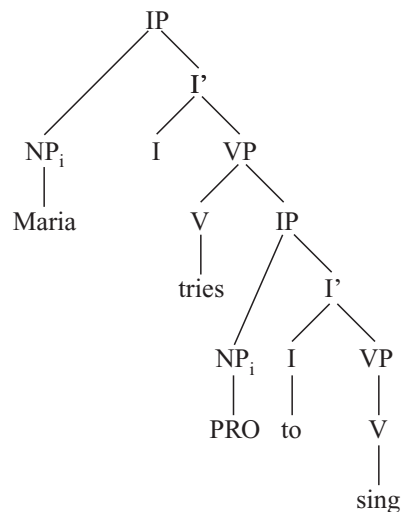
subject of the main clause. The EC that is the subject of infinitives is designated PRO; thus (1) has the structure in (2), where co-indexation indicates coreference. There is a considerable literature on whether the embedded infinitive clause is a CP (S') or IP (S); see Bošković (1997) for discussion. We have represented the embedded clause as an IP mostly for reasons of simplicity, as its precise structure is not immediately relevant.

On the whole, the acquisition studies on English have demonstrated that by four to five years, children have a command of the system of control of complement clauses for that language, although errors are made (Chomsky, 1969; Maratsos, 1974; Goodluck, 1981; Hsu, Cairns & Fiengo, 1985; McDaniel, Cairns & Hsu, 1990/1991; Goodluck & Behne,, 1992; Sherman-Cohen & Lust, 1993; Cairns, McDaniel, Hsu & Rapp, 1994; Eisenberg & Cairns, 1994). Most pertinent to this study, Eisenberg & Cairns (1994) found a high level of success for three to five-year-olds in both elicited production and comprehension (act-out) for control structures of the type in (1). Of the main verbs that Eisenberg & Cairns studied, the three verbs *want*, *try* and *say* provide the closest source of comparison for the cross-linguistic data that we report below. *Try* and *want* require control by the main clause subject, as illustrated by (1/2) and (3) (whether *want* is in fact obligatorily controlled is discussed below),

(3)   Maria$_i$ wants [PRO$_{i/*j}$ to sing]

By contrast, *say* requires the embedded subject to refer outside the sentence,

(4)   Maria$_i$ says [EC$_{j/*i}$ to sing].

In elicited production, over 90% of productions with *want* and *try* type verbs in the Eisenberg & Cairns study involved intended coreference with the main clause subject, compared with 35% such intended coreference for *say*. In act-out comprehension, 35% of children permitted the embedded subject to refer to an unmentioned entity for *want* and *try* type verbs, in comparison with 77% of children for *say*. (These figures for production and comprehension of *want* and *try* are derived from Table 2 in Eisenberg & Cairns, and include also responses to the verbs *like* and *pretend*). Thus although errors were made in both production and comprehension, overall in the child data reported by Eisenberg & Cairns there was a reflex of the pattern of control by the main clause subject for *want* and *try* and external reference where it is required, that is, with *say*.

The fact that the development of complement PRO has been studied quite extensively with respect to the acquisition of English, with results that suggest that the patterns for empty subject interpretation are in place for that language by five years or younger, does not entail that the same is true for the

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development of EC subjects in other languages. In the next section we sketch the grammars of sentences parallel to (1) and (3) in Greek and Spanish, showing how both structural and lexical factors distinguish Greek and Spanish from one another and from English. These factors play an important role in determining whether a PRO subject is permitted, and potentially have an impact on the age at which control constructions are mastered.

'Want' and 'try' in Greek and Spanish
Basic facts about Greek control contexts. The infinitival forms found in many of the world's languages do not exist in Modern Greek. Rather, Greek uses finite subjunctive forms; the embedded clause is introduced by the subjunctive particle *na*, and the verb is inflected for agreement with the subject, and minimally for tense. The tense of subjunctive complements in Greek does not exhibit the full range of tense alternations encountered in indicative complements, but rather depends on the $+/-$ past specification of the main verb (Iatridou, 1988/1993, Terzi, 1992, 1997); it is in this sense that we mean the verb to be inflected for tense 'minimally'. (5) and (6) are examples of such subjunctive clauses, with the main verbs *prospatho* 'try' and *thelo* 'want',

(5) I Maria$_i$ prospathi [EC$_{i/*j}$ na tragoudisi]
     the Maria try -3s   EC PRT sing-3s-sub
     'Maria tries to sing'
(6) I Maria$_i$ theli [EC$_{i/j}$ na tragousidi]
     the Maria want-3s EC PRT sing-3g-sub
     'Maria wants to sing' or 'Maria wants someone else to sing'

As the glosses to (5) and (6) show, the interpretation of the subject of the embedded clause differs: when the main verb is *prospatho*, the EC subject of the embedded clause must refer to the main clause subject, as in English. By contrast, when the main verb is *thelo*, the EC can refer either to the main clause subject, or to an entity not mentioned in the sentence. This contrast has led linguists to analyse the EC in (5) as PRO, the empty subject of infinitivals in languages such as English, and the EC in (6) as pro, the empty category that occupies the subject position in null subject languages such as Greek, Spanish or Italian – languages that permit subject pronouns to be dropped in tensed clauses (Terzi, 1992; Iatridou, 1988/1993; Varlokosta & Hornstein, 1993; Terzi, 1997).

Basic facts about Spanish control contexts. Like Greek, Spanish is a language that permits subject pronouns to be dropped. Unlike Greek, it has both infinitival and subjunctive complements and the distribution of PRO and pro embedded subjects is quite different to that for Greek. Whereas Greek makes a distinction based on the main verb in examples (5) and (6) above, Spanish distinguishes the counterpart sentences according to whether the embedded

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TABLE 1. *WANT and TRY in three languages* [*NP want/try* [*EC V*]]

English				Greek				Spanish			
WANT		TRY		WANT		TRY		WANT		TRY	
Sub	Inf	Sub	Inf	Sub	Inf	Sub	Inf	Sub	Inf	Sub	Inf
—	EC = PRO	—	EC = PRO	EC = pro	—	EC = PRO	—	EC = pro[a]	EC = PRO	EC = pro[a]	EC = PRO

[a] Obligatorily disjoint from main clause subject.

verb is infinitival or subjunctive. If the verb is infinitival, the EC subject is PRO and is obligatorily controlled by the main clause subject in examples such as (7). If the embedded verb is in the subjunctive, the EC is pro. Unlike the case in Greek, however, the pro of the subjunctive clauses in (8) is OBLIGATORILY DISJOINT in reference from the main clause subject, as indicated by the indices in (8). Such obligatory disjoint reference is observed for subjunctive clauses in other Romance languages as well (Picallo, 1984; Padilla, 1990).

(7) María$_i$ intenta/quiere [EC$_{i/*j}$ cantar]
Maria try-3s/ want-3s [EC sing-INF]
'María wants/tries to sing'

(8) María$_i$ intenta/quiere [que EC$_{j/*i}$ cante]
Maria try-3s/ want-3s [COMP EC sing-SUB]
'María wants/tries (for) someone else to sing'

Table 1 summarises the differences between English, Greek and Spanish with respect to the nature and interpretation of the EC subject of the complements to the verbs meaning WANT and TRY. Henceforth we will use small capitals for WANT and TRY to designate a core of meaning we assume is shared by these verbs in the different languages we discuss.

Theories of control, cross-linguistic variation and learning
How do the facts we have outlined so far fit within theories of the grammar of complement subject interpretation? Although the theory of control structures is a contentious area of generative grammar, there are some generalizations that are widely agreed on.

First, there are structural constraints on the relationship between a subject position that is obligatorily controlled and the controller. It is generally agreed that the controller must c-command the controlled position. There are various definitions of c-command in the literature; for our purposes Reinhart's (1976) definition is adequate: node A c-commands node B iff and only if the first branching node dominating A also dominates B and neither A

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nor B dominates the other. The c-command condition is met for all the sentence types discussed above, since the controller is the subject of the main clause, and the subject of a main clause c-commands everything in the sentence. Hence, the main clause subject is a POTENTIAL controller for the embedded EC subject in all the sentence types we have discussed.

A more controversial matter is the local environments in which a PRO subject may occur. In the theory of Chomsky (1981, 1995), PRO is confined to non-finite clauses (infinitives and gerunds), a requirement with which the facts of both English and Spanish fit. The facts of Greek, however, seem to pose a problem, since PRO occurs in finite clauses (that is, in subjunctive clauses), as in (5). Recent work has attempted to better identify the environments in which PRO can be licensed in the light of Greek, focussing on the distinctive tense and mood properties of the contexts in which PRO occurs (Iatridou, 1988/1993; Terzi, 1992; Varlokosta & Hornstein, 1993; Watanabe, 1993; Terzi, 1997). For example, Iatridou (1988/1993) has claimed that PRO is possible in Greek subjunctive complements because the subject is ungoverned (Chomsky, 1981) by virtue of the fact that the Tense is defective, and Terzi (1997) has argued that the subjunctive particle plays a role in licencing PRO. Overall, these analyses claim that some inflection is permitted for a verb whose subject is obligatorily controlled, although this does not extend to fully articulated tense specifications. The result is that PRO is licenced in a finite context.

