

Subject and predicate effects on long distance anaphor *Caki* in Korean

The Issue While early studies on the Korean long distance anaphor *caki* describe it to be subject-oriented (Lee, 1973; Chang, 1977), more recent studies argue that it can take non-subject antecedents as well (Park, 1986; Yoon, 1989; Cho, 1994; Sohng, 2004; Madigan, 2006). In a Truth Value Judgment task experiment, Han and Storoshenko (In press) found that a preference for the subject antecedent is indeed in effect, but this can be mitigated by other factors such as a preference for the source of information (Sells, 1987; Yoon, 1989; Büring, 2005): in sentences such as (1) with *malha-* ('say') as the matrix predicate, speakers predominantly chose the matrix subject as the antecedent, but when the matrix predicate was replaced with *tut-* ('hear'), some chose the subject and some the indirect object.

- (1) Yuli-ka Toli-hanthey *caki*-ka chengso-lul kkaykkusi ha-lke-lako malha-yess-ta.
Yuli-Nom Toli-to self-Nom cleaning-Acc thoroughly do-Fut-Comp say-Past-Decl
'Yuli said to Toli that self will clean thoroughly.'

Building upon Han and Storoshenko's study, we conducted a visual-world eye-tracking experiment to investigate the time course of the application of the subject preference and the predicate effect, a generalization of the source preference, in the antecedent resolution of *caki* and null pronouns. As Korean is verb-final, eye-tracking can identify the antecedent potential of *caki* or a null pronoun as it is first processed, and how that can change as a predicate is processed. We found that when *caki*, but not null, was first processed, there were more fixations to the subject picture than the object picture regardless of the predicate, but found an interaction between the predicate and the fixations to the pictures after the matrix predicate has been processed, for both *caki* and null.

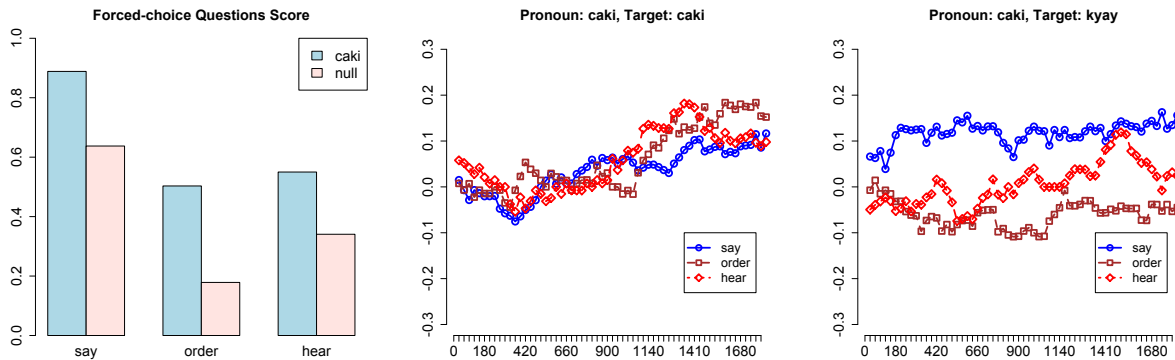
The Experiment Participants were presented with a combination of visual and aural stimuli. For example, while viewing a still screen image of two characters standing on either side of a house, participants heard a narrator state that Yuli and Toli are standing near a house, and that they are going to clean the house. They then heard two target sentences, the first a sentence such as (1) with *caki* or null, followed by a sentence such as (2) with *kyay* ('the kid'). *Caki*/null in the first target sentence and *kyay* in the second are intended to co-refer. A comprehension question is then presented on the screen asking who Yuli said will clean thoroughly. The participants' task was to choose between the two characters by pressing a button on a controller.

- (2) Haciman silceylo *kyay*-nun chengso-lul kkaykkusi ha-ci anh-ass-ta.
but actually the kid-Top cleaning-Acc thoroughly do-Conn Neg-Past- Decl
'But actually the kid didn't clean thoroughly.'

