

Processing Entailed Complements before Subcategorized ones
or **The processor likes control best**
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0. Introduction

The literature on the processing of control structures has yet to be understood adequately. McElree and Bever (1989), Nicol and Swinney (1989) both provided psycholinguistic evidence for the existence of PRO to some extent. But unlike other empty categories such as *wh*- and operator traces, the evidence for PRO, and other argument anaphors like NP-trace, is less convincing. Another line of investigation addresses the actual processing mechanism used for control structures, and the kind of evidence they provide for theories of gap filling (Frazier and Clifton 19xx). This study will try to address both concerns by testing the hypothesis that obligatory control (OC) structures do not contain a PRO at all but rather are construed using meaning postulates (Chierchia 1984); on the processing side, this predicts that OC structures are immune to active gap-filling effects for the very simple reason that there is no gap to fill. This study will provide some evidence that this is the case. It will be suggested that the processor posits OC where it can. That is, the processor will more quickly access the complement type that a predicate determines by virtue of a meaning postulates than it will access a complement determined by a syntactic sub-categorization frame alone.

1. The problem

To show this, I test OC structures against Exceptional Case Marking (ECM) structures using test materials like those of Frazier and Clifton (19xx). When the same predicate can alternate between OC and ECM, *wh*-extraction creates an ambiguity:

- (1) Who does John want to drink?¹
- | | |
|-----------------------------------|-----------------------------------------|
| a. Who does John want to eat ___? | <i>Control</i> (vampire interpretation) |
| b. Who does John want ___ to eat? | <i>ECM</i> |

Most English speaker's first reaction to an utterance of (1) is laughter, indicating that the control structure is processed, as implausible as it is, before the ECM. This is the intuition that I will test. Furthermore, in an unambiguous string, the ECM structures show a filled gap effect. While (1b) is perfectly grammatical, *Bill* comes as a surprise.

- (2) a. Who did Mary want to hire *e*?
b. Who did Mary want *e* to hire Bill?

If the EC after *want* were truly an empty category, we would expect that the processor would posit the *wh*-tail in that position first, and then the control structure would have to be reanalyzed. The intuition pursued here (and supported elsewhere) is that the ECM structure undergoes reanalysis.

¹ Of course, *wanna* contraction can disambiguate for a control structure; since the experiment was a read questionnaire, this was not an issue.

Similar findings attain in the case of object control (ObjC) vs. subject control (SC) (Frazier et al):

- (3) a. Which woman did the child beg to sing those silly French songs last Christmas?
ObjC
- b. Which woman did the child beg to sing those silly French songs for last Christmas?
SC

Object control (3a) is judged harder (Frazier and Clifton 19xx).

2. A semantic account

While the PRO theorem (Chomsky 1981) provided an ingenious solution to satisfy both the theta-criterion and the case filter requirements of unexpressed infinitival subjects, PRO has been an awkward object in syntax from the outset (see Hornstein 1999 and references therein). Alternative accounts point toward the semantic character of the predicates that select OC complements, showing that PRO is neither necessary nor desirable way to represent control structures (Chierchia 1984, Wurmbrand 2001).

Chierchia's account holds that OC verbs take property level complements, that do not contain any subject position at all. To derive the control interpretation, there is a meaning postulate for verbs like *want* and *try* that entail that the 'subject' of the embedded property is co-referent to the matrix subject. The embedded subject is thus *added semantically* through a meaning postulate: (\Box is a modal operator making the meaning dependent on context (Kratzer 1981)) :

- (4) The meaning postulate in *try*, *want*

$try'(P)(x) \rightarrow \Box P(x)$

'Whenever x tries to bring about P, then in all the contextually relevant situations (namely those where what x tries actually succeed) x does P

[Wurmbrand's 2003 paraphrase]

Wurmbrand (199, 2001) has advanced syntactic evidence that OC complements are VPs that lack syntactic subjects. For her, the embedded verb and the matrix verb form a complex predicate. The two syntactic analyses are contrasted below:

- (5)

a. Complex Predicate Analysis

John tried [_{VP} to leave]

John wanted [_{VP} to leave]

b. PRO Analysis

John_i tried [PRO_i to leave]

John_i wanted [PRO_i to leave]

The Chierchia/Wurmbrand account lacks any syntactic EC. As noted, this predicts that there will be no gap in the embedded subject position of OCs for the processor to even contemplate filling with a moved constituent.

