Number attraction effects on object-clitic agreement in Spanish: Behavioral and ERP evidence

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Introduction: The number of a local noun included in a modifier to the subject head can interfere with the agreement process resulting in subject-verb number agreement “attraction errors” (Bock & Miller, 1991). Number attraction in subject-verb relations has been widely studied in language production (e.g., Franck, et al., 2006; Hartsuiker, et al., 2001) and comprehension (e.g., Nicol, Forster, & Veres, 1997; Pearlmuter, Garnsey, & Bock, 1999; Wagers, Lau, & Phillips, 2009). Bock, Eberhard, and Cutting (2004) revealed that similar number attraction effects occur in the production of subject-verb and antecedent-pronoun (subject) agreement relations. However, only two papers have explored the neurophysiological mechanisms underlying these effects in subject-verb agreement: Kaan (2002) observed a larger P600 component (i.e., difference wave between grammatical and ungrammatical conditions) in the number-match condition compared with the number-mismatch condition. In contrast, Severens, Jansma and Hartsuiker (2008) observed a P600 in the noun number-mismatch conditions (i.e., difference wave between grammatical and ungrammatical conditions) and a N400 in the noun number-match conditions (the P600 component is assumed to reflect repair or reanalysis processes after real or apparent syntactic violations, while the N400 component is assumed to reflect semantic incongruencies). However, no study has so far reported on object-clitic pronoun agreement attraction. We explored the electrophysiological responses of number attraction effects on object-clitic pronouns in Spanish.

Method: In a grammaticality judgment task, 46 native Spanish speakers were presented (word-by-word) with sentences containing a singular object-NP with a local noun that matched (la montaña) or mismatched (las montañas) in number with the head noun (la casa). Sentences were either grammatical or ungrammatical, depending on whether they contained an object-clitic pronoun that agreed or not in number with the preceding object-NP (e.g., La pastora dijo que la casa de la(s) montaña(s) la / *las visitó en invierno [The shepherdess said that the house in the mountain(s), she visited it / *them in winter]). ERPs (32 electrodes) and grammaticality judgment task responses were registered.

Results: Number attraction effects were found in both behavioral and electrophysiological data. In the grammaticality judgment task, participants were significantly slower (only for grammatical sentences) and less accurate (for both grammatical and ungrammatical sentences) in number mismatch than match conditions. More interestingly, at the critical word position (la vs. *las clitics; 'it' vs. 'them'), different ERP patterns related to grammaticality effects were reported for number match (a fronto-central N400 followed by a P600) and mismatch (only a P600 component) conditions (see Figure).

Conclusions: Our data suggest that the electrophysiological responses related to number attraction effects during the encoding of subject-verb and object-clitic pronoun agreement relations are similar: both types of relations reveal N400 and P600 components. Furthermore, the absence of N400 components in number mismatch conditions indicates that number attraction effects have a deep impact on early (considered automatic) stages of agreement computation, whereas later comprehension processes seem to remain unaffected.
References: