Cross-linguistic differences in parsing: Restrictions on the use of the Late Closure strategy in Spanish

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Abstract

Two questionnaire studies and three on-line experiments were carried out in an attempt to determine whether a parsing strategy which is widely used in English (the Late Closure strategy) simply represents an arbitrarily chosen procedure or whether it is likely to have become a relatively stable feature of the parsing routine because it confers real information processing advantages on the reader or listener. Experiment 1A showed that Spanish readers apparently do not use the Late Closure strategy to interpret a particular type of sentence. With comparable materials, however, English readers do use this strategy (Experiment 1B). Experiments 2, 3 and 4 showed that the structural choices were made while the subjects were actually reading the sentence. The results throw doubt on the suggestion that the Late Closure strategy is favoured in English mainly because it is efficient in information processing terms. It may be that different languages make use of parsing strategies in an essentially arbitrary way. Implications for general theories of human parsing are discussed.

Introduction

Over the past few years considerable effort has been devoted to the study of human parsing processes (e.g., Frazier, 1987; Frazier & Rayner, 1982; Mitchell, 1987b; Mitchell & Holmes, 1985; Rayner, Carlson, & Frazier, 1983;...
Tyler & Marslen-Wilson, 1977). Underlying much of this work there appears to be an unstated assumption that it is possible to study parsing as a general language-independent feature of human cognitive processing. On the face of it, this seems highly implausible. We know that there are something like 5,000 different natural languages (Ruhlen, 1987) and between them these languages employ an impressive range of devices to code and communicate different aspects of human experience. Different subclasses of languages code and represent syntactic information in fundamentally different ways, and so it is difficult to believe that there could be anything approaching a single, uniform process for decoding this information. If this is accepted, then there is little point in trying to investigate the human parsing process because there is unlikely to be any such general mechanism for conducting syntactic analysis. A more realistic goal would be to start by studying the processes people use to parse individual languages and then, using systematic comparisons, gradually try to build up a picture of which strategies and operations are unique to a particular language and which of them are shared with a wide range of other languages.

Previous work has highlighted a number of notable differences in parsing across different languages. For example, Bach, Brown and Marslen-Wilson (1986) have shown that Dutch listeners are more successful at coping with certain sentences with complex dependencies than German listeners are. Also, in a series of different studies, MacWhinney, Bates and colleagues (e.g., Bates, MacWhinney, Caselli, Devescovi, Natale, & Venza, 1984; MacWhinney, Bates, & Klugl, 1984; McDonald, 1987) have shown that there are cross-linguistic differences in the cues people use to interpret internally inconsistent sentences. Thus, English speakers tend to place most emphasis on word order, while Italians rely more on noun–verb agreement and Germans are strongly influenced by noun-animacy cues. Differences of this kind are not very surprising where there are marked structural differences between the contrasting languages. Indeed, clear-cut processing differences are exactly what might be expected if syntactic distinctions are coded or expressed in radically different ways. Presumably if there is any general human process for parsing sentences, then language-specific variants of this kind must be handled by specialised subcomponents of the general procedure. However, potentially more interesting issues are raised by structures which are syntactically equivalent in different languages (i.e., structures in which comparable syntactic devices are used to express distinctions in attachment, labelling, etc.). If sentences of this kind are processed in a similar manner in different languages then it might be possible to make a case that we are looking at the workings of some kind of “general” syntactic processor. We can elaborate the argument by considering alternative ways in which a stable parsing phenomenon (or strategy) might evolve in any given language.

First, the strategy may represent an optimal way of using human information processing resources and avoiding any corresponding processing limitations (such as short-term memory restrictions). Presumably it is often possible in principle to use a variety of different computational procedures to solve any given parsing or decoding problem. In such circumstances it is easy to see that one particular strategy might come to predominate if it proves to be more “efficient” in some sense. The precise strategy which eventually emerges in this way will presumably be determined jointly by the nature of the processing system and by the formal properties of the parsing/decoding problem. However, comparable strategies should be used when different parsing problems are formally or computationally equivalent. In particular, if we assume that the computational machinery itself is universal (or, at least, that it does not vary in any systematic or qualitative manner from one language-speaking community to another), then similar strategies should be used to deal with equivalent structures across languages. Mechanisms and strategies of this kind may be referred to as principled or process-generated strategies.

The obvious alternative to this is that there is no reason for favouring one strategy over another based on the basis of “efficiency” or compatibility with the features of the general processing system. In these circumstances there may be an essentially arbitrary decision about the interpretation to be assigned to a given linguistic structure and an equally arbitrary strategy may then evolve to derive this interpretation. Such choices would have to become fixed conventions to enable them to be used effectively by all members of the linguistic community. However, since the strategies were not originally selected on the basis of processing differences (by hypothesis), they might be referred to as unsystematically generated or arbitrary strategies.

As a preliminary step in understanding human parsing as a general process, it would be useful to discover whether there are parsing procedures which are process-generated in the manner outlined above and which therefore appear in similar forms across different languages. In a recent review, Frazier (1987) has argued that at least two widely discussed parsing strategies may fall into this category. These are the Minimal Attachment strategy (“Do not postulate any potentially unnecessary nodes”) and the Late Closure strategy (“If grammatically permissible, attach new items into the clause or phrase currently being processed [i.e., the phrase or clause postulated most recently”]). (Both definitions are from Frazier, 1987, p. 562.)

In the present paper we will be concentrating on the second of these two strategies. However it is worth saying a few words about Minimal Attachment as a way of setting the scene for this discussion.
Frazier (1987) points out that Minimal Attachment offers a robust account of the interpretations people give to a wide variety of potentially ambiguous or locally ambiguous structures in English (see Frazier, 1983; Frazier & Fodor, 1978; Frazier & Rayner, 1982; and Rayner, Carlson, & Frazier, 1983, for further details; but also see Holmes, Kennedy, & Murray, 1987, for a contrary view). Frazier argues that this degree of systematicity is unlikely to be accidental and she suggests that there are good processing reasons for favouring Minimal Attachment strategies over nonminimal ones. In particular, she notes that “Minimal attachment analyses will be available earlier than nonminimal ones due to the relative number of phrase structure rules that must be accessed for the two analyses” (Frazier, 1987, p. 564). The result is that the strategy allows new material to be structured earlier than it would be under alternative strategies and this yields processing advantages in terms of reductions in processing load and so forth. Frazier (1987) then goes on to present preliminary evidence that the strategy appears to play a role in languages other than English (e.g., Japanese and Dutch). While further cross-linguistic comparisons would obviously strengthen the argument, this preliminary work is highly suggestive and it seems reasonably likely that Minimal Attachment will turn out to be a process-generated, non-arbitrary strategy.