An issue related to the structural conditions on PRO is the distinction between obligatory and non-obligatory control. Williams (1980) developed a set of criteria characterizing this distinction. One of Williams' conditions on obligatory control was the c-command condition just described: PRO must be c-commanded by the NP it refers to. Another of Williams' criteria was the possibility of alternation with a phonetically present NP. Williams proposed that such alternation was impossible in the case of obligatorily controlled PRO (see also Partee, 1976). The no-alternation condition is illustrated in (9a,b), with the verb *try*,

(9) a   Maria tries [PRO to sing]
    b   *Maria tries [Bill to sing]

The condition receives an explanation within a theory such as Chomsky (1981), where a full NP requires a richness of morphological environment that is not met in the subject position of an infinitive verb. However, the verb *want* in English poses a problem for the no-alternation condition on obligatory control, since the subject position of its complement does admit alternation with a full NP,

(10) a   Maria wants [PRO to sing]
     b   Maria wants [Bill to sing]

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Williams' solution to this problem was to claim that the EC subject of the complement to *want* in English is in fact optionally, not obligatorily, controlled – the illusion of obligatory control in sentences such as (10a) results from an extremely strong interpretive preference for coreference with the main clause subject.

Williams' solution might seem *ad hoc*: *want* doesn't pass the non-alternation test for obligatory control, so it has to be non-obligatory control, despite what the intuitions of native speakers are. However, it cannot go unnoticed that the same predicate (*want*) which is problematic for the theory of obligatory control in English corresponds to a predicate in Greek (*thelo*) that selects pro as the EC subject of its complement clause. The fact that WANT in Greek has a pro subject in its complement clause, and permits free reference, can be seen as analogous to the possibility of specifying a subject other than the main clause subject by use of a lexical NP in English infinitival complements to *want*. English may resort to allowing an overt NP in embedded subject position because the language does not have a category pro with which to implement reference to an entity other than the subject of the main clause. Why should English have cases such as *want*, and is it an accident that *want* not *try* is exceptional in English? In addition to structural restrictions on where PRO may appear, there appear to be semantic factors that also condition control, influencing the distribution of optional and obligatory control contructions. Although the contrasts between WANT and TRY in English, Greek and Spanish show that it is not the case that the meaning of a verb determines absolutely the range of interpretations its EC subject receives, the range of variation is plausibly limited by semantic factors. The semantic roles of the subject for the verbs WANT and TRY differ: the subject of WANT has the role of experiencer, whereas the subject of TRY is an agent. Agenthood appears to promote obligatory coreference with an embedded subject, and the experiencer role may exert a semantic push towards non-obligatory control. (For pertinent discussion see Jackendoff, 1972: 207–226 and Wyngaerd, 1994). Given such semantic biases, we would expect not to find a language identical to Greek, but with TRY selecting pro and WANT selecting PRO.

To sum up, study of adult languages shows that both lexical semantic and structural factors are involved in the distribution of PRO. In both the case of the structural distinction between subjunctives and infinitives and in the case of the lexical distinction between WANT and TRY, it is safe to assume that there is an unmarked value for the assignment of PRO; viz. that the infinitive will favour PRO and that the subjunctive will disfavour it, and that TRY will favour PRO whereas WANT may exert a push towards non-obligatory control and pro. What predictions can be made with respect to language acquisition? Assume that the child's innate knowledge (universal grammar) makes available the markedness values just sketched with respect to both structural

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and lexical factors. This amounts to saying that universal grammar will select as an 'ideal' language one in which WANT takes a finite complement with pro and TRY takes a non-finite complement with PRO. As we have seen above, neither English, nor Greek nor Spanish meets this ideal. On a theory of language acquisition in which lexical semantic factors dominate in guiding the child's hypotheses, we might expect children learning Spanish (or English) to err in the direction of treating WANT as a non-obligatory control verb in contexts (non-finite clauses) that require obligatory control in the adult language. By contrast, on a theory of acquisition in which structural factors are the primary guide to the child's hypotheses, we might expect children learning Greek to err in the direction of treating TRY as a non-obligatory control predicate. On either a scenario in which structural factors dominate or one in which lexical semantic factors dominate, the child must have the learning ability to reach an adult state in which a non-optimal system in terms of the markedness values we assume obtains.

Our study had the goal of investigating the relative force of lexical and structural factors in the course of children's acquisition of control complements. A study of Greek (or English) alone is not in a position to offer a clear answer as to whether the factor(s) responsible for licensing PRO in children's grammar are the lexical properties of the matrix verb or the structural properties of the embedded clause, since there is no structural contrast in either language and any distinction that is made must be made on lexical grounds. By contrasting Greek with Spanish, in which a structural distinction is made in the assignment of PRO, but not a lexical distinction between WANT and TRY, we are in a position to potentially see which factors dominate in children's hypotheses concerning the distribution of PRO. We confined our study to the two verbs WANT and TRY, since these are paradigmatic instances of verbs whose semantics promote non-obligatory and obligatory control, respectively.

EXPERIMENTS

GREEK ACT-OUT EXPERIMENT

Design and materials

In Greek, there is no right answer in interpreting the EC subject of the complement to WANT: the EC subject refer to the main clause subject or it can refer outside the sentence. In an initial experiment using a judgment task (in which the experimenter acted out a meaning for a sentence and the subject had to say if the action fitted the sentence) we found that adult speakers of Greek almost invariably rejected an interpretation of WANT sentences in which the subject of the embedded clause was made to refer outside the sentence. Clearly, our task was to make the external reference reading for

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sentences whose matrix verb was WANT transparent. We did so in an act-out test in which the subject was pointed towards the possibility of external reference.

Maratsos (1974) found that when English-speaking children were asked to act-out English infinitives with *tell* in marginal sentences such as *John tells to get in the truck* the majority of them preferred to choose a nonmentioned doll as the referent of the embedded subject. We pointed our Greek subjects towards external reference by beginning the experiment with a sentence using the verb meaning ORDER (*diatazo*). As in English, this verb is grammatical with a main clause object and complement with a PRO subject, which is controlled by the object of the main clause (example 11) and semi-ungrammatical when the main clause object is missing (example 12). The experiment comprised three tokens of each of the sentence types in (11–14), presented in that order: all of the tokens of type (11), followed by all tokens of (12), then all the tokens of (13), and finally the sentences of type (14).

(11) ORDER sentences with a matrix object
    I mama diatazi to baba EC na kani mia toumba
    the mom order-3s the dad [EC PRT do-3s a somersault]
    'Mom orders dad to do a somersault'

(12) ORDER sentences without a matrix object
    I mama diatazi EC na diavasi tin efimerida
    the mom order-3s [EC PRT read-3s the newspaper]
    'Mom orders to read the newspaper'

(13) WANT sentences
    O babas theli EC na fai ti banana
    the dad want-3s [EC PRT eat-3s the banana]
    'Dad wants to eat the banana' or
    'Dad wants someone else to eat the banana'

(14) TRY sentences
    I Maria prospathi EC na krifti piso apo ton tiho
    the Maria try-3s [EC PRT hide-3s behind the wall]
    'Maria tries to hide behind the wall'

Subjects acted-out these sentence types using a doll family (mom, dad, a boy and a girl) and a set of props.

Subjects
Subjects were 10 adult speakers of Greek and 23 four- to five-year-olds (mean age 4;10). The children were tested in pre-schools in Athens and Patras, Greece.

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TABLE 2. *Greek act-out task*

	Percentage internal and external construal of the EC							
	ORDER +object		ORDER −object		WANT		TRY	
	I[a]	E*	I	E[b]	I	E	I	E*
Adult ($n = 10$)	100	0	0	100	47	53	100	0
Child 4–5 ($n = 23$)	100	0	30	70	70	30	98	2

[a] With use of main clause object as controller.
[b] Preferred adult response to semi-ungrammatical sentence.
* Incorrect response.

Results

Table 2 reports the percentage of internal (I) and external (E) reference for the four sentence types. These were fairly simple sentences and there were almost no instances of incorrect act-out. In the tabulation we have included under external responses instances in which the subject volunteered both internal and external readings of the EC. The child subjects gave four such responses for *thelo* ('want') and one such response for *prospatho* ('try') (the sole erroneous response in the experiment).

As the figures in Table 2 show, performance on ORDER with an explicit object was perfect, for children as well as adults. When presented with the semi-grammatical sentences with ORDER with no object adults invariably switched to an external referent of the EC, and children did so in 70% of responses. Turning to the contrast between WANT and TRY, both children and adults obeyed the obligatory control rule for TRY, allowing only internal reference, whereas for WANT the children gave 30% external responses and the adults gave 53% external responses. The difference in amount of internal reference for WANT vs. TRY is significant both for adults ($t_9 = 3.25$, $p < 0.01$, two tail) and for children ($t_{22} = 5.35$, $p < 0.001$, two tail). Seven out of 10 adults distinguished between WANT and TRY, showing less internal reference for WANT, as did 10 children; the mean age of the children distinguishing the two verbs did not differ significantly from that of those who failed to differentiate between the two verbs (4;6 vs. 4;8, $t_{21} = 0.23$).

In sum, this experiment showed about half of the children making a distinction between WANT and TRY along the lines described above. Since there is no correct answer for WANT sentences, we cannot conclude that the children who did not show the distinction did not have an adult grammar, and it is pertinent in that regard that not all the adults showed the WANT–TRY distinction either. Children may simply differ from adults in preferring internal reference for an EC.

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First experiment : design and materials

Pilot work on Spanish revealed that Spanish speaking adults had no difficulty in giving an external reading for the EC in subjunctive complements – which is not surprising since, as noted above, external reference is obligatory with subjunctives. Therefore, in our initial act-out experiment, we did not follow the order of presentation used in the Greek experiment. Rather, each subject received three tokens of each of the four sentence types in (15–18), presented in three blocks of one token of each type,

(15) WANT subjunctive sentences
      Papá quiere que EC de una voltereta
      Dad want-3s [COMP EC do-3s-SUB a somersault]
      'Dad wants someone else to do a somersault'
(16) WANT infinitive sentences
      María quiere EC ir a dormir
      Maria want-3s [EC go-INF to sleep]
      'Maria wants to go to sleep'
(17) TRY subjunctive sentences
      Papá intenta que EC lea un libro
      Papa try-3s [COMP EC read-3s-SUB a book]
      'Dad tries for someone else to read a book'
(18) TRY infinitive sentences
      María intenta EC beber una coca cola
      Maria try-3s [EC drink-INF a coke]
      'Maria tries to drink a coke'

As in the Greek experiment, subjects acted out the test sentences using a doll family and a set of props.

Subjects

The subjects were 15 four- to five-year-olds (mean age 4;11), 18 six- to seven-year-olds (mean age 6;11) and 8 adults. The children were tested in a pre-school in Madrid, Spain.

Results

The results are summarized in Table 3. Aside from a very small amount of error with TRY subjunctive sentences, the performance of adults was completely correct, with internal reference selected for infinitival comple-ments and external reference for subjunctives. At age four to five children incorrectly acted out the embedded subject of subjunctive clauses as coreferential with the main clause subject, with 89% such responses for WANT and 96% for TRY. The six- to seven-year-olds correctly selected an

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TABLE 3. *Spanish act-out task*

	Percentage internal and external construal of the EC[a]							
	WANT sub		WANT inf		TRY sub		TRY inf	
	I*	E	I	E*	I*	E	I	E*
Adult (n = 8)	0	100	100	0	4	96	100	0
Child 4–5 (n = 15)	89	9	100	0	96	4	100	0
Child 6–7 (n = 18)	46	54	98	2	56	44	100	0

[a] Percentages of I and E do not always total 100 due to unscorable responses.
* Incorrect response.

TABLE 4. *Spanish act-out task: follow-up*

	Percentage internal and external construal of the EC											
	ORDER +object		ORDER −object		WANT +sub		WANT -inf		TRY -sub		TRY -inf	
	I[a]	E*	I	E[b]	I*	E	I	E*	I*	E	I	E*
Child 4–5 (n = 14)	100	0	69	31	62	31	95	5	74	26	93	7

[a] With use of main clause object as controller.
* Incorrect response.

external referent for the embedded subject of a subjunctive clause in 54% of their responses to WANT and in 44% of their responses to TRY, and gave adult-like internal reference on the infinitival clauses for both verbs. For the child subjects, there was a main effect of age group ($F(1, 31) = 16.00$, $p < 0.0004$), and of sentence structure (infinitive/subjunctive) ($F(1, 31) = 26.40$, $p < 0.0001$), and a significant interaction between age group and sentence structure (infinitive/subjunctive) ($F(1, 31) = 13.59$, $p < 0.009$). There was no effect of WANT vs. TRY ($F(1, 31) = 3.17$, $p > 0.8$).

In sum, this experiment revealed a pattern that reflects the adult Spanish system at age six to seven, albeit with a high degree of error where external reference is required, but not at age four to five. Four to five year olds almost completely fail to give external reference. Difficulty with obligatory disjoint reference has been observed in the past for young children (Padilla, 1990; Avrutin, 1994).[1]

[1] The closest study to our own is Padilla (1990), which includes an act-out test of subjunctive complements to volitional verbs, including *querer* ('want'). Padilla's error rates (incorrect failure to give external reference) are approximately the same as in the act-out experiment just reported.

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Follow-up experiment

We thought that children's performance on the subjunctive sentences might be ameliorated if they were given more training to go outside the sentence. In a follow-up experiment we administered the act-out again in a form similar to that used in the Greek experiment. The subjects were presented with three ORDER sentences with a direct object, three ORDER sentences with no object (which, as in Greek and English, are marginal constructions at best), followed by three WANT subjunctive sentences, followed by three TRY subjunctive sentences, next three WANT infinitival sentences, and finally three TRY infinitivals. Thus, as in the Greek experiment, ORDER sentences without an object were used to point the child towards external reference, and sentences that require internal reference were presented at the end, after sentences that permit (for Greek) or require (for Spanish) external reference.

