**ERP correlates of processing long-distance sig in Icelandic**

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**Introduction** In this study, we examine the neurophysiological correlates of processing the long-distance reflexive *sig* in Icelandic, which has both anaphoric and logophoric uses. We show that violations of both uses exhibit P600 effects. We argue that there are similar underlying processing mechanisms for those violations (phi-feature violation), which rebuts previous evidence that logophoric processing lacks ERP correlates (Harris et al. 2000).

**Background** Reinhart and Reuland (1991; 1993) proposed that the distribution of anaphoric reflexives is governed by a property called reflexivity, which demands that the arguments of a reflexive-marked predicate are co-indexed. A predicate is reflexive-marked if and only if either the predicate is intrinsically marked as reflexive on its theta grid or one of its arguments is a self-anaphor, such as *himself, themselves* in English. From this binding theory it follows that in the local domain self-anaphors are syntactically licensed, whereas logophors (anaphors which are neither reflexive-marked nor in a reflexive–marked predicate) are licensed pragmatically by the center of perspective. Harris et al. (2000) compare the syntactic licensing of anaphors (1a-b) with the pragmatic licensing of logophors (1c-d).

(1) a. The diver’s teammates congratulated themselves on the discovery
   b. The diver’s teammates congratulated himself on the discovery
   c. The diver’s teammates congratulated Rick and themselves on the discovery
   d. The diver’s teammates congratulated Rick and himself on the discovery

In (1a-b), the reflexive must be syntactically licensed by a c-commanding DP. This is not possible in (1b), as the phi-matching antecedent (diver) does not c-command the anaphor. In (1c-d), the reflexive must be pragmatically licensed by the center of perspective. In (1d), the phi-matching antecedent is not the center of perspective (teammates). (1b) elicits a P600 relative to (1a) but there is no such effect for (1d) relative to (1c). Harris et al. therefore argue that the P600 is associated with syntactic processing as opposed to pragmatic processing.

We test this in Icelandic, where the 3rd person reflexive *sig* (which is not a self-anaphor) is argued to have both anaphoric and logophoric long-distance uses (Thráinsson 1976), Maling (1984), and others). Anaphoric *sig* in infinitival long-distance contexts is sensitive to c-command relationships whereas logophoric *sig* in subjunctive long-distance contexts is sensitive to pragmatic requirements.

**Methods** Following the analysis in Sigurjónsdóttir (1992) and Reuland and Sigurjónsdóttir (1997), we compare syntactically licensed anaphoric *sig* (2) with pragmatically licensed logophoric *sig* (3). Anaphoric *sig* is licensed by the c-commanding matrix subject in (2a); logophoric *sig* is licensed by the center of perspective (experiencer subject) in (3a). In both cases *sig* matches phi-features with the antecedent. In (2b) and (3b), there is no phi-licit antecedent for the 3rd person *sig* since the 1st and 2nd person pronouns cannot supply its missing phi-features (this differs from Harris et al., where the possessors act as syntactically illicit distractor antecedents). If the P600 is sensitive to syntactic versus pragmatic licensing, the ERPs from the violation in (2b) will differ from those in (3b). If the P600 is the result of phi-matching, the two will be the same. ERPs are measured from the onset of *sig* in each condition.

(2) Infinitival (anaphoric *sig*)

a. Hanni skipaði mér, að lemj sig\(^{i/*j/*k}\) í fríminútunum Agree
   He ordered me to hit\(_{inf}\) SIG in recess

b. Þú skipaðir mér, að lemj sig\(^{i/*j/*k}\) í fríminútunum Disagree
   You ordered me to hit\(_{inf}\) SIG in recess

(3) Subjunctive (logophoric *sig*)

a. Hanni òtaðist að ég lembi sig\(^{i/*j/*k}\) í fríminútunum Agree
   He was afraid that I it\(_{subj}\) SIG in recess
b. Þú óttaðist að ég lemdi sig í frímínútunum Disagree
You were afraid that I hit subj SIG in recess

42 right-handed native speakers of Icelandic read 40 experimental sentences (10 from each condition, Latin square design) among 80 filler sentences. Sentences were presented RSVP (700ms SOA) and randomized by subject. Potentials were from 32 electrodes at a 256 Hz sampling rate, band-pass filtered from .01 to 40 Hz. Linked mastoids were used for reference.

Results

Infinitival - In the 500-700ms window, we find a main effect for Agreement [F(1,41)=4.84, p=.03] and an interaction between Agreement and Anteriority [F(2,82)=6.29, p=.01]. Pairwise comparisons show that the Disagree condition is significantly more positive than the Agree condition in both the Central [t(41)=2.31, p=.03] and Posterior [t(41)=3.42, p=.001] regions.

Subjunctive - In the same 500-700ms window we find a main effect for Agreement [F(1,41)=8.79, p=.005] and an interaction between Agreement and Anteriority [F(2,82)=3.93, p=.004] and between Agreement, Anteriority, and Laterality [F(2,82)=2.50, p=.04]. Disagree is more positive than Agree in the Central [t(41)=3.22, p=.002] and the Posterior [t(41)=3.51, p=.001] regions, in addition to all 6 posterior and central ROIs shown below (p<.03 for all).

Discussion

Both the anaphoric and logophoric uses of long-distance sig show P600 effects when not properly licensed by a third-person pronoun, whereas no significant effects were found when comparing subjunctive and infinitival results. This suggests that the P600 is not indexing syntactic licensing versus pragmatic licensing, as suggested in Harris et al., but rather phi-feature violations. In the Icelandic examples, the lack of a phi-licit antecedent triggers a P600 in both syntactic and pragmatic licensing contexts. This suggests a reinterpretation of the Harris et al. results. For syntactically licensed anaphors (1a-b), only c-commanding DPs are candidates for phi-checking, so the presence of syntactically illicit distractors will not prevent a phi-matching violation and a P600. For pragmatically licensed logophors (1c), all DPs are in principle available for phi-checking including the possessive DP, avoiding a phi-matching violation. Co-indexing with the possessor (1d) will produce a pragmatic violation in this context but that does not result in a P600: as the Icelandic results show, the difference between syntactic and pragmatic licensing is not itself the source of the P600. Rather the P600 is a consequence of phi-matching violations.

Conclusion

This study provides evidence that both anaphoric and logophoric long-distance reflexives incur P600 effects in violations such as in (2b) and (3b). These effects run against previous studies that suggest that anaphoric and logophoric licensing incur different costs because they are completely different processes. We conclude that both syntactic and pragmatic licensing involve phi-feature checking and that the P600 indexes this.

References