Turning to the Late Closure strategy, Frazier (1987) again argues emphatically that the process is non-arbitrary but, as we shall see, the evidence here is much more patchy. There is certainly evidence that the strategy is applied quite generally in English (see, for example, Frazier, 1979; Frazier & Fodor, 1978; Frazier & Rayner, 1982; Mitchell & Holmes, 1985). Ford, Bresnan, and Kaplan (1982) have suggested that the strategy may occasionally be overridden in the context of certain types of verb, but recent work by Mitchell (1987a) suggests that such reversals occur in the relatively late “filtering” stage of parsing, so that the evidence suggests that the Late Closure analysis is initially applied even in sentences where it fails to generate the final interpretation.

There are also several reasons for supposing that Late Closure might be associated with genuine processing advantages. One advantage (noted by Frazier, 1987) is that with Late Closure “new items may be structured together immediately with already processed material” (p. 564). As with Minimal Attachment, this could potentially reduce the processing load compared to alternative strategies. If the current constituent is kept open as long as possible, the strategy also avoids the additional processing that can occur when a structure is closed prematurely, then reopened and eventually closed yet again at a more appropriate point later in the sentence. Redundant operations of this kind may be quite costly, since there is some evidence that linking and structure building operations may be scheduled at the ends of constituents (e.g., Mitchell & Green, 1978). Indeed, it has even been suggested (e.g., by Jarvella, 1971) that surface-structure information is purged at these points, so it is possible that premature closure could result in the destruction of information which is vital raw material for the parsing process. Thus, there is good reason for supposing that Late Closure might be a process-generated strategy. However, all of the evidence cited so far has been based on the processing of English and, unlike in the case of Minimal Attachment, Frazier (1987) was not in a position to cite evidence from other languages. It could therefore be that Late Closure is an unsystematically generated or arbitrary strategy and not one that has evolved on the basis of its processing efficiency.

In the present study we look for evidence of Late Closure in the way people process sentences in another language (Spanish). Comparable sentences in English (and, in many cases, exact literal translations) produce the conventional Late Closure effects, and we argue that if this is attributable to general processing advantages, then precisely the same effects should occur in Spanish.

**Experiment 1A – Spanish**

The materials consisted of simple sentences with a relative clause as in Example (1a) (literal translation in 1b):

(1a) El periodista entrevistó a la hija del coronel que tuvo el accidente.

(1b) The journalist interviewed the daughter of the colonel who had had the accident.

According to the Late Closure strategy the relative clause should be attached to the phrase “currently being processed” (i.e., “del coronel”), and the colonel should therefore be interpreted as the person who had the accident. However, on an Early Closure strategy the clause would tend to be attached to the preceding NP (i.e., “la hija – the daughter”). In either case extra nodes or links would have to be created, as the relative clause is “Chomsky-adjointed” within one or other of the alternative NPs as follows:

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NP
  det N NP
    N RC
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The degree of restructuring involved in incorporating the RC is equivalent for the two alternative readings and so other parsing principles, such as Minimal Attachment, should not discriminate between the two readings. Thus, by examining the way in which people interpret such sentences we should be able to learn something about the applicability of Late Closure in Spanish.

In the first experiment, Spanish subjects were required to answer simple questions to probe their understanding of a series of sentences of this kind.

Method

Materials

The study was based on 24 sentences of the form:

NP1 – V – NP2 – del (or de la, de las, or de los) – N – relative clause.

The relative clause was selected so that on semantic and pragmatic grounds it could be attached equally plausibly to NP2 or to the noun immediately preceding it. The Spanish materials together with their literal English translations are given in Appendix 1.

Procedure

Subjects were simply presented with typed sheets containing the 24 experimental sentences interspersed with 26 filler sentences with a variety of different syntactic structures. The sentences were all punctuated normally and all contained potential ambiguities of attachment. Each sentence was followed by a question and the subject was required to write down the answer in each case.

For example, for sentence (1) above, the question was (the Spanish for) “Who had had the accident?” Similarly, an example of a filler sentence was “I met Luis when I/Luis went to the beach (Encontre a Luis cuando iba a la playa).” In this case the question was “Who went to the beach? (Quien iba a la playa?)” and an appropriate answer could either be “I did (yo iba)” or “Luis (Luis iba).”

Subjects

The subjects were 20 undergraduate volunteers from the University of Oviedo.

Results and discussion

Table 1 shows the mean number of sentences in which subjects judged the relative clause to be attached to each of the two nouns in question. For choices consistent with the Late Closure strategy, the relative clause is understood to qualify the noun appearing immediately before it in the sentence. Alternatively, with Early Closure, the clause is interpreted as being attached to the preceding noun phrase (i.e., the second NP in the sentence – labelled NP2 in the Materials section above).

The results showed a marked tendency for subjects to attach the clause to the first of the two potential nouns (contrary to the Late Closure strategy). This was supported statistically by a repeated-measures ANOVA in which the dependent measure was the number of sentences in which each subject attached the relative clause to each noun. The specific noun (corresponding to Late or Early Closure) was used as the experimental factor. The analysis showed that Early Closure choices predominated ($F(1,19) = 38.14$, $p < .001$). The corresponding analysis with Materials (using the numbers of subjects making the alternative choices) was also highly significant ($F2(1.23) = 63.54$, $p < .001$) and the combined effect shows that the result can be simultaneously generalised to new subjects and to new materials ($\text{Min}F^* (1.38) = 23.8$, $p < .001$).

Experiment IB – English

Before proceeding to examine this effect in more detail, it seems reasonable to check that English readers show the conventional bias in favour of Late Closure and that there is therefore a genuine cross-linguistic difference in preferences across the two languages. Clearly the most direct comparison would be one using literal translations of the sentences used in the Spanish questionnaire. However, it turned out that this was not entirely practical
because the Spanish relative pronoun "que" can be translated either as "who" or "that" in several sentences and so there was no way of retaining the neutrality guaranteed by the single Spanish form. In particular, there was a problem when the first noun was non-human and the second was human (e.g., sentences E1 and E5, Appendix 1).

In such cases there would presumably be a bias in favour of Late Closure if "que" were translated as "who," and a corresponding bias in the opposite direction if it were translated as "that" or "which." For this reason we decided to focus the main analysis on the 11 sentences in which both of the critical nouns were human. In such cases the relative pronoun itself ("who") should not favour one noun over the other, and so it should be possible to pick up the effects of a general bias in favour of Early or Late Closure. The remaining 13 sentences were retained in the test material primarily to ensure that the questionnaire length and structure were as similar as possible to the parallel Spanish version described above.

Method

Materials

The experimental sentences were literal English translations of the 24 sentences used in Experiment 1A. As indicated above, the relative pronoun "que" was translated as "who" whenever both potential heads were nouns referring to humans and as "that" whenever the first noun was non-human (see Appendix 1).

Procedure

This was exactly the same as that in Experiment 1A.

Subjects

The subjects were 26 undergraduate volunteers from the University of Exeter.

Results and discussion

Table 2 shows the attachment preferences for sentences in which both alternative nouns were human and in which the first noun was non-human.