Subjects

Subjects were 14 four- to five-year-olds (mean age 4;10), tested in daycare in Madrid, Spain.

Results

The results of the follow-up experiment are given in Table 4. When we compare Tables 3 and 4 we see that performance of four to five-year-olds improved considerably in the follow-up, although it is still far from adult. There is a significant difference in the overall amount correct responses for the WANT and TRY sentences given by the four to five-year-olds in the first experiment compared to the children in the follow-up ($t_{27} = 5.7$, $p < 0.001$). In the follow-up both WANT and TRY exhibit over 25% external reference in the subjunctive and less than 10% external reference in the infinitive. (The ORDER sentences had infinitival complements; it is possible that more external reference might have been found if the subjunctive has been used in the ORDER sentences). As in the first experiment, for the WANT and TRY sentences there was a significant effect of subjunctive vs. infinitive ($F(1, 13) = 8.11$, $p < 0.02$), but not of WANT vs. TRY ($F(1, 13) = 1.68$).

The results of the follow-up thus suggest that Spanish-speaking four- to five-year-old children do have some grasp of the effect of the structural differences implicated in the choice of an internal or external referent of the EC, despite their difficulty in giving external responses.

SUMMARY OF ACT OUT RESULTS

The experiments just described indicate that by four years of age, children learning Greek and Spanish have absorbed some of the basics of the distribution of PRO and pro in their language. Young children have difficulty

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with assigning external reference to an EC embedded subject, which may contribute to the degree of failure to reveal the difference between WANT and TRY in Greek and results in error with the construal of the EC in Spanish subjunctive complements. It might be supposed that the difference that was shown between WANT and TRY for Greek was related to the order in which the test sentences were presented, *viz*. the fact that WANT sentences were presented directly after the ORDER sentences that were used to promote external reference. The follow-up Spanish experiment argues against this. If the difference between WANT and TRY in the Greek experiment were due to a gradual wearing off of the effects of being pointed to external reference, then we would expect a difference between the WANT subjunctive sentences and TRY subjunctive sentences in the Spanish follow-up study. This does not occur, however; instead, the switch towards internal reference occurs at the point at which the embedded clause was switched from subjunctive to infinitive.

PICTURE VERIFICATION TASK

In addition to the act-out experiments just described, we also carried out a picture verification task with all the subjects. In this task, subjects were shown pictures in which one individual performed an action, while another individual looked on. Short (three–four-sentence) stories accompanied the pictures, which were designed to make a final test sentence either correct or incorrect as a representation of the picture. The correctness of each picture-final sentence combination depended on the language (Greek vs. Spanish), the main verb in the final sentence (WANT vs. TRY) and the structure (subjunctive vs. infinitive) of the complement to the main verb. Consider, for example, a picture of a young boy in the process of buying a bone while an eager-looking dog looks on, accompanied by (the equivalent of) 'The dog wants to buy a bone' or 'The dog tries to buy a bone'. The prediction was that the picture would be accepted in Greek when the verb was WANT but rejected when the verb was TRY, the predicted rejection arising because the dog was the subject of the main clause, but the boy was the individual doing the buying, and TRY does not permit external reference of the EC in Greek. For Spanish, it was predicted that both the WANT and TRY versions of the final sentence would be accepted when the embedded verb was in the subjunctive and the subject of the main clause was distinct from the person performing the action, and that both would be rejected in the same circumstance when the embedded verb was in the infinitive. The picture verification task was performed before the act-out task, since it was designed to point the subject towards an external reading of the EC (cf. the discussion above of the difficulty of getting subjects to see the external reading in Greek).

The results of the picture verification task were not as clear as those of the act-out, although for the adult Spanish subjects the error rate for any

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condition (WANT-sub, WANT-inf, TRY-sub, TRY-inf) did not exceed 25%, with an average difference between the subjunctive and infinitive conditions of over 60%. The performance of the Spanish adults thus indicates that the test was a fairly effective one, where the adult grammatical distinctions are structural rather than lexical. For both the Greek adults and children, there was a low level of acceptance of WANT sentences, which conforms to the observations made above concerning Greek-speakers' reluctance to accept external reference even when it is permitted. For the Spanish four- to five-year-olds in the initial act-out experiment, performance was extremely low, with high over-acceptance (75%) of the pictures when the complement was in the infinitive. This poor performance can be attributed to a task-related bias to respond affirmatively. A more adult-like pattern emerged for the six- to seven-year-olds and for the four- to five-year olds in the follow-up, with erroneous acceptance of the infinitival sentences dropping to around 40–50%.[2]

