The processing of French relative clauses: effect of semantics and the morphological cue
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Introduction

Relative clause (RC) processing studies have seen the development of extensive research (Caplan, & Waters, 1999; Gibson, 1998; King, & Just, 1991). According to the DLT (Gibson, 1998, 2000) two processing costs, the memory and the integration costs, tax the reader's working memory. These costs can be calculated for each word, the highest being found on verbs. The difference between Subject and Object RC is located on the RC verb. The integration cost is characterized by a P600 and the memory cost by a LAN (Kaan, et al., 2000; Fiebach, Schriefers, & Friederici, 2002; Phillips, & et al., 2001).

A factor may also influence the relative difficulty of RC processing. Unlike the English complementation that which is ambiguous, some languages like German and French have a morphological cue that indicates the type of the RC. Consequently, the reader is able to anticipate the role of the filler in the RC: Unfortunately, no evidence was found yet (Fiebach, et al., 2002).

However, language processing relies also on semantic information. Usually, semantic role assignment is assumed to take place on the verb, but Weckery and Kutas (1999) demonstrated that the role assignment is made on the subject of an Object RC, that is, before the processing of the RC verb. The aim of this work is to test the effect of the morphological and a semantic cue (congruency) on the processing French Subject and Object RCs. The following ERP responses are expected:

(1) Subject, Congruent: Le policier qui arrête l’assassin arrive la déposition.
(2) Subject, Incongruent: L’assassin qui est arrêté par le policier arrive la déposition.
(3) Object, Congruent: Le policier qui arrête l’assassin arrive la déposition.
(4) Object, Incongruent: Le policier qui arrête l’assassin arrive la déposition.

Method

Participants

12 native speakers of French, right handed (4 female), mean age = 22.9.

Materials

120 experimental sentences were built according to a 2 x 2 design (Syntax x Semantics):

1. Subject Congruent: Le policier qui arrête l’assassin arrive la déposition.
2. Subject Incongruent: L’assassin qui est arrêté par le policier arrive la déposition.
3. Object Congruent: Le policier qui arrête l’assassin arrive la déposition.

Procedure

• Word by word presentation with a moving window paradigm
• 400ms/word, 400ms (blank)
• Each sentence was followed by a comprehension question

ERP recording & data analysis

• 65 Ag/AgCl electrodes mounted on a geodesic net
• EEG and EOG were continuously recorded and segmented 100ms before and 1000ms after word onset
• 7 spatial domain (cf. Fig. 1)
• 2 time windows: 300-500ms, 500-1000ms

Results

Object RCs are more difficult than Subject RCs, leading to longer response times. No effect of Semantics was observed.

Electrophysiological results

• Effects of sentence type
  - Complementizer, LAN: the amplitude of the LAN is larger for Object RCs in the left anterior domain.
  - Main clause verb, LAN: the amplitude of the LAN is larger for Object RCs in the anterior domain.
  - Main clause verb, P600: the amplitude of the posterior P600 is equally large, either for Object and Subject RCs.

Table 1: Mean number of errors (%)

<table>
<thead>
<tr>
<th>Subject Congruent</th>
<th>Object Congruent</th>
<th>Subject Incongruent</th>
<th>Object Incongruent</th>
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</thead>
<tbody>
<tr>
<td>Subject Congruent</td>
<td>Object Congruent</td>
<td>Subject Incongruent</td>
<td>Object Incongruent</td>
</tr>
<tr>
<td>1.59 (5.9)</td>
<td>3.34 (2.2)</td>
<td>3.58 (2.3)</td>
<td>4.00 (1.7)</td>
</tr>
</tbody>
</table>

Discussion

Where the error rate is not sensitive enough to capture an effect of Semantics or a Syntax x Semantics interaction, the ERP data are. If the results observed on Object RCs confirm those from Weckery and Kutas (1999), the Subject RC condition allows us to add further implications of Semantics in the syntactic processing; considering a semantically used Subject Verb/Object triplet, the semantic role assignment takes place when reading the second constituent (the verb in Subject RCs, the subject in Object RCs). This demonstration that readers attempt to anticipate the semantic roles even before reading the verb.

These data also add further support for the DLT (Gibson, 1998, 2000; Kan, et al., 2000) a high integration cost exhibits a P600 while the memory cost exhibits a LAN, the two being located on the verb.

Finally, the data obtained on the complementizers demonstrates, for the first time to our knowledge, that a morphological cue leads to a processing difference. A cue introducing an Object RC, more difficult than a Subject RC, induces a larger LAN, suggesting that the syntactic role assignment takes place that early.

References
