

He does not like subject referents - pronoun resolution in Georgian

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Abstract. Experimental research on pronoun resolution has shown that speakers frequently encounter difficulties in interpreting ambiguous referents. This study, conducted with Georgian speakers, manipulated nominative-dative and ergative-absolutive sentence construction, sought to identify factors which could affect pronoun processing. Specifically, it examined the impact of subject bias, case marking and grammatical role of the antecedents. Analyses of online data revealed a consistent bias toward the non-subject antecedent, regardless of the sentence construction, a pattern that was confirmed by statistical analyses. These findings are discussed in relation to evidence suggesting that antecedents in split-ergative languages may behave differently from the subject bias typically observed in nominative-accusative languages.

Keywords: Case marking, pronoun resolution, online study, split-ergativity

1 Introduction

Past research revealed that pronoun interpretation is influenced by a complex interplay of multiple factors. These factors include subjecthood, first or second mention [1, 2], discourse status [3, 4], and grammatical role parallelism [5, 6], which have been explored mainly in well-studied languages such as in English [5, 7], German [1, 8], and Italian [9]. However, less is known about how factors such as subjecthood and grammatical role influence pronoun resolution in split-ergative languages like Georgian. A recent eye-tracking study [10] examined this phenomenon in German among highly proficient L2 speakers (Georgian L1). The findings indicated that L2 speakers exhibited a stronger bias toward the object antecedent compared to L1 speakers when resolving ambiguous pronouns. A follow up eye-tracking study in Georgian [11], utilizing only nominative-dative sentences, confirmed the pattern of a preference towards the non-subject antecedent. By contrast, offline data from Niuean, a split-ergative language, showed an overall subject bias during pronoun resolution [12]. As the varied findings show, we are faced with a complex puzzle when seeking to understand the interpretation of anaphoric expressions in split-ergative language such as Georgian.

The present within-subject design study aimed to investigate to what extent the subject bias, case marking and grammatical role of the antecedents with subject*Nom* - object*Dat* markings in Experiment 1, and subject*Erg* - direct object*Nom* markings in Experiment 2 would influence the interpretation of

grammatical subject *Is* and object *Mas* pronoun in Georgian. Conducting two online-response experiments in a split-ergative language, which has a variable word order [13] and the rich morpho-syntactic markings, provides a unique opportunity to address the challenging questions and to gather behavioral data on the resolution of ambiguous pronouns in a less well-studied language, which expand our understanding of their role in discourse interpretation.

2 Methods

Participants: Thirty-six (13 females, age range: 18 to 28; $M = 20.7$ years, $SD = 2.42$ years) students of universities in Tbilisi and Batumi took part in Experiment 1. Another group of eighteen younger adults (11 females, age range: 18 to 32; $M = 23.6$ years, $SD = 3.17$ years), took part in the ongoing Experiment 2. They were all unaware of the purpose of the experiment.

Materials: The same visual stimuli in Experiment 1 was used as in a previous study on ambiguous pronoun processing [11]. The visual and linguistic stimuli created for Experiment 2 followed the criteria in accordance with [11]. Each critical item consisted of three simply structured images displayed on the computer screen: two human or animal agents and one inanimate item or place (see Figure 1). For the linguistic materials, sentences were recorded spoken by two female native Georgian speakers (see Table 1). The critical antecedent sentences had the subject-verb-object and object-verb-subject word order in Exp 1 and the subject-object-verb and object-subject-verb word order in Exp 2, followed by a sentence with a subject or an object pronoun at the initial place in the sentence (see Table 1). The pronoun itself was ambiguous as either antecedent was an equally plausible referent (i.e., the postman/the sailor or the crow/the boar). In addition to the 20 critical items, we created 20 filler items. Thus, each pseudo-randomized list contained every critical item in one of the two conditions and all fillers.

Procedure: In both experiments, participants were instructed to view the images, listen carefully to the sentences, and then select one of the antecedent characters. After hearing the sentence, the corresponding images remained on the screen for up to 10,000 milliseconds, allowing participants to press *d* or *k* to select a target picture. Once a selection was made, the next item appeared. If no response was given within the allotted time, the experiment automatically proceeded to the next trial. This process was repeated for all subsequent items. Additionally, after being presented with several items, they answered questions related to the story mentioned in the audio.

Analyses and results: For the analysis, the responses were coded based on whether the subject or object antecedent was chosen across all pronoun and sentence type conditions. These were coded with '1' when participants chose the subject antecedent, and '0' otherwise in all conditions. Responses with reaction time values below 200 ms or above 6000 ms were excluded to ensure meaningful processing time measurements based on the data. Accordingly, 8.4 % data was removed in Exp1 and 7.9 % data was removed in Exp2 during the cleaning process. Additionally, a log transformation was applied to normalize the distribution for subsequent analyses.

The response data in neither experiment revealed any subject antecedent bias during pronoun processing. As regards the grammatical role, participants preferentially chose an object antecedent in the object pronoun condition in Exp 1, which was confirmed by statistical analyses ($\beta = 0.382$, $p = 0.047$). By contrast, the responses in the subject pronoun condition showed neither a subject nor object antecedent preference in Exp 1. A remarkable non-subject preference was further observed in the data of Exp 2, especially in the ergative-absolutive sentences. Similarly, to Exp 1 no subject bias was found in the subject pronoun condition of Exp 2.

Discussion: The online-response experiments investigated how subjecthood, case marking, and the grammatical role of antecedents affect ambiguous pronoun processing in Georgian [5, 6]. The study consisted of antecedent sentences in various word-order, followed by sentences starting with either the subject or object pronoun (see Table 1). The results revealed that, upon encountering subject or object pronouns, listeners did not exhibit a subject bias or grammatical role parallelism in the subject pronoun condition. The expected influence of case markings on establishing the grammatical role, particularly in the subject pronoun condition, which could have been a clear marker in the ergative-absolutive construction in the preliminary results of Experiment 2, did not occur. Another speculation, regarding whether the non-subject preference is related to the order of mention, which has been discussed in [10, 11], was not supported in the object-verb-subject word order sentences. The application of grammatical role parallelism in the object pronoun condition in Exp 1 may be explained by the relatively clearer grammatical markers in Georgian (e.g., [11]) and is consistent with previous research showing the use of grammatical cues (e.g., [5, 6, 10]). The lack of subject antecedent choice during the pronoun processing could be due to several reasons. One possible explanation is the syntactic ergative features in Georgian, where the subject role is shared between nominative and ergative cases, and transitivity depending on the verb type. This may further complicate the resolution of ambiguous pronouns in Georgian compared to other languages (e.g., [4, 8, 9]). Further experimental data, including transitive/intransitive constructions, need to be gathered to confirm this assumption.

To summarize our findings, we provided evidence for the application of grammatical role parallelism in the object pronoun condition, which replicates previous eye-tracking findings with Georgian speakers. Case marking alone does not seem to sufficiently influence the resolution pattern. It would appear that when processing pronouns in ergative-absolutive sentence constructions, the application of cues – those of grammatical role parallelism and subject/object bias, seems to have a different ranking to those typically observed in nominative-accusative languages.

References: [1] Bosch, and Umbach (2007); [2] Järvikivi, et al., (2017); [3] Bosch, et al., (2003); [4] Kaiser and Trueswell (2008); [5] Chambers and Smyth (1998); [6] Smyth (1994); [7] Arnold et al. 2000); [8] Schumacher et al. 2015); [9] (eCarminati, 2002); [10] Abashidze, et al., (2022); [11] Abashidze, Asatiani, et al., (2023); [12] Tollan and Heller, (2020); [13] Apridonidze (1986).

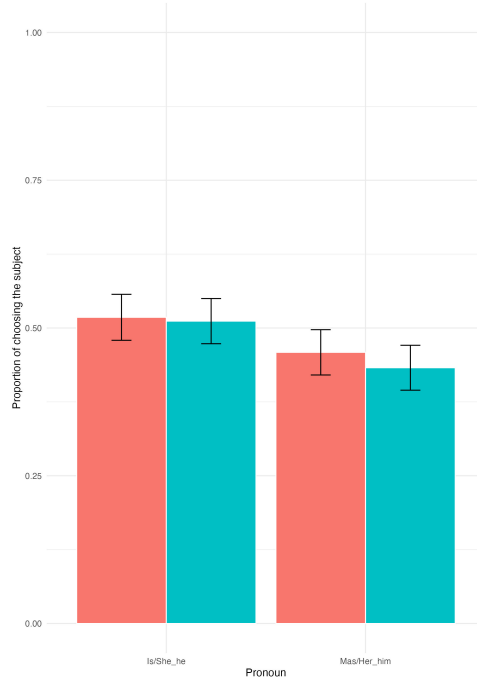
Figure 1. Example of the visual stimuli of a typical experimental trial, Experiments 1 and 2



Table 1 Example experimental sentences and conditions

Conditions	Sentences
Exp 1	
Introduction	მეზღვარი და ფოსტალიონი თანხმდებიან ზღვაზე შეხვედრაზე. Lit. "The sailor and the postman arrange to meet on the shore"
SVO, SubjPron	ფოსტალიონი იხმობს მეზღვარს ხიდის წინ. ის მოიქცა მამაცურად Post'alion-i ixmob-s Mezrvaur-s Xidis c'in. Is moikca mamacurad Lit. "The postman-NOM calls the sailor-DAT in front the bridge. He-NOM behaved brave"
SVO, ObjPron	ფოსტალიონი იხმობს მეზღვარს ხიდის წინ. მას ახარებს სულიერში Lit. "The postman-NOM calls the sailor-DAT in front the bridge. Him-DAT gladdened the surprise"
OVS, SubjPron	მეზღვარი იხმობს ფოსტალიონი ხიდის წინ. ის მოიქცა მამაცურად Lit. "The sailor-DAT calls the postman-NOM in front the bridge. He-NOM behaved brave"
OVS, ObjPron	მეზღვარი იხმობს ფოსტალიონი ხიდის წინ. მას ახარებს სულიერში Lit. "The sailor-DAT calls the postman-NOM in front the bridge. Him-DAT gladdened the surprise"
Exp 2	
Introduction	ყვავი და ტახი გადაეყარნენ ერთმანეთს სცენასთან ახლოს. Lit. "The crow and the wild boar met by chance near the concert stage".
SOV, SubjPron	ყვავმა ტახი გასართობად როკკონცერტზე დაპატიჟა. ის გულს იჯერებდა ცეკვით Q'avav-ma tax-i gasartobad rok'k'oncirt'ze dap'at'it. Is guls ižerebda cek'vit Lit. "The crow-ERG the boar-NOM to the rockconcert invited. He-NOM was enjoying the dance"
SOV, ObjPron	ყვავმა ტახი გასართობად როკკონცერტზე დაპატიჟა. მას ენერგიას ჰმატებდა სასმელი Lit. "The crow-ERG boar-NOM to the rockconcert invited. Him-DAT was giving energy drink"
OSV, SubjPron	ტახი ყვავმა გასართობად როკკონცერტზე დაპატიჟა. ის გულს იჯერებდა ცეკვით Lit. "The boar-NOM the crow-ERG to the rockconcert invited. He-NOM was enjoying the dance"
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Response data of the younger adults, N=36



Preliminary data of the younger adults, N=18

