An Experimental Study of the Grammatical Status of *caki* in Korean

CHUNG-HYE HAN
Simon Fraser University

DENNIS RYAN STOROSHENKO
Simon Fraser University

R. CALEN WALSHE
Simon Fraser University

1. Introduction

In the existing literature, the Korean long-distance anaphor *caki* is often described as subject-oriented, meaning that its antecedent is always a clausal subject (Yang 1985, Cole and Sung 1994). But the potential for non-subject antecedents has also been noted elsewhere (Kim 2000, Madigan and Yamada 2006). In (1), any of the c-commanding DPs in the sentence can serve as an antecedent for *caki*, including the non-subject *Mary*.

(1)   *John$_i$-i*   *Mary$_j$-eykey*   *[Tom$_k$-i*   *caki$_{i,j,k}$-lul*   *cohaha-n-tako]*
       John-NOM   Mary-DAT   Tom-NOM   self-ACC   like-PRES-COMP
       malha-yess-ta.
       say-PAST-DECL
       'John told Mary that Tom likes self.' (Sohng 2003, ex 11a)

In light of this fact, the question arises as to how the antecedent for *caki* is determined when more than one potential antecedent is available in the

same sentence. In this paper, we present our experimental study that tests the hypothesis that the DP referring to the most salient entity in the discourse is chosen as the antecedent, in the same manner as the antecedent for a pronoun is chosen. The data from our experiment show that while discourse context has an effect on the reference resolution of pronouns, it has little effect on the choice of antecedent for *caki*.

This paper is organized as follows. In section 2, we present data that illustrate pronoun-like qualities of *caki*, motivating our experimental hypothesis and research questions. Section 3 presents behavioral and eye-tracking data obtained from the experiment comparing the behaviour of *caki* with the third person pronouns *ku* ('he') and *kunye* ('she'). We conclude in section 4 with a discussion on the implications of our findings.

2. Framing the Issue: Pronouns and *Caki*

Condition B of the binding theory states that pronouns must be free within their binding domain (Chomsky 1981). So, pronouns can be coreferential with other entities in the sentence, whether they are c-commanded by the antecedent or not, as long they are free within their binding domain. They can also refer to entities established in discourse, from previous sentences. With these potentials for ambiguity, it is generally assumed that discourse context plays a role in ultimately resolving the reference of a pronoun.

Though typically treated as a long-distance anaphor, *caki* has pronoun-like qualities (Cho 1996). First of all, it can have a non-c-commanding antecedent within the same sentence. In (2), although *caki* is not c-commanded by genitive *Suni* embedded in a DP *Suni-uy sinpal-un* ('Suni-GEN shoes-TOP'), it is read as being coreferential with that genitive.

(2)　*Suni$_i$-uy　sinpal-un　caki$_i$-uy　pal-pota　hwelssin　khu-ta.*
　　　Suni-GEN　shoes-TOP　self-GEN　foot-than　a lot　　big-DECL

　　　'Suni's shoes are a lot bigger than self's feet.' (Kim 2000, ex 2a)

Secondly, *caki* seems to demonstrate split antecedence (Huang 2000). For example, in (3), *caki-tul* ('self-PL') finds its reference from a composite of matrix subject and the dative argument. This type of split antecedence is generally considered to be a diagnostic for a pronominal-like element.

(3)　*John$_i$-un　Mary$_j$-eykey　[caki-tul$_{i+j}$-i　iki-lke-lako]*
　　　John-TOP　Mary-DAT　　self-PL-NOM　win-FUT-COMP

　　　malha-yess-ta.
　　　say-PAST-DECL

　　　'John told Mary that selves would win.' (Huang 2000, ex 2.179).

Thirdly, *caki* doesn't even require an antecedent within the same sentence. In (4), *caki* is co-referential with *Suni* from the previous sentence.

(4) *Na-nun Suni_i-eykey chayk-ul pillye cwu-ess-ta. Kulentey*
I-TOP Suni-DAT book-ACC lend give-PAST-DECL and yet

sasil ku chayk-un caki_i oppa-ka ceney nay-key
in fact that book-TOP self elder brother-NOM before me-DAT

pillye cwun kes i-ta.
lend give thing be-DECL

'I lent a book to Suni. But the fact is that self's brother had lent it to me before.' (Kim 2000, ex 2b)

Given the apparent similarities between pronouns and *caki*, we might expect the discourse context to have an effect on determining the antecedent of *caki* in a similar way that it influences reference resolution on pronouns. We thus designed an experiment to address the following two questions:

1. Can we manipulate context to influence reference resolution on pronouns?
2. Given the noted similarities, will *caki* show the same pattern as pronouns?

3. The Experiment

To test these questions, we designed an experiment which combined an on-line processing measure, in the form of visual world eye-tracking, with a delayed behavioural measure in the form of a forced-choice questioning task. By making use of this dual approach, we were able to observe participants' reactions to stimuli as they were presented, as well as their considered judgements of those same stimuli. Because the data reported in the previous literature are all the result of considered grammaticality judgements, we were interested in seeing whether speakers presented with a pronoun or *caki* with multiple possible antecedents would consider more options for reference resolution than simply the one which they would report in our forced-choice task. Our reasoning that eye-tracking would be useful in addressing this issue is based on the demonstration by existing research that eye movements to objects that are potential referents of a referring expression are closely time-locked to the linguistic input (Cooper 1974, Tanenhaus et al. 1995).

3.1. Material

The stimuli used in this experiment combined audio and visual presentation. The visual portion consisted of a series of 18 still images (2 for training and 16 for experimental trials), a sample of which is given in Figure 1. Each image contained two characters, standing on either side of the scene. Between the characters is a scene-anchoring item, a blackboard in Figure 1. Others were items such as a gas range to suggest a kitchen, a tree to suggest a park, or a treadmill to suggest a gymnasium. In all cases, the setting is further reinforced

84 / Han, Storoshenko, & Walshe

FIGURE 1 Sample Visual Stimulus (Classroom Scene)

by the clothing of the characters. For all the images, one character was male and the other female, and their positions (left or right) in the image were evenly counterbalanced across the whole set of images used.

The audio portion of the stimuli consisted of a five-sentence recorded narration, spoken by a native speaker of Korean. The first two sentences provided background information, naming the characters and establishing the setting. The background information for the scene in Figure 1 is given in (5).

(5) *Jongwu-wa Yuli-ka   kyosil-ey   iss-ta.   Jongwu-wa*
    Jongwu-and Yuli-NOM classroom-DAT be-DECL Jonguw-and
    Yuli-nun pangkum sihem-ul chi-less-ta.
    Yuli-TOP   just   test-ACC take-PAST-DECL

    'Jongwu and Yuli are in their classroom. Jongwu and Yuli just took a test.'

The following two sentences gave further information about either one of the characters, or about the item in the centre of the image. For the scene in Figure 1, further information about Jongwu (6a), Yuli (6b), or the blackboard (6c) is given.

(6)   a. *Jongwu-nun mayil pam   yele   sikan tongan*
        Jongwu-TOP every night several hour   while
        kongpwuha-yess-ta. Kuliko Jongwu-nun cinan sihem-eyse
        study-PAST-DECL   And   Jongwu-TOP last   test-at

iltung-ul   ha-yess-ta.
first-ACC   do-PAST-DECL

'Jongwu studied for many hours every night. And Jongwu was the top student on the last test.'

b. *Yuli-nun   wutungsayng-i-ta.   Yuli-nun   sihem-eyse*
   Yuli-TOP   honour student-COP-DECL   Yuli-TOP   test-at

90cem   iha   mat-un   cek-i
90 point   below   score-ADNOM   experience-NOM

eps-ta.
non exist-DECL

'Yuli is an honour student. Yuli has never scored below 90 on a test.'

c. *Kyosil-ey   chilphan-i   iss-ta.   Chilphan-ey-nun*
   classroom-at   blackboard-NOM   be-DECL   blackboard-at-TOP

amwukesto ssuyye iss-ci   anh-ta.
anything   written   be-CONNECT   not-DECL

'There is a blackboard in the classroom. The blackboard doesn't have anything written on it.'

