DIFFERENTIAL RELATIVE CLAUSE PROCESSING IN TWO BILINGUAL GROUPS: AN ERP STUDY

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Previous psycholinguistic literature describes a well-documented, cross-linguistic processing asymmetry between subject relative clauses (SRC) as in (1), and object relative clauses (ORC) in (2). In both English and Spanish, ORCs have been found to be more difficult to process than SRCs (Betancort, Carreiras, & Sturt, 2009; Traxler, Morris, & Seely, 2002).

1. Jorge vio la película [que ___ || ganó el premio]  
   ‘Jorge saw the movie that won the prize.’

2. El periódico publicó la noticia [que el redactor || escribió ___]  
   ‘The newspaper published the news that the editor wrote.’

This asymmetry has both working memory and parsing explanations. ORCs create a greater working memory load by requiring that the relativized noun phrase be stored in memory for a longer time than in SRCs (e.g., Frazier & Fodor, 1978). In regard to parsing, the active filler hypothesis proposed by Clifion and Frazier (1989, et seq.) argues that the parser actively searches for a gap to associate the relativized noun to. In SRCs, the first parse fills the relativized noun into the gap following the complementizer and is valid. For ORCs in contrast, this first parse fails when the noun phrase in the subject position of the relative clause is encountered, requiring a reanalysis of syntactic structure.

In ERP studies of monolinguals, LAN and N400 components elicited by ORCs, compared to SRCs, have been argued to reflect greater working memory load (e.g., King & Kutas, 1995; Wang et al., 2015; Yang et al., 2010). Also, the syntactic reanalysis required by the initial failed parse of ORCs has been tied to observed P600 components (e.g., Mecklinger et al., 1995; Wang et al., 2015; Yang et al., 2010).

Our study asks how these monolingual findings extend to the L1 processing of two groups of fluent Spanish-English bilinguals who differ only in lifetime exposure to their first language: heritage speakers (n=18)—whose home language was Spanish but who were raised in the anglophone US—and first-generation bilinguals (n=20)—who moved to the anglophone US from a Spanish speaking country after age 18. Two conditions were auditorily presented in Spanish: subject relative clauses, as in (1), and object relative clauses, as in (2). All target conditions (n=30) were grammatical and were interspersed with grammatical and ungrammatical sentences (n=590) as part of a larger study. Single-trial epochs of EEG were time locked to the onset of the subordinate verb, as marked by “||” in (1-2).

A principal component analysis (PCA) was used to identify ERP components with distinct latency and spatial characteristics (Spencer et al., 2001, et seq.). ERP components were identified which were consistent with those previously discovered in the literature. In heritage speakers, ORCs elicited early negative deflections consistent with the N400. ORCs in late bilinguals caused an early, positive wave consistent with the P300 family. Additionally, a slow, late, positive-going wave consistent with the characteristics of a P600 was found for ORCs for the late bilinguals, but not for the heritage speakers. Heritage speakers further differed from late bilinguals by exhibiting a frontal P600 across conditions.

Our results indicate that both bilingual groups exhibit early, differential processing of ORCs compared to SRCs. This asymmetry may be attributed to an initial failed parse of ORCs and the increased memory demands of holding the relativized noun in memory. In contrast, only late bilinguals demonstrate a difference in later processing, with ORCs eliciting a P600, indicating syntactic reanalysis, i.e. a second parse. Heritage speakers did not show later, differential processing between the two relative clause types. Instead, both relative clauses in heritage speakers elicited a frontal P600 indicative of syntactic ambiguity resolution or complex syntactic integration difficulties (Friederici et al., 2002; Kaan & Swaab, 2003). This may indicate increased processing costs in heritage speakers across conditions.
Figure 1: Grand mean waveforms for subject-relatives (solid, blue line) and object-relatives (dashed, red line) by-electrode by-millisecond smoothed with a (100ms) filter.

References:


