

C-command and bound variable processing: Evidence from the Korean anaphor *caki*

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Issue The Korean anaphor *caki* has had multiple analyses over the years describing different facets of its use and interpretation, including (i) its allowance of non-c-commanding antecedents (S.-Y. Kim, 2000; O’Grady, 1987) and (ii) its having the properties of bound variables (Cho, 1996; Han & Storoshenko, 2012; J. Kim & Yoon, 2009). These two facts paint a conflicting picture, as c-command is often considered to be a key component in generating bound variable readings. In this study, we use a series of both offline and online experiments to argue that while c-command may not be strictly necessary for *caki*’s bound variable readings, it does have a facilitative effect in the online processing of sentences which generate such readings.

Background Moulton and Han (2018) found that in English, covarying bound pronouns can access c-commanding quantified antecedents early in processing, but not non-c-commanding antecedents – even when a bound variable interpretation is possible. Lakhani and Schwarz (2024), however, report findings that question the processing advantage of c-commanded bound pronouns: when Moulton and Han’s test sentences were modified to facilitate the covarying interpretation of the pronoun, the processing difference between c-commanded and non-c-commanded pronouns disappeared. A recent paper by Han and Moulton (2024) reports on a self-paced reading study testing the processing of *caki* versus the pronoun *ku* with proper noun antecedents in Korean. Assuming that *caki* is primarily a bound variable, Han and Moulton reasoned that the use of proper noun antecedents would free *caki* from being subject to the pragmatics of covariation. The authors report that reading times for *caki* trials are significantly faster when the anaphor has a c-commanding antecedent. Conversely, *ku* shows no such effect, which is taken to be evidence that a c-commanding antecedent for *caki* provides a processing advantage for accessing the bound variable reading. However, there is a potential weakness in the experiment, drawing the results into question. The test items in the c-command condition of that study were structurally ambiguous, with a possible parse where the intended antecedent for a matrix clause *caki* is in an embedded clause, leaving *caki* bound by a *pro*. In addition, it is unclear whether *caki* in their test sentences was actually being interpreted as a bound variable, given that *caki* has been reported to allow referential interpretation in certain discourse contexts (Jayaseelan, 1997; Yang, 1982). Our main goal is to improve upon their experiment in two ways. First, we test the experiment items in a series of offline tasks to ensure that the intended bound variable readings are reliably available. Second, we use a maze task (Boyce, Futrell, & Levy, 2020; Forster, Guerrero, & Elliot, 2009; Freedman & Forster, 1985) rather than self-paced reading, which has been argued to encourage deeper engagement with the sentence content (Han et al., 2024; Sloggett et al., 2020) and to provide superior localization of processing effects (Boyce et al., 2020; Forster et al., 2009).

Experiments A sample test item set for our study is given in (1), shown as segmented for the maze task experiment. Our maze task experiment used a 2×2 factorial design crossing Anaphor (CAKI, KU) with Structure (CCOMMAND, NO.CCOMMAND).

- (1) a. /₀ Kimpwucang-i /₁ pokose-lul /₂ hoysa /₃ samwusil-eyse /₄ **caki/ku-uy**
Manager.Kim-Nom report-Acc company office-at self/he-Gen
/₅ khemphyuthe-ey /₆ cecangha-yess-ta.
computer-on save-Past-Decl
‘Manager Kim saved a report on his computer at the company office.’ CCOMMAND
- b. /₀ Kimpwucang-uy /₁ pokose-ka /₂ hoysa /₃ samwusil-eyse /₄ **caki/ku-uy**
Manager.Kim-Gen report-Nom company office-at self/he-Gen
/₅ khemphyuthe-ey /₆ cecangtoy-ess-ta.
computer-on be.saved-Past-Decl
‘Manager Kim’s report was saved on his computer at the company office.’ NO.CCOMMAND

These examples are considerably simpler than those used in Han and Moulton (2024), with no embedded clause structure leading to potential ambiguity. Region 4 is the critical region, containing either *caki* or *ku*. In the CCOMMAND conditions, the antecedent *Kimpwucang* ‘Manager Kim’ is the sentential subject, c-commanding the rest of the sentence. In the NO.CCOMMAND conditions, *Kimpwucang* is a possessor inside the sentential subject, which is the theme of the passivized verb, and does not c-command *caki* or *ku*. Crucially, case markings at Regions 0 and 1 establish the different structures immediately, three regions before the critical region. Prior to the maze task experiment, we first conducted three offline experiments using an acceptability judgment task and contextual felicity tasks. These established that *caki* has a strong bias toward a bound variable interpretation, diagnosed through a preference for sloppy readings under verb phrase ellipsis, that NO.CCOMMAND sentences are as acceptable as minimally different CCOMMAND sentences, and that this bound variable reading bias is equally available in both structural configurations.

With these results in hand, we report on our maze task experiment testing whether c-command has any impact on the online processing of *caki*. The null hypothesis, bolstered by the lack of any differences in acceptability or interpretive bias, would be that we find no difference in the processing of sentences containing *caki* across CCOMMAND and NO.CCOMMAND conditions. The version of the maze task used was the G(rammatical)-Maze task, where participants make individual word choices between the target and a distractor at each region to build a sentence. We adopt the A(utomatic)-Maze task modification, where distractor words at each region are generated by a language model. Participants (100 Korean native speakers) saw 16 trial items in a Latin square design, inter-mixed with 24 unrelated fillers.

Results and Discussion The mean reaction times for each region by condition are summarized in Figure 1. We analyzed log-transformed reaction times at the critical Region 4, finding a significant interaction ($p < 0.001$) between Anaphor and Structure. Planned pairwise comparisons isolated the interaction to the CAKI conditions: reaction times were significantly faster in the CCOMMAND trials than in the NO.CCOMMAND trials ($p = 0.0002$). No such effect was found for *ku*. While all of our offline experiments show that there is no c-command-based difference in the acceptability or interpretation of *caki*, c-command still facilitates the online processing of the anaphor. This provides a more nuanced account of the distinction between an anaphor like *caki* and a pronoun like *ku*. Even though we have shown *caki* and *ku* to have the same range of interpretations in these trial items, the fact remains that *ku* has an overall wider distribution, being easily able to co-refer as well as to find a referent extra-sententially. On the other hand, *caki* has a strong bias toward bound variable interpretation. It is here that we find processing facilitation when early evidence in the sentence signals the presence of a c-commanding antecedent. This c-command effect in the processing of *caki* cannot be attributed to non-structural or contextual aspects of covariation, as our test sentences used referential noun phrase antecedents. These results speak to the perceived connection between the availability of bound variable readings and c-commanding binders: c-command facilitates the online processing of variable binding.

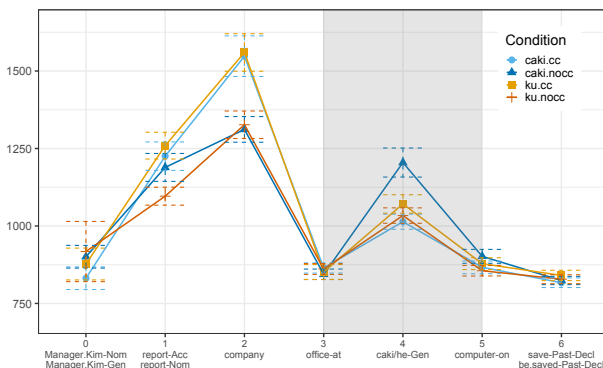


Figure 1: Mean RTs by condition with standard errors

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