The experiment had two within-subjects factors: Predicate (the matrix verb of the first target sentence is *malha-* ('say'), *tut-* ('hear') or *myenglyengha-* ('order')) and Pronoun (the embedded subject of the first target sentence is *caki* or null). Forced-choice selection of the antecedent for *caki*/null was scored as 1 if the subject was chosen, and 0 if the indirect object was chosen. For eye-tracking, we calculated proportions of fixations to the pictures from the onset of *caki*/null upto 1800 ms, and from the onset of *kyay* upto 1800 ms, at every 30 ms. Fixations after *caki*/null are indicative of the initial interpretation of the pronoun, and fixations after *kyay* are indicative of the interpretation of the pronoun after the predicate has been processed. 40 native speakers of Korean participated in the experiment. Each participant received 48 test trials (8 per condition) and 24 fillers, in a uniquely generated random order.

Findings and Discussion Mean scores on the answers to the forced-choice questions on each of the Predicate/Pronoun combination are summarized in the left figure below. Generalized linear mixed-effects models revealed main effects of Predicate ($p < .0001$) and Pronoun ($p = .0004$), and an

interaction between the two ($p < .05$). That is, regardless of pronoun type, speakers are significantly more likely to select the subject as an antecedent in *say*-sentences than in *hear*- or *order*-sentences. And regardless of predicate type, speakers are significantly more likely to select the subject as an antecedent for *caki* than for null, and this effect is most pronounced in *order*-sentences. These findings show that while the predicate effect is present for both *caki* and null, the subject effect is only evident for *caki*. They however do not yet tell us the time course of the subject effect: Is it in play when *caki* is initially processed or after the predicate has been processed?



To do analysis on the eye-tracking data, we used subject advantage scores, differences between the proportions of fixations to the subject picture and the object picture (Kaiser et al., 2009). Mean subject advantage scores starting from the onset of *caki* up to 1800 ms at every 30 ms are plotted in the middle figure above, and mean subject advantage scores for *kyay* in the *caki* condition are plotted in the right figure above. A score of 0 indicates no subject or object advantage, scores above 0 indicate the presence of subject advantage, and scores below 0 indicate object advantage. For statistical analysis, we divided the 1800 ms into three time slices, 0-600 ms, 600-1200 ms and 1200-1800 ms, and constructed linear mixed-effects models with Time Slice and Predicate as fixed effects. For *caki*, we found a main effect of Time Slice. That is, *caki* showed subject advantage in the 3rd time slice ($p = .0001$), regardless of the verb. For *kyay* in the *caki* condition, we found a main effect of Predicate: regardless of time slice, *say*-sentences showed subject advantage ($p = .0001$), but *hear*- and *order*-sentences showed neither a subject nor an object advantage. In the null condition, we found no effect of Predicate or Time Slice when null is initially processed: regardless of the verb, it showed no subject or object advantage in all time slices. For *kyay*, we found a main effect of Predicate: while *say*-sentences showed no subject or object advantage, *hear*-sentences showed marginal ($p = .07$) and *order*-sentences showed significant object advantage ($p = .002$).

These results taken together suggest an initial subject effect for *caki*, but not for null. Initially, *caki* has preference for the subject antecedent but null is neutral in its preference. Fixations for *kyay* in the null condition suggest that in the absence of the subject effect, *order* has the highest preference for the indirect object antecedent followed by *hear*, and *say* is neutral in its preference. However, the initial subject effect persists for *caki*, raising the subject preference for all three verbs, in comparison to null. This accounts for the high preference for the subject antecedent for *say*, and no preference for subject or object antecedent for *hear* and *order*, in the final interpretation of *caki*, as shown in the mean scores on the answers to the forced-choice questions in the left figure above.

Conclusion Our experiment demonstrated that the default antecedent potential of *caki* is the subject, supporting the early proposals on *caki* that it is subject-oriented. We have also shown, however, that this default property of *caki* interacts with other factors, such as the predicate of the sentence, allowing *caki* with non-subject antecedents. Our overall findings are compatible with the multiple-constraints approach to anaphor resolution (Kaiser et al. 2009, and references therein): interpretation of anaphors is determined by multiple interacting constraints which may impose differing weightings for different anaphoric forms, such as *caki* and null.