Because of its superior performance for the Spanish adults and the closer correspondence between adult grammar and child performance, we take the act-out task as a better reflection of children's knowledge than the picture verification task. However, despite the fact the picture verification task did not produce results as revealing of grammatical knowledge as the act-out did, some aspects of the data are of interest with respect to both the interpretation of particulars of the act-out results and the more general issues of the relationship between structural and lexical factors in the acquisition of control that we set out to investigate. First, both the younger children in the initial Spanish act-out experiment and the children in the follow-up did the picture verification task before they did the act-out. The improved performance of the children in the follow-up act-out study cannot be categorically attributed to the fact that the follow-up act-out for the Spanish children contained ORDER sentences, since the children who did the follow-up also did better on the picture verification. A t-test comparing the overall amount correct for the two groups of four to five-year-olds in the picture verification task approaches significance ($t_{27} = 1.75$, $p > 0.05 < 0.10$). The first group of four to five-year-olds may simply have been less adept than the second group at the experimental tasks. Second, the performance of the Spanish children on the picture verification task was not free of lexical effects. All three groups of children (younger and older in the first experiment, and the children in the follow-up) were more successful in rejecting sentence-picture combinations involving external reference of the embedded subject

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[2] A fuller report of the picture verification data can be found in Goodluck & Terzi (1996) and Goodluck, Terzi & Chocano Díaz (1997); those reports do not include the data from five of our adult Greek subjects.

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with the infinitive when the verb was TRY than they were when the verb was WANT (the differences in success rate were 16%, 18% and 26% respectively). In the first experiment there was a significant interaction between structure (subjunctive/infinitive) and verb (WANT/TRY) ($F(1, 31) = 6\cdot77$, $p < 0\cdot02$), and in the follow-up, the WANT-TRY distinction reaches significance as a main effect ($F(1, 13) = 5\cdot03$, $p < 0\cdot05$), contrary to the case in the act-out experiment, where there was no lexical effect of WANT vs. TRY.

DISCUSSION

The act-out task produced two main results. First, there is evidence that by four years of age children have established in their grammar distinctions that reflect those of the adult language they are learning. Greek children show sensitivity to lexical semantics of the main verb in assigning reference to the EC subject of a complement clause, permitting external reference in the case of WANT but not in the case of TRY[3]. Spanish children show sensitivity to the structural properties of the clause, permitting external reference more readily when the complement is in the subjunctive than when it is in the infinitive, for both WANT and TRY. Second, for children learning both languages, external reference does not come easily. Children learning Greek give more external reference for WANT than TRY, but nonetheless still prefer internal reference for WANT. Children learning Spanish distinguish between subjunctive and infinitive complements, but even at six to seven years of age have a rate of approximately 50% failure to give external reference in the subjunctive, where the adult grammar demands external reference.

These two results – overall patterns of performance that reflect the adult system and reluctance to go outside the sentence for reference of an EC – need to be evaluated together. Let us first consider the significance of the different cross-linguistic patterns we see in children's performance. Reviewing evidence that shows a degree of error in interpreting complement control constructions in experiments with English speaking children, Wexler (1992) suggested that at an early stage children might lack the category PRO – and hence that PRO might be subject to maturation. If we accept that the distinctions in adult Greek and Spanish are characterized by differing distributions of the categories PRO and pro, then by extension children's sensitivity to the distinctions of the ambient language argues that they too have an adult-like repertoire of ECs, including PRO. Thus if PRO is subject to maturation, that maturation can be argued to have taken place by the youngest age we tested.

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[3] Whether children's sensitivity to this lexical distinction encompasses also subtle structural distinctions encoding tense dependencies between the main and subordinate clauses (cf. the theoretical literature cited previously) is an important question beyond the scope of this discussion.