In a preliminary analysis, the results were submitted to a repeated-measures ANOVA in which the dependent measure was the number of sentences in which each subject attached the relative clause to a given noun. The two main factors were noun (first vs. second) and material type (human/human vs. non-human/human). As anticipated, there was a strong interaction between these two factors ($F(1, 25) = 36.28, p < .001$), indicating that the preferred attachment of the relative clause differs over the two classes of material. Following the arguments raised in the Introduction to the current experiment, we assume that this is largely, if not entirely, due to the fact that the relative pronoun "that" introduced a bias causing readers to attach the clause to the non-human noun rather than to the human noun in the second class of materials. We take this as justification for concentrating the remainder of the analysis on the first class of materials – where the relative pronoun ("who") was neutral with respect to the two potential points of attachment.

In this class of materials, a simple contrast revealed that subjects showed a reliably greater tendency to attach the relative clause to the second noun rather than to the first ($F(1, 25) = 5.59, p < .05$). This result confirms that the general bias in favour of Late Closure in English does indeed apply in the usual way to this particular set of materials.

In order to make comparisons across the two languages, we computed the proportions of English and Spanish subjects displaying a Late Closure preference for each of the sentences in the human/human subset. A simple comparison using sentences as a random effect showed that the mean proportion for Spanish (.28) was lower than that for English (.61) ($t(10) = 4.85, p < .001$). In other words there seems to be a genuine cross-linguistic difference in the sense that a set of equivalent sentences (literal translations of one another) revealed a stronger tendency for subjects to follow Late Closure in English than in Spanish.

Finally, while it is regrettable that the cross-linguistic comparisons had to be restricted to a subset of just 11 of the 24 sentences, it is worth pointing...
out that additional analyses gave us no reason to suspect that this subset was in any way unrepresentative of the entire set of Spanish sentences. First, an analysis restricted to just the “human/human” sentences in the prior experiment showed the same Early Closure bias that was revealed in the overall analysis reported earlier. Specifically, with these particular sentences, more Spanish subjects judged the relative clause to be attached to the first noun than to the noun in the possessive phrase \( F(2,10) = 24.60, p < .001 \). Moreover, the proportion of subjects opting for Early Closure in this subset (.72) was essentially the same as that opting for Early Closure in the remaining 13 sentences (.78) \( r(22) = .94, \text{n.s.} \). This last result suggests that the two subsets did not differ substantially in terms of any semantic or pragmatic differences which might have influenced the closure bias in either direction. If we assume that this semantic/pragmatic equivalence applies equally well to the English materials, then it follows that virtually the entire bias difference between the two groups shown in Table 2 can be attributed to the effect of the alternative translations of the relative pronoun.

To summarise, then, the underlying bias for the English readers was to use the conventional Late Closure strategy to bind the relative clause to a noun in the possessive phrase of the sentences considered here. Spanish readers showed the opposite bias and the difference was reliable – indicating that there is a genuine cross-linguistic difference in the strategies used to parse these sentences.

Experiment 2

The results of Experiment 1A show that, with the particular sentence structure under examination, Spanish readers show a strong tendency to attach the relative clause to the earlier of two potential noun targets. In doing this they depart from the Late Closure strategy widely used in English. However, these judgements represent the subjects’ considered preferences and the informants were under no pressure to give rapid responses. There is no guarantee, therefore, that these verdicts represent choices that the subjects made while they were actually processing constituents of the sentence for the first time. The decision could easily have been made at the end of the sentence, when all the relevant information is available. It is therefore possible that Spanish readers used Late Closure at first, but then reversed the majority of their decisions before answering the questions. In view of this possibility, the present experiment was carried out to determine whether subjects showed any commitment to their ultimately preferred (Early Closure) attachment while they were still processing the sentence. The materials were based on those used in the first experiment, but each sentence was extended by adding a new clause after the relative clause. This extra clause was designed to be incompatible with the Early Closure interpretation of the first part of the sentence, but entirely consistent with the alternative Late Closure interpretation. The arrangement is illustrated in Example (2), which is a literal English translation of Spanish sentence (S1) (see Appendix 1).

(2) Peter was looking at the book of the girl / who—that was in the living-room / watching TV.

If the readers adopt an Early Closure strategy and immediately attach the relative clause to the word “book,” then they should have some difficulty in interpreting the final clause, since a book is obviously not capable of watching TV. On the other hand, if the relative clause is initially attached to the word “girl” (and presumably reversed subsequently – Experiment 1A), then there should be no difficulty in processing the final clause. In order to provide a baseline for comparative purposes we use a “reduced” form of the original sentence, as in Example (3).

(3) Peter was looking at the girl / who—that was in the living-room / watching TV.

In this case there should be no ambiguity about the attachment of the relative clause and the final portion of the sentence should be processed without difficulty. Using these materials, it should be possible to draw inferences about on-line parsing strategies by comparing the processing times for the final clauses of the experimental form (e.g., Example (2)) with those for the corresponding clauses in “reduced” (control) sentences (Example (3)). More specifically, the processing time for the critical part of the sentence should be comparable in the two examples if the relative clause is routinely and systematically attached to “girl” in both cases. However, if there is an immediate tendency to attach it to “book” in (2), then the processing time for the final clause should be significantly longer than that in the control condition in (3).

The present experiment was designed to test this by using a clause-by-clause version of the subject-paced reading task (see Mitchell & Green, 1978 and Mitchell, 1984, for a methodological evaluation of this task).

Method

Materials

The experimental sentences were based largely on those used in Experiment 1A. (In fact, four were replaced by new items because the wording was
almost identical to that in other sentences.) In each sentence a new clause was added to disambiguate the interpretation of the relative clause. This was done by using either pragmatic devices or gender mismatches to signal that the relative clause was intended to refer to the second of the two possible NPs. The sentences ranged in length from 14 to 17 words and were divided into three segments for the purpose of display. The final (and critical) display always consisted of three words. Details of the sentences and the way they were segmented are given in Appendix 1.

The control sentences were constructed from the main experimental items by removing the second NP (i.e., the object of the matrix clause) together with the immediately following possessive pronoun (de la or del) – as in Example (3), above. Again, the details are presented in Appendix 1. In addition to the experimental and control sentences, there were 36 filler sentences. These were included to introduce syntactic variation into the study. The entire set of 60 sentences was divided into 12 blocks of 5 with 1 experimental, 1 control and 3 filler sentences per block. Order was randomised within and between blocks separately for each subject, with the following constraints: (1) test sentences were always followed immediately by filler sentences and (2) a pair of successive filler sentences was always followed by a test sentence. At the end of each block there was a simple Yes/No question about one of the sentences, to provide a relatively straightforward test of comprehension.

Procedure

The sentences were presented in capital letters in a subject-paced reading task on an Apple IIe microcomputer. Each trial was preceded by the prompt “¿Preparado?” (“Ready?”) in the centre of the screen. When the subject hit the space bar the prompt was immediately replaced by the first display of the sentence. Subjects were instructed to press the space bar again when they had read the first display. On doing this the first segment was immediately replaced by the second display of the sentence, and so on until the sentence was completed. After five sentences the subject was presented with a comprehension question preceded by the warning “Prueba de comprensión: ¿preparado?” (i.e., “Comprehension probe: ready?”). He or she was required to respond by pressing either the S key (for “Sí”) or the N key (for “No”). The computer recorded the response time to the final segment of the test sentences and the actual response and latency of response for the comprehension questions.