The final sentence of the narration was our target sentence. Again, there were three different possible versions of this sentence, depending upon the anaphor type used as the subject of the embedded clause, as in (7).

(7)   *Jongwu-ka   Yuli-eykey chilphan   yeph-eyse*
       Jongwu-NOM   Yuli-DAT   blackboard   beside-at
       caki/ku/kunye-*ka   sihem-ul   cal   chi-less-tako*
       self/he/she-NOM   test-ACC   well   take-PAST-COMP
       malha-n-ta.
       tell-PRES-DECL

'Jongwu tells Yuli beside the blackboard that self/he/she did well on the test.'

Crucial here is that there are two potential antecedents for the embedded clause subject; either Jongwu or Yuli could serve as the antecedent for *caki*. For *ku* and *kunye*, there is less room for ambiguity, as the sentence contains one male and one female referent. Target sentences were constructed to be counterbalanced by gender, with half male and half female matrix subjects, equally distributed across the images where the positions of the male and female characters were also counterbalanced.

Once the audio presentation was completed, the image disappeared from the screen, replaced by a black screen presenting a comprehension question written in Korean, as in (8).

(8) *Jongwu-nun nwu-ka   sihem-ul   cal   chi-less-tako*
     Jongwu-TOP   who-NOM   test-ACC   well   take-PAST-COMP
     malha-yess-supnikka?
     tell-PAST-INT

     'Who did Jongwu say did well on the test?'

Beneath this sentence were two clickable boxes, labelled for the names of the two characters in the given scene. Through the answers to this comprehension question, we were able to determine the participants' considered judgements as to the antecedent of the potentially ambiguous embedded clause subject.

As soon as an answer was entered, a cross would appear in the centre of the screen, which the participants would have to click before the image for the next item would appear, and the audio playback for that item would begin. This fixation cross was used to control the gaze of the participant at each trial.

For each of the 16 images used in the experimental trials, 3 scripts were prepared foregrounding the female character, male character or the scene-anchoring item in the middle, corresponding to (6). Each of the 3 scripts were presented with a target sentence containing *caki*, and a target sentence containing either *ku* or *kunye*, corresponding to (7). This produced 96 experimental trials in total.

3.2. Design

Our study consisted of two independent variables, each with three levels. The first of these variables was Contextual Bias. In examining the target sentence (7), Jongwu is the matrix subject, Yuli is the matrix indirect object, and the blackboard is mentioned as a locative adjunct. Contextual Bias was manipulated in the choice of which sentence pair from (6) was presented in a given trial. For the classroom scenario, (6a) placed additional emphasis on the target sentence subject, (6b) on the target sentence object, and (6c) on the locative adjunct. This manipulation was designed to make one or the other character more salient in the discourse. The emphasis on the locative adjunct was included as a control, to observe what happens where there has been no additional emphasis placed on either character. These three conditions were coded as the Subject, Object, and Neutral Biases, respectively.

The second independent variable, Anaphor Type, was represented in the form of the target sentence itself. As shown in (7), there were three possibilities for the embedded clause subject: *caki*, *ku*, or *kunye*. Taking the two independent variables in combination, the result is a 3 X 3 within-subjects design with 9 conditions, shown in Table 1.

