

The processing of ambiguous object pronoun in L1 and L2 speakers

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Abstract

Experimental evidence on pronoun resolution has shown that speakers have difficulties in interpreting referential cues and anaphora biases. Our study tested L1 German and highly proficient L2 speakers (with L1 Georgian) and targeted factors which might differentially impact the resolution of ambiguous object pronouns in these two populations. Specifically, we examined grammatical role parallelism and asked to what extent L2 speakers differ from L1 speakers in forming grammatical dependencies. Eye-movement results revealed a bias towards the subject antecedent in L1, while the L2 showed object preference when resolving the referent of the object pronoun. Offline tests supported the eye-tracking findings of both groups. Grammatical role parallelism occurs to be a more prominent cue in the L2 compared to the L1.

Keywords: ambiguous pronoun, L2 processing, eye-tracking

Introduction

Understanding pronoun resolution poses a challenge to many different fields of linguistics. This challenge arises due to the ambiguity encountered when pronominal anaphora refers to multiple possible antecedents. Even, when regarding languages with fixed subject-verb-object word order, theoretical accounts differ as to ascertaining the underlying mechanisms of pronoun resolution. This situation is exacerbated further in languages with variable word order, for instance, when an object anaphora is permitted in the sentence initial position, as in the German example: *Der Postbote ruft den Seemann vor der Brücke. Ihn freut die Überraschung.* “The postman^a calls the sailor^b in front of the bridge. He^{a/b} is pleased by the surprise.” In sentences with a non-canonical word order, the resolution mechanisms are likely submitted to additional processing factors. As in general, studies on German have mainly examined the resolution of subject pronouns following canonical sentences (e.g., Sauermann & Gagarina 2017; Schumacher et al. 2016). So far, less is known concerning the resolution of object anaphora, as for instance, the masculine accusative personal pronoun *ihn*, which can refer to either ‘*postman*’ or ‘*sailor*’, in non-canonical word order sentences.

By conducting two eye-tracking and two offline sentence completion experiments on object pronoun resolution, we aimed to fill this gap. Our

experiments also expand previous research on L1-speakers to include pronoun processing in L2 speakers.

Methods

Participants

Thirty-two German participants (13 males; age range: 18 to 32; $M = 23.5$ years, $SD = 4.3$ years), mostly students of universities in Berlin, took part in Experiment 1. Another twenty-eight Georgian L1 speakers (9 males; age range: 19 to 35; $M = 28.5$ years, $SD = 4.4$ years), students or graduates from different universities in Germany, participated in Experiment 2.

Materials and procedure

The studies employed a visual world paradigm design in that participants viewed images and listened to sentences. The antecedent sentence was in the subject-verb-object word order, followed by a sentence with a subject or an object pronoun at the initial place in the sentence (see Figure 1). The pronoun itself was intentionally ambiguous between the two referents presented in the previous sentence, as either referent was a plausible antecedent for the pronoun. The visual material consisted of simply structured images displayed on the computer screen, containing three images each: two human or animal agents and one inanimate item or place (see Figure 1). In addition to 20 critical items, we created 40 filler items. Thus, each participant saw a pseudo-randomised list of 60 items.

Using a Tobii Eye-tracker device, subjects first went through a 5-point calibration grid and then began an eye-tracking session. Participants' task was to carefully watch depicted images and listened to sentences. After completing the eye-tracking experiment, which lasted approximately 18-20 minutes, participants took part in a sentence-completion offline test. In this test, power-point slides depicting the images used in the eye-tracking experiment. The first and second sentences were shown in their entirety below the images on the slide, however, the third sentence ended directly after the pronoun. Participants were asked to write down on a paper to which of the characters they thought the pronoun referred to.



Der Seemann und der Postbote verabreden sich am Ufer. Der Postbote ruft den Seemann vor der Brücke. Er war mutig / Ihn freut die Überraschung.
Lit. „The sailor and the postman arrange to meet on the shore. The postman calls the sailor in front of the bridge. He was brave / He is pleased by the surprise.“

Figure 1. Example item images and sentences.

Analysis and results

Eye-tracking data, we used a Tobii Studio Software to export the fixation data for the analyses. To create time course graphs, the data included the 200 milliseconds before and 1300 milliseconds after the pronoun onset (see Figure 2), which present the proportion of looks to both the subject and object antecedent. The solid lines indicate trials with the subject pronoun, and the dotted lines present trials with the object pronoun. The solid vertical lines at 0 ms indicate the onset of the subject and object pronouns (*er* or *ihn*).