Each subject read all 24 basic sentences – 12 of them in the experimental form and 12 in the control form. The actual sentences appearing in each form were counterbalanced over the experiment as a whole. The experimental session was preceded by a practice block consisting of 20 sentences.

Table 3. Results of Experiment 2: Mean reading time (in milliseconds) for the final display of experimental sentences in which the relative clause could potentially refer to either of two NPs and of control sentences in which there is only one plausible candidate

<table>
<thead>
<tr>
<th>Condition</th>
<th>Experimental</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading time (ms)</td>
<td>1978</td>
<td>1689</td>
</tr>
</tbody>
</table>

Subjects

The subjects were 13 male and 11 female undergraduates from the University of Oviedo. All were native speakers of Spanish.

Results

Table 3 shows the mean viewing time for the final displays of sentences in the two main conditions. (Reading times for the first two displays were not recorded in this study.)

A simple ANOVA, with experimental condition as a fixed effect, and subjects as a random effect, showed that the critical display took significantly longer to read in the context of sentences including a possessive phrase than in the context of the simpler control form (F1 (1.23) = 24.34, p < .001). This effect was also significant on a materials analysis (F2 (1.23) = 20.68, p < .001) yielding a significant MinF value (MinF (1.46) = 11.2, p < .005).

Discussion

The results imply that on at least a proportion of occasions the ambiguous clause in Display 2 is initially attached to the “wrong” noun (i.e., “book” rather than to “girl” in Example 2 above). This causes the final display to appear anomalous, and the subjects then presumably spend time modifying the earlier attachment so that they can go on to make sense of the entire sentence. In the control condition there is no scope for this kind of misinterpretation and therefore no reason to revise the initial decision about attachment. The processing time for the final display is therefore considerably faster than that in the previous type of sentence structure. If this interpretation of the data is correct, then the results suggest that the preferences shown in Experiment 1 are put into effect almost immediately and certainly well before the end of the sentence. In other words the results suggest that subjects tend to close the first clause comparatively early (i.e., after “girl” in Example 2) and that they go on to attach the following relative clause to the earlier
NP ("the book"). Clearly they were not using a Late Closure strategy, since this would have led them to leave the first clause open after the later NP, attaching the relative clause directly to this. It should be noted that the latency data cannot be used to establish that the subjects always avoided the Late Closure strategy, since the average reading time for the final display could be raised significantly on both $F_1$ and $F_2$ even if appropriate choices were made on some occasions. However, it seems clear that there has been a notable departure from the Late Closure strategy in this case.

**Experiment 3**

Unfortunately, there is an alternative to the interpretation we have just given for the results of Experiment 2. Up to now we have assumed that the reading time for the final display in the experimental condition is longer because some or all of the subjects made the "wrong" attachment of the relative clause in this condition. However, it is conceivable that readers responded less rapidly in this condition simply because the experimental sentences were longer than the control sentences. In an earlier study, Mitchell and Green (1978, p. 625) found that there was a significant correlation between sentence length and the reading time for the final frame, and although the magnitude of this effect (8.68 ms per display or about 3 ms per word) suggests that it is almost certainly too small to have played a major part in the present study, it does raise some doubts about our interpretation of the results of Experiment 2.

The experiment was therefore repeated with an extra control condition in which the Spanish "de" (for "of") was replaced by "y" ("and"), yielding sentences such as (4a) (or its literal translation – 4b).

(4a) Pedro miraba el libro y la chica / que estaba en el salon / viendo la tele.
(4b) Peter was looking at the book and the girl / who—that was in the living room / watching TV.

Control sentences of this kind are clearly no shorter than the experimental sentences. It follows that if there is a reliable difference between the experimental condition and this new control condition, then the result cannot be attributed to changes in the length of the sentence.

The current experiment also provided an opportunity for us to examine another issue. In Experiment 1A, although the majority of subjects made judgements reflecting a preference for Early Closure, a substantial minority (almost a third) responded in the other way. Up to now it has not been possible to say whether these decisions represent decisive choices one way or the other or whether individual subjects experience a degree of conflict as they weigh up the claims of the competing points of attachment, as in Competition theory (e.g., MacWhinney et al., 1984). If subjects were following strategies which directed them unambiguously to a single interpretation in each case (albeit, perhaps, a different interpretation for different subjects or different sentences) – then, following arguments set out by Frazier and Rayner (1982, p. 200), the reading time for the ambiguous segment in the experimental condition should be equivalent to that for the same material (now unambiguous) in the two control conditions. On the other hand, if both alternatives are regularly considered from trial to trial and if subjects spend time deciding between attachments in active competition, then the reading time for the ambiguous segment should be longer than that in the two control conditions. In addition, given that there are more potential points of attachment, viewing time for the second display should be longer in the long control condition than in the short control condition.

**Method**

**Materials**

There were 30 basic sentences. Of these 15 were taken from Experiment 2, while the rest were prepared specially for the current study. (Nine of the earlier sentences were not used because they did not read well in the new control condition.) There were three forms of each sentence: the experimental and control versions from the preceding experiment, and a new control condition with the two critical nouns linked by the word "y" ("and") rather than "de" ("of"). To distinguish between the two control conditions from now on, we will refer to them as the short control and long control conditions, respectively. A full list of the materials with details of segmentation and literal English translations is given in Appendix 2.

In addition to the test sentences there were 40 filler sentences. Other aspects of the design and presentation were comparable with those used in Experiment 2. There were 10 internally randomised blocks, each comprising 1 experimental sentence, 1 short control, 1 long control and 4 fillers, and a comprehension question was displayed at the end of each block. All other experimental details were the same as those in Experiment 2.

**Procedure**

The procedure was exactly the same as that used for Experiment 2.

**Subjects**

The subjects were 15 male and 15 female students from the University of Oviedo. None had participated in either of the preceding experiments.
Table 4. Mean reading time (in milliseconds) for each of the three displays of sentences in Experiment 3. Times are given separately for the experimental condition, the short control condition and the long control condition

<table>
<thead>
<tr>
<th></th>
<th>Experimental</th>
<th>Short control</th>
<th>Long control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display 1</td>
<td>2623</td>
<td>2012</td>
<td>2874</td>
</tr>
<tr>
<td>Display 2</td>
<td>1567</td>
<td>1604</td>
<td>1595</td>
</tr>
<tr>
<td>Display 3</td>
<td>1701</td>
<td>1472</td>
<td>1456</td>
</tr>
</tbody>
</table>

Results and discussion

Table 4 shows the mean viewing time for each of the displays in each of the three viewing conditions.

Comparisons between the reading times for successive displays is not particularly informative because no attempt was made to equate the amount or complexity of material in the three displays. However, planned contrasts on the data for Display 1 revealed, as might be expected, that this frame was read more rapidly in the short control condition than in the other two conditions (MinF' (1,58) = 50.6, p < .001). An unexpected finding, however, was that the viewing time for the long control condition was somewhat longer than that for the control condition (MinF' (1,35) = 4.53, p < .05). Since the materials were equated for length, this suggests that the first clause in the long control condition may have been slightly illicitious. Fortunately this difference does not seriously undermine the logic of the experiment because if the new (long control) condition is too awkward, then the most likely consequence is that the viewing times for subsequent displays will tend to be slightly inflated. If the reading time for the final display in the experimental condition is longer than the (potentially) inflated value in this long control condition, then we can certainly be confident that it would also exceed any “cleaner” control which we might put in its place. In fact the difference was 245 ms in the expected direction and a pairwise comparison confirmed that this was highly significant (MinF' (1,49) = 7.62, p < .01). This confirms that the result of Experiment 2, replicated here in the comparison between reading times in the experimental and short control conditions (MinF' (1,41) = 16.10, p < .01), cannot simply be attributed to the fact that the short control condition was an inappropriate control.

Finally, turning to the viewing times for the second displays, there was no statistical difference at all between the three conditions ($F_1, F_2 < 1$, for all pairwise comparisons). If anything, the viewing time for the ambiguous condition in the experimental condition (1,567 ms) was marginally shorter than that in the two control conditions where the material was unambiguous (1,604 and 1,595 ms, respectively). Certainly, there was no evidence that subjects were vacillating between alternative interpretations in the ambiguous segment, and no support, therefore, for the MacWhinney-Bates Competition model.

Experiment 4

The previous experiment goes some way towards ruling out the suggestion that final displays of experimental sentences took longer to process simply because they were preceded by more words than those in the control condition. However, two new problems were introduced by this study. First, readers apparently found that there was something odd about the long control sentences and it could be argued that this questions the value of using performance with these sentences as a baseline. Second, while the experimental and long control sentences were matched precisely in terms of numbers of words preceding the test phrase, they were not matched in other respects which could potentially be just as important. Most obviously, the test phrase was preceded by two modifying constituents (“of the girl” and “who—that was in the living room”) in the experimental condition and by just one in the long control condition (“who—that was in the living room”). It is therefore conceivable that the results of Experiments 2 and 3 can be attributed to differences in preceding sentence structure rather than to Spanish readers’ on-line use of Early Closure strategies.

The experiment was therefore repeated with a new control condition with exactly the same structure (and length) as the experimental condition. The experimental sentences were identical in form to those used in the previous studies (see Example 5a and its literal translation 5b).

(5a) Alguien disparó contra el criado de la actriz / que estaba en el balcón / con su marido.

(5b) Someone shot the (male) servant of the actress / who was on the balcony / with her husband.

In this case the final phrase should be easy to process whenever the reader attaches the relative clause to “actriz” (Late Closure) but, because of the

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Footnote: We acknowledge the contribution of one of the referees in raising this objection and suggesting the current experiment.
gender mismatch, it should be difficult to handle whenever the initial attachment is to “criado” (Early Closure). In the new control condition “el criado” is replaced by “la criada” (“[female] servant”) which leaves the structure unchanged but should remove all attachment difficulties, since the final phrase reads equally well whichever attachment the subject chooses to make in the earlier part of the sentence. The reading time for the last display thus provides a measure of the time taken to read the test phrase and to establish its anaphoric links with the prior material without including the time to deal with mismatches and modify inappropriate attachments made earlier in the sentence. If Spanish readers do genuinely make on-line use of Early Closure strategies, then their reading times for the final displays should be longer in the experimental condition than in the control condition. Unlike the earlier studies, there is no way in which an effect of this kind could readily be attributed to factors other than Spanish readers’ tendency to use an Early Closure strategy in immediate sentence processing.

Method

Materials
There were 24 experimental sentences, 19 of which were based on materials used in Experiment 2. The control sentences were constructed by replacing the first noun by one which was an acceptable head for the relative clause (including the final display). Details of the materials are given in Appendix 3. All other aspects of the design were the same as those described in Experiment 2.

Procedure
This was identical to that used in the preceding experiments.

Subjects
Fifteen male and fifteen female students from the University of Oviedo, none of whom had participated in any of the earlier experiments.

Results and discussion
Table 5 shows the mean viewing time for each of the displays in the experimental and control conditions.

<table>
<thead>
<tr>
<th>Display</th>
<th>Experimental</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>Display 1</td>
<td>2526</td>
<td>2561</td>
</tr>
<tr>
<td>Display 2</td>
<td>1552</td>
<td>1530</td>
</tr>
<tr>
<td>Display 3</td>
<td>1689</td>
<td>1480</td>
</tr>
</tbody>
</table>

not at all surprising given that the different displays differed markedly in length. More crucially, the total reading time in the experimental condition was longer than that in the control condition ($F_1 (1,23) = 4.95, p < .05; F_2 = 22.35 (1,29), p < .001; MinF' (1,33) = 4.05, .05 < p < .1$) and this effect interacted with display ($MinF' (2,81) = 5.67, p < .01$). This interaction was submitted to more detailed analysis by carrying out simple pairwise comparisons between experimental and control data for each of the displays individually. As expected, there were no differences in the first two displays ($F_1, F_2 < 1$, in both cases), whereas in the final display the mean reading time was significantly longer in the experimental condition than in the control condition ($MinF' (1,34) = 11.95, p < .005$). In other words, the results confirm once more that Spanish readers face particular difficulties when they come to the final (disambiguating) phrases of sentences that require Late Closure attachment of the relative clause. In the present study this effect has been demonstrated when the reading times are compared with those for control sentences which are matched for number of preceding modifying clauses and for word length. At this stage there finally seems to be no alternative to interpreting the result as evidence that Spanish readers’ preferences for Early Closure (shown in Experiment 1A) are implemented immediately during the first pass through the sentence and that the earlier results are not simply a consequence of reinterpreting sentences after they have initially been parsed.

General discussion
Taken together, the five experiments provide clear evidence that the Late Closure strategy is not entirely general. In Experiment 1A a majority of Spanish subjects interpreted ambiguous sentences in a manner that was compatible with the use of an Early rather than a Late Closure strategy. By demonstrating that English readers show the more conventional bias in favour
of Late Closure, Experiment 1B confirmed that this preference represents a cross-linguistic difference. Experiments 2, 3 and 4 provided evidence that these decisions are made while people are still in the process of reading the sentence. In these studies, we measured the reading times for phrases and clauses that would have been easy to interpret if subjects had applied the Late Closure strategy, but difficult to process if they stuck to Early Closure. The results showed that the viewing times for these displays were significantly longer than those for non-ambiguous control displays, and this was true even when the (long) control and experimental conditions were matched for length in Experiment 3, and for length and number of modifying constituents in Experiment 4. It seems clear that this processing difficulty must have occurred because the final display in the experimental condition appeared to be anomalous following the Early Closure decisions (some of) the subjects made earlier in the sentence.