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Given that our cross-linguistic data supports the view that at four years children have a full repertoire of empty categories and have a grasp on how these are assigned with respect to the lexical items that we tested (WANT and TRY), then we are led to propose that the substantial errors of incorrect assignment of internal reference in the child Spanish data have a performance explanation, namely, an explanation in terms of the structure of the comprehension device and/or task demands rather than the underlying grammar. We recognise that our cross-linguistic data do not in and of themselves refute an account of children's errors in terms of a non-adult setting for the domain in which pro is interpreted (Padilla, 1990), but several factors argue that a performance-based approach is plausible, and has at the least a substantial role to play in explaining errors. First, our Greek adult subjects do not strongly prefer external reference for WANT, indicating that internal reference may be an option that adults readily access, where the grammar permits either internal or external reference. Internal reference may be favoured by the structure of the sentence processing mechanism, a bias that may be exacerbated by quantitatively lesser processing ability on the child's part (Goodluck, 1990). Second, many child experiments testing the interpretation of pronominal and empty categories (PRO and pro and definite pronouns) in a variety of contexts demonstrate a difficulty with external reference (e.g. Padilla, 1990; Avrutin, 1994; Goodluck & Solan, in press). The various categories tested are subject to different grammatical principles in the adult grammar, for which there is evidence in the literature of basic knowledge on the part of children. The overall picture is then one of knowledge of grammatical distinctions, but with a common thread of preference or error in the direction of internal reference that has no plausible basis in grammar *per se*. To claim that the performance system makes external reference challenging for children is not to say that children cannot assign external reference – for example, our Greek child subjects did so 70 % of the time in interpreting ORDER sentences without an object. Rather, the child's grammar has to fight a bias towards internal reference.[4]

The data from Eisenberg & Cairns that we summarised in the introduction represents a case in point with respect to the interpretation of errors. Eisenberg & Cairns found a high level of success amongst English-speaking three to five year-olds' production and interpretation of sentences with *want*, *try* and *say*, assigning internal reference of the EC subject for *want* and *try* and external reference in the case of *say*. Errors were made, however, with

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[4] The difficulty of external reference in the case of pro may also be exacerbated by the fact that the child has to combine lexically-specified knowledge with structural knowledge. Even in Spanish this is the case; although WANT and TRY do not differ in this regard, there do exist lexical restrictions on obligatory disjoint reference (Padilla, 1990).

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about 10% erroneous external reference for *want* and *try* and 20–35% (depending on the task) of internal reference for *say*. Our studies of Greek and Spanish allow these data to be put in a new perspective. Since English has controlled PRO in the standard case of infinitival clauses, it might be the case that error rates on *say* reflect difficulty that is particular to the combination of infinitive structure and the presence of a potential controller (the main clause subject). The Greek and Spanish data show that external reference in the configuration [NP V [EC V]] causes difficulty even when there is a structural situation (the subjunctive) that promotes, and in the case of Spanish requires, external reference. Thus it is plausible to suppose that it is the sheer fact of having to give external reference that raises the error rate for English *say*. Overall, adding the English data to the Greek and Spanish data reported here reinforces the point that we have made above, *viz.* that language particular patterns for the categories PRO and pro have been established by four years, even if the child's ability to execute his knowledge in experimental situations falls quite short of adult levels of performance.

Even if errors made by children aged four and older in the interpretation of the control constructions we tested are plausibly performance errors, rather than the product of a non-adult grammar, this does not imply that the child's grammar is adult-like from the earliest stages, or that mastering the grammar of control is simply a matter of overcoming a reluctance to give external coreference. Any conclusive answer to the basic question we set out to study – that is, whether lexical semantic or structural factors dominate in driving childen's hypotheses about the distribution of PRO – will have to come from studies of younger children. The fact that in the picture verification task for Spanish children there were effects of WANT vs. TRY gives a hint of an early stage where lexical factors play a more substantial role than we saw in our Spanish-speaking children. We can speculate that the picture verification task taps to a degree a level of semantic/conceptual structure (Culicover & Jackendoff, 1997) that has a more prominent role in the linguistic systems of younger children than it does in the adult grammar. At the same time, some of the recent theories of the distribution of PRO that we mentioned above make crucial use of functional projections (Agreement Phrase, Mood Phrase) above the VP, realized at the phonetic level by inflection on the verb. If there is a very early stage of semantically-based control, obedient to the markedness values for WANT and TRY we outlined above, then the mastery of verb inflection by the child, giving overt evidence of functional projections, may be a source of adjustment to a system that does not differentiate on the basis of lexical semantics, but on the basis of structural properties of the sentence. Thus the study of control phenomena cross-linguistically with younger children than we tested has the potential to provide insight on fundamental questions concerning the existence of very early semantically-based grammars and the emergence over time of a fully-

articulated syntactic system of functional categories appropriate to the language being learned.

CONCLUSION

In a cross-linguistic study we have measured children's knowledge of the relationship between the lexical semantics of verbs selecting complements with EC subjects and the structural properties of the embedded clause. Although children experience difficulty when reference external to the sentence is required, there is evidence that four to five-year-olds have a grasp on the patterns particular to their language. Such crosslinguistic contrasts support the view that children aged four and older have a category PRO available for the subject of sentential complements. Whether there is an early stage of development in which lexical semantics dominates and determines the interpretation of EC subjects is a matter for future research.

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