Results revealed that the looks to the subject and object antecedent as a function of the pronoun start to diverge increasingly approximately 250 ms after the pronoun onset. In Exp 1a, the increased looks towards the subject antecedent occurred in the object pronoun condition. By contrast, in Exp 2a, the increased looks towards the subject antecedent occurred in the subject pronoun condition. These looks remained for about 250 - 300 ms. The deviation in looks towards the antecedents, as a function of the pronouns, started to increase again at around 700-800 ms, showing preferential looks towards the subject in Exp 1a and towards the object in Exp 2a, which was confirmed by the statistical analyses in Exp 1a ($b = 0.293$, $t = 2.340$) and in Exp 2a ($b = 0.314$, $t = 2.392$).

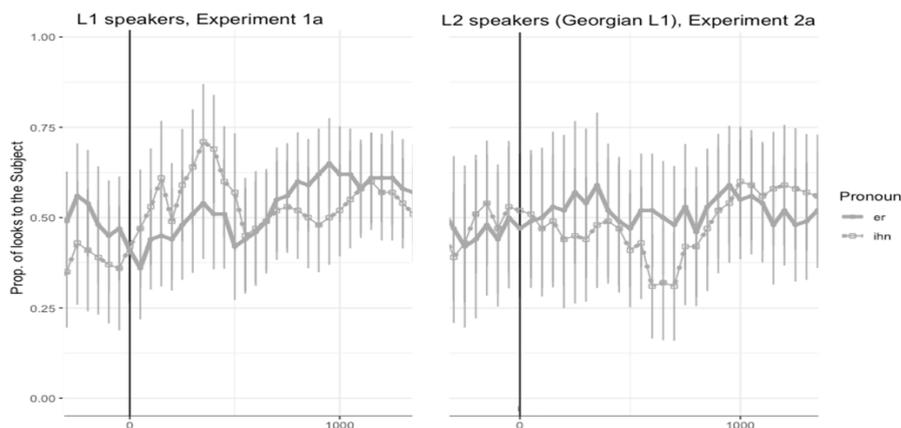


Figure 2. Mean proportion (with *SE*) of looks to the subject antecedent depending on the pronoun in Experiments 1a and 2a. Note: that looks to the object antecedent were complementary to the looks to the subject.

Offline test data, in Experiment 1b, the choice of the subject antecedent while reading a subject pronoun was around 87%, whereas it was around 57% in Experiment 2b. Moreover, the L2 speakers showed a response well above the chance level in the object pronoun condition by choosing the object antecedent, compared to the data from the L1 speakers which showed a response rate at the chance-level.

Discussion

The current study evaluated whether the grammatical role hypothesis (e.g., Smyth 1994) holds for the resolution of the German accusative object pronoun *ihn* 'him'. Previous studies showed an impact of grammatical role parallelism on subject pronoun resolution (e.g., Sauermann, Gagarina 2017, Schumacher et al. 2016). The results of Experiments 1a and 2a indicate that after encountering the object pronoun, L1 and L2 German speakers did not show a rapid use of grammatical role parallelism. L1 participants did not reveal any preferential looks towards the object antecedent, which is not in agreement with previous studies (e.g., Sauermann, Gagarina 2017, Smyth 1994, Schumacher et al. 2016). Whereas L2 participants looked more frequently towards the object antecedent than to the subject antecedent. This later gaze pattern began to increase 500 ms after the pronoun onset was confirmed by a significant difference.

The sentence-completion experiments partly supports the eye-movements' data (see Figure 2). As the L1 participants did not relate the object pronoun to the object antecedent in the online processing, their response pattern was replicated in the offline test, namely, the object antecedent was not chosen more than the subject antecedent in the object pronoun condition. By contrast, L2 participants did relate the object pronoun to the object antecedent significantly more than to the subject antecedent ($t(298) = 6.38, p = .000$). Overall, the pronounced object pronoun processing in L2 participants is in line with some earlier findings that showed a lasting object preference in L2 (French L1) compared with L1 German speakers (e.g., Colonna et al. 2014).

Summarizing our results, we did not find evidence for the application of grammatical role parallelism for the object pronoun in the data of the L1-speakers, while the data of the L2-speakers support the application of this cue. The difference between L1 and L2 speakers in the application of grammatical parallelism suggests that the L1 speakers could find and use another cue (i.e., topicality) for pronoun resolution in the stimuli. This cue might be ranked differently than grammatical role parallelism in the L1 and L2 processing.

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