What are the implications of this demonstration that the Late Closure strategy is not entirely general? The most obvious is that it questions Frazier’s (1987) suggestion that Late Closure is a process-generated or principled strategy. If the Late Closure strategy had come to predominate because it systematically confers processing advantages upon the reader, then these benefits should have been just as influential here as they are elsewhere. The fact that Late Closure does not appear to take precedence in Spanish for certain clauses following the possessive phrase suggests that the supposed computational considerations did not prevail here and it follows that these factors may not have been responsible for the pre-eminence of this strategy elsewhere. It is possible, then, that the two closure strategies are essentially arbitrary and that at some point in the evolution of the language there was effectively an accidental choice as to which strategy would take precedence in different circumstances.

However, we should stress that such a conclusion is by no means forced by the data: It is merely the most immediate interpretation of the present results. In fact, there are good reasons for arguing that it would be premature to reject the hypothesis that Late Closure is a “process-generated” strategy.

The most important reason is that it remains possible that the Early Closure preference shown here is the exception rather than the rule – even for Spanish readers. Indeed, after we had completed the experiments it occurred to us that we had inadvertently relied on the use of the Late Closure strategy in designing the materials for the on-line studies. The underlying rationale of these experiments was that the final phrase or clause of each sentence (e.g., “watching TV” in Example 2 in the Introduction to Experiment 2) should have been easy to process if subjects had used the Late Closure strategy to handle the preceding (ambiguous) display but difficult to process if they had not. However, it is clear that this prediction only follows if the final display is itself attached to material in the second display (i.e., using Late Closure). If the relative clause had been closed early, forcing the final display to be attached at some higher point in the sentence (e.g., to the word “girl” in Example 2), then there would not necessarily have been any processing difficulty in this condition. In other words, the results suggest that while Early Closure was apparently used for the possessive construction, Late Closure must have been used in attaching the final adverbial clause to the relative clause. This raises questions about the prevalence of Early and Late Closure strategies in Spanish. If it is actually true that Late Closure is widely used, then it would not be advisable to use a single counterexample to argue against the proposal that Late Closure is “process-generated.”

If we opt to retain this hypothesis for the time being, however, we are left with several problems. First, we have to explain why the general rule is overturned in the particular structures examined here. The only plausible suggestion seems to be that some new strategy is brought into play in these special circumstances and that this “local” or “specialised” strategy is strong enough to override the general bias in favour of Late Closure. This proposal is not without its problems, because one the present studies (Experiment 3) failed to provide any support for “competitive” parsing of the kind proposed by MacWhinney and Bates.

The next question is: Why should this putative “local” strategy be more influential in Spanish than it is in English? The answer to this is not self-evident, since a quick examination of the materials in the Appendices reveals that many of the sentences are equivalent in the sense that they read perfectly well as word-for-word translations in the two languages. It is difficult to see how any general information processing consideration could result in the emergence of a robust strategy for dealing with such sentences in one language while no comparable mechanism develops in the other.

At this point we are only able to speculate about the cause of this cross-linguistic difference. Our suggestion is based on a rather obvious grammatical difference between the two languages – namely that Spanish adjectives follow the noun, whereas in English they precede it. This means that sequences of the form (...N – adj – RC...) are quite common in Spanish while they never occur in English. In structures like this the attachment of the RC is unambiguous, and there might well be a “local” strategy which specialises in establishing the obligatory RC/N connection. Suppose this putative strategy evolved in such a way that it came to be generalised to a slightly wider class of structures – those of the form: (...N – [modifying constituent] – RC...). Now, this more general strategy would still produce the correct answer when the middle constituent is an adjective. However, it would also cause the reader to attach the RC to the first N when this constituent contains a noun phrase (as in the possessive phrase). Following this line of reasoning, the Spanish results can
be explained if it is assumed that the specialised strategy is triggered by the
structural sequence – (...N – [modifying constituent] – RC...). Application
of the strategy results in the proposal to attach the RC to the first noun. This
takes precedence over the more general Late Closure strategy, thus account-
ning for the departures from Late Closure reported in this study. To complete
the account we only have to assume that no English equivalent of the local
strategy ever evolved – perhaps because there is no need for such a strategy
in a language where there are no (...N – adj – RC...) sequences with obliga-
tory links between the N and the RC.

We do not claim any secure status for this proposal. It is a speculative
suggestion developed to provide a post hoc account of a single reversal of
Late Closure and at this stage it has not been substantiated or checked in any
other context.² However, it does have the merit that it allows us to retain the
hypothesis that the more general Late Closure strategy is “principled” or
“process-generated.”

Which is the more appropriate interpretation of the data? Is Late Closure
more likely to be an arbitrary or a process-generated strategy? As we have
seen, the experimental data are not decisive enough to discriminate between
the two proposals at present. The first conclusion is obviously simpler and
more direct in that it depends on fewer ancillary assumptions. However, this
conclusion is unappealing. If the strategies employed by different linguistic
communities are merely derived from arbitrary conventions, then the cross-
linguistic study of parsing can aspire to little more than creating a taxonomy
of mechanisms used for decoding syntactic information in different languages.
There would be no cause to search for overarching principles or parsing
universals of any kind.

The second proposal is much less direct in its relation to the data. It can
only be sustained by making a string of additional assumptions. However, if
Late Closure and other strategies are process-generated, then this opens the
way for investigators to tackle a much more interesting set of questions. We
can ask how parsing tactics are constrained by the computational limitations
of the processor (i.e., the listener or reader). How are they tied to the com-
putational task in hand? Do they differ in systematic ways when the grammar
calls for gender, case or register matching, when the language is highly in-
flected or virtually uninflected, and so on. Answers to questions of this kind
would provide a secure basis for developing a general theory of parsing.

²It is perhaps worth noting that this proposal receives a degree of support from French preference data
collected very recently by Daniel Zagar (personal communication). In a study similar to Experiments 1A and
1B, almost 96% of classifiable responses favoured Early Closure. This finding is more in line with that for
Spanish readers than for English readers, as would be expected in the light of the fact that the majority of
French adjectives follow the noun.

Whichever view proves to be correct, it seems likely that future progress
will come to depend increasingly upon research on parsing in languages other
than English. While most current work is highly anglocentric, there are en-
couraging signs that psycholinguistic techniques are beginning to be applied
to the study of parsing in some of the other 5,000 odd languages, and this
may eventually provide the basis for a more general account of syntactic
processing in humans.

Appendix 1
A full list of the Spanish test sentences used in Experiment 2 (labelled S1
– S24) and their literal English translations (E1 – E24). The oblique lines (/ )
mark the ends of displays and the phrases in brackets indicate the words that
were excluded from the sentence in the control condition. Note that “que”
in Spanish can either be translated as “who” or “that” and that in the control
sentences the obligatory contracted forms “del” and “al” were used instead
of “de el” and “a el”, respectively, in the reduced sentence. Also in some
of the literal translations the gender of nouns is marked if this is evident in
the Spanish version of the sentence. With the exception of items marked (* )
all of the sentences were also used in Experiment 1 – unsegmented and with
final display removed. The last section of the Appendix lists the four addi-
tional sentences that were used in Experiment 1 but not in Experiment 2.

(S1) Pedro miraba (el libro de) la chica / que estaba en el salón / viendo
la tele.

(E1) Peter was looking at (the book of) the girl / who–that was in the
living-room / watching TV.

(S2) Alguien disparó contra (el criado de) la actriz / que estaba en el
balcón / con su marido.

(E2) Someone shot (the servant [m] of) the actress / who was on the bal-
cóny / with her husband.

(S3) Juan conoció a (el amigo de) la maestra / que estuvo en Alemania /
cus estudiantes.

(E3) John met the (friend [m] of) the teacher [f] / who was in Germany /
with her students.

(S4) Un ladrón espiaba (la maleta de) el turista / que estaba junto al buzón /
echando una carta.

(E4) A thief was keeping an eye on (the case of) the tourist / who–that
was by the mail-box / posting a letter.

(S5) El turista fotografía (el mulo de) el campesino / que estaba junto a
la charca / regando las lechugas.
The tourist photographed (the mule of) the peasant / who—that was by the puddle / watering the lettuce.

La policía detuvo a (la hermana de) el portero / que estuvo en Melilla / haciendo la mili.

The police arrested (the sister of) the porter / who was in Melilla / serving in the army.

La enfermera apartó (el jarabe de) el paciente / que estaba junto a la ventana / tomando el sol.

The nurse took (the syrup of) the patient [m] / who—that was by the window / sunning himself.

Un alumno apedreó a (la amiga de) el profesor / que estuvo en el colegio / como director técnico.

A student stared at (the friend [f] of) the teacher [m] / who was at the school / as technical director [m].

Mi padre visitó (las casetas de) los soldados / que están junto al río / construyendo un puente.

My father visited (the quarters of) the soldiers / who—that are by the river / building a bridge.

Amelia se escribe con (el primo de) el cantante / que estuvo en la iglesia / dando un concierto.

Amelia exchanges letters with (the cousin of) the singer / who was in the church / performing a concert.

El alguacil encerró al (caballo del) gitano / que estaba junto al puente / haciendo una hoguera.

The bailiff locked up (the horse of) the gipsy / who—that was by the bridge / lighting a fire.

La anciana observaba (el juguete de) el bebé / que estaba encima de la cama / durmiendo la siesta.

The old lady was observing (the toy of) the baby / who—that was on the bed / having a snooze.

El periodista entrevistó a (la hija de) el coronel / que tuvo el accidente / con sus soldados.

The journalist interviewed (the daughter of) the colonel / who had the accident / with his soldiers.

El campesino contemplaba (el equipaje de) el vagabundo / que estaba bajo un árbol / tocando la guitarra.

The peasant was gazing at (the luggage of) the wanderer / who—that was under a tree / playing the guitar.

La gente observaba (la caja de) el soldado / que estaba en el andén / esperando el tren.

The people watched (the box of) the soldier / who—that was on the platform / waiting for the train.

Luis atropelló a (el perro de) el frutero / que viene a este barrio / a vender naranjas.

Lewis ran over (the dog of) the fruiterer / who—that comes to this district / to sell oranges.

Andrés cenó ayer con (la sobrina de) el conserje / que está en partido comunista / de secretario provincial.

Andrew had dinner with (the niece of) the porter [m] / who belonged to the communist party / as county secretary [m].

Jorge acariciaba a (el gato de) la francésa / que estaba en la fuente / lavando la ropa.

George was stroking (the cat of) the French girl / who—that was at the fountain / washing the clothes.

Marta saludó al (hermano del) cura / que estuvo en el colegio / dando una misa.

Martha cheered (the brother of) the priest / who was in the school / celebrating mass.

El detective fotografió (la maleta de) el estudiante / que estaba en la terraza / comiendo una manzana.

The detective photographed (the suitcase of) the student / who—that was on the terrace / eating an apple.

María discutió con (la prima de) el lechero / que estuvo en Argentina / cuando era soltero.

Mary argued with (the cousin [f] of) the milkman / who had been to Argentina / when he was single.

Los chicos se burlaron de (la sobrina de) el maestro / que estaba en el parque / con su esposa.

The boys poked fun at (the niece of) the teacher [m] / who was in the park / with his wife.

El loco golpeó al (perro del) vecino / que estaba en el jardín / cortando el césped.

The crazy man hit (the dog of) the neighbour / who—that was in the garden / mowing the lawn.

Esta tarde he visto al (hijo del) doctor / que estuvo en nuestra casa / curando al abuelo.

This afternoon I saw (the son of) the doctor / who was at our home / treating grandfather.
Sentences used in Experiment 1 (Replacing those marked * above)

(S8') Andrés estuvo hablando con la sobrina de la limpiadora que estuvo en Brasil.
(E8') Andrew was speaking with the niece of the cleaner who was in Brazil.
(S9') La sirvienta contemplaba el zapato de la invitada que estaba junto a la chimenea.
(E9') The servant contemplated the shoe of the guest who—that was close to the fireplace.
(S10') Ayer me encontré con la amiga del concejal que estuvo en Australia.
(E10') Yesterday I met with the girlfriend of the town councillor who was in Australia.
(S23') Mi madre discutió con la sirvienta del duque que marchó de casa.
(E23') My mother argued with the maid of the duchess who left the house.

Appendix 2

Sentences used in Experiment 3. With the exception of items marked (*), all of the sentences were also used in Experiment 2.

For details of conventions employed, see initial paragraph of Appendix 1.

(S1) Pedro miraba (el libro de /y) la chica / que estaba en el salón / viendo la tele.
(E1) Peter was looking at (the book of / and) the girl / who—that was in the living-room / watching TV.
(S2) Alguien disparó contra (el criado de) la actriz / que estaba en el balcón / con su marido.
(E2) Someone shot (the servant [m] of) the actress / who was on the balcony / with her husband.
*(S3) El conserje alejó (los balones de) los chicos / que estaban en el patio / jugando al fútbol.
(E3) The caretaker drove away (the footballs of) the boys / who—that were in the yard / playing football.
(S4) Un ladrón espiaba (la maleta de) el turista / que estaba junto al buzón / echando una carta.
(E4) A thief was keeping an eye on (the case of) the tourist / who—that was by the mailbox / posting a letter.
(S5) El turista fotografió (el mulo de) el campesino / que estaba junto a la charca / regando las lechugas.

(E5) The tourist photographed (the mule of) the peasant / who—that was by the puddle / watering the lettuce.
*(S6) La policía detuvo a (la criada de) el marqués / que estuvo en Argelia / con su esposa.
(E6) The police arrested (the maiden of) the marquis / who was in Argelia / with his wife.
(S7) La enfermera apartó (el jarabe de) el paciente / que estaba junto a la ventana / tomando el sol.
(E7) The nurse took (the syrup of) the patient [m] / who—that was by the window / sunning himself.
*(S8) Un alumno apedreó a (la secretaria de) el profesor / que estuvo en el colegio / como director técnico.
(E8) A student stared at (the secretary [f] of) the teacher [m] / who was at the school / as technical director [m].
(S9) Mi padre visitó (las casetas de) los soldados / que están junto al río / construyendo un puente.
(E9) My father visited (the quarters of) the soldiers / who—that are by the river / building a bridge.
*(S10) El camión atropelló (la bicicleta de) el policía / que estaba junto al semáforo / dirigiendo el tráfico.
(E10) The lorry ran over (the bicycle of) the policeman / who—that was by the traffic-light / directing the traffic.
(S11) El alguacil encerró al (caballo del) gitano / que estaba junto al puente / haciendo una hoguera.
(E11) The bailiff locked up (the horse of) the gypsy / who—that was by the bridge / lighting a fire.
(S12) La anciana observaba (el juguete de) el bebé / que estaba encima de la cama / durmiendo la siesta.
(E12) The old lady was observing (the toy of) the baby / who—that was on the bed / having a snooze.
*(S13) El periodista entrevistó a (el chofer de) la alcaldesa / que tuvo el accidente / con su marido.
(E13) The journalist interviewed (the chauffeur of) the mayor / who had had an accident / with her husband.
(S14) El campesino contemplaba (el equipaje de) el vagabundo / que estaba bajo un árbol / tocando la guitarra.
(E14) The peasant was gazing at (the luggage of) the wanderer / who—that was under a tree / playing the guitar.
(S15) La gente observaba (la caja de) el soldado / que estaba en el andén / esperando el tren.
(E15) The people watched (the box of) the soldier / who—that was on the platform / waiting for the train.

*(S16) Luis atropelló a (el carro de) el frutero / que estaba delante del ayuntamiento / con sus amigos.

(E16) Lewis ran over (the carriage of) the fruit seller / who—that was in front of the Town Hall / with his friends.

*(S17) Esta tarde he visto a (la enfermera de) el doctor / que estuvo en nuestra casa / con su esposa.

(E17) This afternoon I have seen (the nurse of) the doctor / who was at home / with his wife.

(S18) Jorge apedreó a (el gato de) la francesa / que estaba en la fuente / lavando la ropa.

(E18) George was stroking (the cat of) the French girl / who—that was at the fountain / washing the clothes.

*(S19) El viento empujó (la lona de) el marinero / que estaba en la arena / preparando las redes.

(E19) The wind blew (the canvas of) the sailor / who—that was on the sand / preparing the fishing net.

*(S20) La cruz roja recogió (las maletas de) los refugiados / que estaban en el puerto / esperando la comida.

(E20) The Red Cross took (the luggage of) the refugees / who—that were in the harbour / waiting for the food.

*(S21) La explosión alcanzó a (el coche de) el maestro / que estaba en el parque / con su esposa.

(E21) The explosion reached (the car of) the teacher / who was in the park / with his wife.

*(S22) Los chicos se burlaban de (el burro de) el lechero / que estaba en la plaza / vendiendo el queso.

(E22) The children were poking fun at (the donkey of) the milkman / who—that was in the market / selling cheese.

*(S23) El paciente ensangrentó a (el cuaderno de) el doctor / que estaba junto a la cama / tomándole la fiebre.

(E23) The patient stained with blood (the notebook of) the doctor / who—that was by the bed / testing his temperature.

*(S24) El reportero hizo una película de (las armas de) los rebeldes / que estaban detrás de una colina / preparando el ataque.

(E24) The reporter filmed (the arms of) the rebels / who—that were behind the hill / preparing for the attack.

*(S25) La lluvia mojó (la hamaca de) el cura / que estaba en la terraza / lavando la ropa.

(E25) The rain wet (the hammock of) the priest / who—that was on the terrace / washing the clothes.

*(S26) La sirvienta contemplaba (el vestuario de) la condesa / que estaba en el dormitorio / cambiándose de ropa.

(E26) The maid was having a look at (the wardrobe of) the countess / who—that was in the bedroom / changing clothes.

*(S27) El perro ladraba a (el balón de) el chico / que estaba detrás del granero / cuidando las vacas.

(E27) The dog barked at (the football of) the boy / who—that was behind the granary / looking after the cows.

*(S28) Alvaro espiaba a (el perro de) el granjero / que estaba por la finca / recogiendo la fruta.

(E28) Alvaro was spying on (the dog of) the farmer / who—that was in the farm / picking fruit.

(S29) El detective fotografió (la maleta de) el estudiante / que estaba en la terraza / comiendo una manzana.

(E29) The detective photographed (the suitcase of) the student / who—that was on the terrace / eating an apple.

(S30) El loco golpeó al (perro del) vecino / que estaba en el jardín / cortando el cesped.

(E30) The crazy man hit (the dog of) the neighbour / who—that was in the garden / mowing the lawn.

Appendix 3

Sentences used in Experiment 3. With the exception of items marked (*) all of the sentences (with some minor changes) were also used in Experiment 2.

For details of conventions employed, see initial paragraph of Appendix 1.

(S1) Pedro se divertía con (el libro) (el hermano de) la chica / que estaba en el salón / viendo la tele.

(E1) Peter had a good time with (the book) (the brother of) the girl / who—that was in the living-room / watching TV.

(S2) Alguien disparó contra (el criado) (la criada) de la actriz / que estaba en el balcón / con su marido.

(E2) Someone shot (the male servant) (the female servant) of the actress / who was on the balcony / with her husband.

*(S3) La cruz roja cuidó de (los equipajes) (los hijos) de los refugiados / que estaban en el puerto / esperando la comida.
(E23) The crazy man hit (the dog) (the uncle) of the neighbour / who—that was in the garden / mowing the lawn.

*S24) La explosión alcanzó (al coche) (al ayudante) del comisario / que estaba junto al almácén / con sus hijos.

*(E24) The explosion reached (the car) (the assistant) of the superintendent / who—that was close to the store / with his children.

References


Résumé

Deux études de questionnaire et trois expériences on line ont été conduites afin de déterminer si une stratégie d'analyse syntaxique très largement utilisée en anglais – la stratégie de Cloture Tardive – est simplement une procédure arbitrairement choisie ou si elle est devenue un trait relativement stable de l'analyse syntaxique parce qu'elle facilite réellement le traitement de l'information auquel doit se livrer le lecteur ou l'auditeur. L'expérience 1A a montré que des lecteurs espagnols n'utilisent apparemment pas la stratégie de Cloture Tardive pour interpréter un type particulier de phrase. En revanche, dans une situation comparable, des lecteurs anglais utilisent cette stratégie (expérience 1B). Les expériences 2, 3 et 4 ont montré que les choix structuraux sont faits pendant la lecture même de la phrase. Les résultats obtenus militent contre l'idée que la Cloture Tardive est privilégiée (en anglais) à cause de ses avantages pour le traitement de l'information. Il se peut que le choix qui est fait de différentes stratégies d'analyse dans différentes langues soit essentiellement arbitraire. On discute les implications de cette thèse pour les théories générales de l'analyse syntaxique.