In the case of ECM verbs, which take a clause-level complement not a property-level complement, a trace position can be posited in embedded subject position. This hinges on the assumption that the ECM version of *want* does not arise through a meaning postulate. Rather, the selectional properties of *want* require a clausal-complement, with a fully saturated predicate.

2.1. Processing Hypothesis

So far nothing said above explains a processing preference for OC over ECM in extraction contexts like (2). Something needs to say why the processor would posit a control structure over an ECM structure. I hypothesize that meaning postulates are activated when the processor receives a verb like *want*. Since the meaning postulate effectively determines, through entailment, that its complement is a VP/Property, the processor need not access sub-categorization information for the verb. In a sense, the syntax comes for free. Or at the very least, the syntax consistent with OC will easily be accommodated. In absence of evidence, the processor will pursue an OC structure. When the OC structure cannot be maintained—as in (2b) where there is no place left to resolve the *wh*-word—the ECM structure is accessed causing reanalysis.

Implied by this account is that syntactic sub-categorization information, of the kind needed for ECM complements, is superceded by semantic entailments. This is why the processor does not simultaneously pursue an ECM structure.

(6) *Predictions of Semantic Processing*

SC control structures will be easier to process and will not show evidence that the processor resolves the *wh*-word in the purported position of PRO. Instead, ECM will show filled gap effects, and require reanalysis in these cases, leading to slower reading and a perceived difficulty in comprehension.

2.2 Against a syntactic account

It might be argued that the subject control (SC) is preferred to ObjC and ECM analysis because it involves minimal attachment. That is, both OC require more complex phrase structure. ObjC involves some kind of double complement structure; ECM requires more functional material, or perhaps movement, to license case on the embedded subject. However, the syntactic evidence is not even consistent on the latter point; debate still rages whether ECM is raising-to-object or real exceptional case marking. If it is the latter, ECM would involve fewer nodes between the matrix predicate and the embedded subject so that the clause is transparent to case assignment (or government or L-marking, or whatever case theory that is needed). In sum, it isn't clear that syntactic complexity would even make the right predictions.

Even more disastrous for a syntactic account is the heterogeneous behavior of syntactically identical predicates. If it were syntactic properties of SC vs. ECM that lead the processor to give a SC analysis first, then we would expect that all verbs that behave

syntactically like *want* would show the effects in (2). Like *want*, *expect* alternates freely between SC and an ECM.²

But *expect* does not occasion the same intuitions as *want* does in the *wh*-extraction cases.

- (6) a. Who did John expect to hire?
 b. Who did John expect to hire Bill? (intuition: no filled gap effect at *Bill*)
- (7) a. Who did John expect to drink? (vampire reading shouldn't be consistently first)

The hypothesis is that *expect* does not carry a meaning postulate that determines the complement type as VP/Property. Rather, control in this case may very well be due to an EC.³ As such, we predict that just the opposite effects are found in the case of *expect* versus *want*.

3.0 Experiment

A questionnaire asked subjects to compare 2 sentences, and say which one is easier. The test materials compared *wh*-extraction from the ECM subject to *wh*-extraction from embedded object of SC. The sentences were like those in (2), but with extra material between the matrix predicate and the disambiguating verb in the subordinate clause. Subjects were asked to indicate which they found easier to understand, or easier to read. The also recorded whether they were sure about this judgment or not.

3.1 Materials

The study consisted of two questionnaires, which were identical expect for a reversal in the order that the test pairs appeared. I list the types of materials below, and explain the justification for their inclusion afterward.

A. 4 token pairs of SC and ECM (*want*, *would like*) COMPLEX

these all were heavily lengthened by material between the matrix predicate and the disambiguating verb in the (lowest) subordinate clause

1. a. Which candidate would John like to be given the chance to campaign for president?
 b. Which candidate would John like to be given the chance to elect for president?

² *Expect* does allow a tensed clausal complement, which *want* doesn't (at least in English).

- (i) I expect (that) I'll be late for the meeting tomorrow.
 (ii) *I want that I'll be early for the meeting tomorrow.

These difference may in fact be attributed to the semantics as well; *want* cannot take fully-tensed propositions.

³ I would have to retract on the claim that PRO or some sort of empty category does not exist in all SC structures. Wurmbrand (1999) concludes the non-obligatory control (NOC) does require an EC subject. *Expect* may very well be a NOC predicate; **insert tests here**

3. a. Which boy would Maria like to get up the nerve to kiss at the party this Friday?
b. Which boy would Maria like to get up the nerve to dance at the party this Friday?
8. a. Which employee did the store manager want to be allowed by the boss to retire before summer started?
b. Which employee did the store manager want to be allowed by the boss to hire before summer started?
10. a. Who did Gerry want to introduce to the crowd at the benefit concert?
b. Who did Gerry want to perform to the crowd at the benefit concert?

B. 4 token pairs of SC and ECM (*want, would like*) SIMPLEX

these were simple biclausal structures with little material between the matrix predicate and the disambiguating verb.

5. a. Who did Mary want to see on her birthday?
b. Who did Mary want to come on her birthday?
11. a. Who did Bob want to drink beer?
b. Who did Bob want to drink with?
16. a. Which of the bullies would Gerry like to disappear?
b. Which of the bullies would Gerry like to hit most?
18. a. Which child did the young girl want to baby-sit?
b. Which child did the young girl want to sleep?

C. 2 token pairs of SC and ECM using *expect*

these items include material between the predicate and the disambiguating verb.

6. a. Which student did the professor expect, by the end of the semester, to give an A+?
b. Which student did the professor expect, by the end of the semester, to earn an A+?
14. a. Which boy did Gretl expect to succeed when he is grown up?
b. Which boy does Gretl expect to dislike when he is grown up?

D. 4 token pairs of SC and ObjC (*beg, promise*)

7. a. Which of her brothers did Gretl ask, at the last moment, to dance with to her wedding?
b. Which of her brothers did Gretl ask, at the last moment, to speak at her wedding?

12. a. Who did the little boy ask to be allowed to go to the park?
b. Who did the little boy ask to be allowed to take to the park?
15. a. Which boy did the baby sitter promise when she arrived to watch all night?
b. Which boy did the baby sitter promise when she arrived to play all night?
17. a. Who did the policeman promise to try really hard to impress?
b. Who did the policeman promise to try really hard to succeed?

E. 4 controls contrasting subject vs. object wh-extraction

4. a. Mary finally met the man who—at every conference—John drinks with.
b. Mary finally met the man who—at every conference—drinks beer
13. a. Who did the woman at the car rental agency say went to Boston?
b. Who did the woman at the car rental agency say John drove to Boston?
20. a. The boss promoted the employee who made the most money for the company.
b. The boss fired the employee who was paid the most money in the company.

F. 4 fillers

3.2 Justification for each type

A. and B. The eight test sentences alternating between SC and ECM structures. The simplex versions were included to see if any significant difference would be detected even if the tokens were not lengthened. The simplex version were also included in case subjects simply found the complex versions too awkward or long to make any judgment (as we will see, this concern was not realized).

C. The *expect* class was include as a control against a structural explanation for the preference of SC over ECM. It was hypothesized that since *expect* is not naturally a obligatory reconstructing predicate (i.e. a predicate with a meaning postulate guaranteeing a SC reading), there would be no significant preference for the SC sentence.

D. The OC~SC pairs were included to see if the hypothesis could be extended to this class of predicates.

E. The subject ~ object extraction pairs served as a control to demonstrate that preferences for the SC over ECM test tokens was not simply a preference for object vs. subject extraction.

As noted, the order of the sentences in each pair was reversed in Questionnaire 2. The counter-balancing is crucial to the experiment, to avoid an order effect. In comparing two nearly identical complex sentences, subject might find the first easier: the first sentence establishes some type of scenario, however out of context; the second sentence being so close in form but different in meaning might then be harder to accommodate. As we will see, however, there was no order effect; subjects did not consistently prefer the a sentences over the b sentences, but instead preferred the “easier” ones.

Subjects

To date, 10 subjects’ responses have been analyzed. All were native English speakers with only small dialectal differences. 8 spoke Southern Ontario English, 1 mid-Western American, and 1 Vancouver-Canadian English. None of the dialect differences extend beyond the phonological and lexical, thereby irrelevant to the processing of control structures.

3.4 Results and Discussion

A majority of responses, from both questionnaires favored SC over ECM in the complex cases (Table 1). Column 2 lists the number of responses favoring SC, while column 3 lists the number of “*sure*” responses. The numbers drop on average by one when only the *sure* responses are included. Column 4 indicates how sure subjects were who preferred the ECM structure. When subjects did prefer ECM, they were almost always sure of it.

Token pair	# of subjects who preferred SC (out of 10)	# sure of preference for SC	# of subjects who preferred the ECM but were unsure
1.	7	6	1
3.	9	8	0
8.	8	7	0
10.	10	8	0

TABLE 1 *Test sentences: complex versions*

In the simplex version of the SC~ECM alternation (Table 2), the numbers drop slightly, but then so do the number of “unsure” ECM responses. I suggest this is simply due to the fact that the simplex versions do not bring out the garden-path bias toward SC as much as the complex ones, as expected.

Token pair	# of subjects who preferred SC (out of 10)	#sure of preference for SC	# of subjects who preferred the ECM but were unsure
5.	7	6	0
11.	8	6	1
16.	8	7	1
18.	9	8	0

TABLE 2: *Test sentences: simplex versions*

The controls confirmed that there is no preference for (long distance) object extraction over subject extraction (Table 3). In fact, subjects preferred the subject extraction cases more often, contrary to the test sentences. However, there was considerable doubt. Several responses were unsure (Column 4) and some subjects simply said they had no preference at all (Column 5).

Token pair	# of subjects who preferred subject extraction	# of subjects who preferred object extraction	# who were unsure of their decision	# of subject who weren't sure at all
4.	8	1	5	1
13.	8	1	2	1
20.	9	0	2	1

TABLE 3: *Controls*

The prediction that the *expect* sentences would not display a preference for SC was partially borne out (Table 4). For token pair #6, seven of the subjects indicated they were sure that they preferred the ECM. Three preferred the SC, but only two were sure of that response. Token pair #14 was much less decisive, the subjects diving in half: 5 for each type. Only three subjects were sure that the ECM was easier, only one was sure that the SC was easier.

Token pair	# of subjects who preferred ECM	# sure of ECM preference	# of subjects who preferred the SC but were unsure
6.	7	7	1
14.	5	3	4

TABLE 4: *Expect class*

While *expect* did not show any real preference for either ECM or SC, this is inline with the hypothesis that no semantic entailment prefers the SC or the ECM structure. We would expect, then, that other factors would account for *expect*, to the extent that there is a significant difference between SC and ECM here. The fact that *expect* behave much more erratically compared to *want* suggests that the syntactic similarity between the two is not operative in this respect.

The object control/subject control pairs also showed a preference for the subject control in most cases:

Token pair	# of subjects who preferred SC	# of subjects who preferred SC who were 'sure'	# who were unsure of their preference for ObjC	# of subject who weren't sure at all
7.	3	3	0	0
12.	7	7	2	1
15.	8	1	0	0
17.	10	1	--	--

TABLE 5: *Subject vs. Object control*

The poor performance on #7. is perhaps due to a typo in the SC. This made the SC version in 7 totally ungrammatical.

Discussion and Conclusion

The majority of responses favored SC over ECM and ObjControl, as consistent with the intuitions outlined in (2). However, the *expect* cases are crucial to determine whether the semantic entailment account for Obligatory control is what is at work. More needs to be done to test obligatory control against non-obligatory control. Perhaps an asymmetry in reactivation at the site of PRO could distinguish the two.

References

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