Our experiment also had two dependent variables. The first of these was the on-line measurement of participants' gaze during the audio presentation of the target sentence. Specifically, we measured the proportion of fixations

TABLE 1 Experiment Design - Independent Variables

	caki	*ku*	*kunye*
Subject Bias	Condition 1	Condition 4	Condition 7
Object Bias	Condition 2	Condition 5	Condition 8
Neutral Bias	Condition 3	Condition 6	Condition 9

on either of the two characters, as well as fixations on the adjunct item in the centre of the image. We were interested in the gaze of participants at two key timepoints. The first of these was after the utterance of a proper name in the target sentence; this was an important control, as it would allow us to establish whether or not participants' gaze was indeed responding to the audio stimulus. The second timepoint of interest was the interval after the utterance of the embedded clause subject in the target sentence. This was the most important measure, as it would show where a participant's gaze shifts upon hearing *caki* or a pronoun. Following similar research on English (Runner et al. 2003; 2006), we focused our analysis of the eye-tracking results on the time interval 300ms to 1000ms after the onset of the proper name or embedded clause subject. This interval was selected to allow for enough time for the execution of the saccadic eye movement, while remaining restricted to a period close to the utterance of the word in question.

The second dependent variable in our experiment was the behavioural measure. For this, responses were coded according to whether the participants selected the target sentence subject or indirect object as the antecedent for the embedded clause subject. Selections of the subject were scored as 1, and selections of the indirect object were scored as zero.

3.3. Participants and procedure

For this experiment, we recruited 27 native speakers of Korean, none of whom had any education outside of Korea after age 12. All were university-age residents of Vancouver, and all were paid $10 for their participation.

Eye-tracking measures were taken using tabletop Tobii X100 eyetrackers, sampling at 60Hz. Experiments were conducted using three different eyetrackers, all operating with the same specifications and settings. Upon arriving at the lab, participants were briefed on the nature of their task, and first introduced to the eye-tracking equipment by way of a calibration routine. After calibration, participants were instructed to remain as still as possible throughout the experiment.

Participants then saw two practice trials using images and narrations which were not repeated during the experiment. These trials were designed to familiarise participants with the audio-visual combination, and to get them accustomed to the self-pacing of the experiment by way of their responses to the comprehension questions and the fixation crosses. Each participant saw 96 experiment items in total, presented in two randomly ordered blocks of 48. Periodically during the experiment, a screen would appear between trials displaying the eyetracker's image of the participants' eyes, as a reminder to return to the position of the original calibration.

Though participants were aware of the operation of the eyetracker, tracking was only done for the duration of the target sentence. The target sentences were specifically constructed to keep the eye-tracking as unobtrusive as possible. Rather than interrupt the flow of the narrative by re-introducing the fixation cross at the beginning of the target sentence, or during the target sentence, the mention of the locative adjunct was intended to serve as a cue to draw the participants' gaze back to the centre of the screen. Furthermore, without this locative adjunct, there would be no time delay between the target sentence indirect object and the embedded clause subject, which could have influenced the gaze results at the onset of the embedded clause subject.

Once the entire experiment was completed, participants were given an optional written debriefing form, as well as an informal verbal debriefing with the experimenter.

3.4. Results

Eye-tracking results are reported for only 14 of the 27 total participants. For 13 participants, more than 25% of the total eye-tracking data was lost due to calibration or equipment errors, and those participants' entire eye-tracking data sets were discarded. However, full behavioural data was collected for all 27 participants. We first examine the eye-tracking results, then turn to the behavioural data.

Our first concern with the eye-tracking results was to check our control test: the proper names. Figure 2 shows the proportions of fixations after the utterance of a proper name, aggregating across all proper names in all target sentences. The duration of the proper names is indicated by the arrows; at the onset, participants show roughly equal proportions of fixations to either character, and a higher proportion of looks to the adjunct item in the centre of the image. As shown in the graph, looks to the correct character spike upward approximately 300ms after the onset of the name, and looks to the other character and the adjunct item show a corresponding decline. We take this as evidence that the eye-tracking methodology is sound, and participants' gaze does indeed respond to the audio stimulus.

From this, we proceeded to examine the proportions of fixation after the
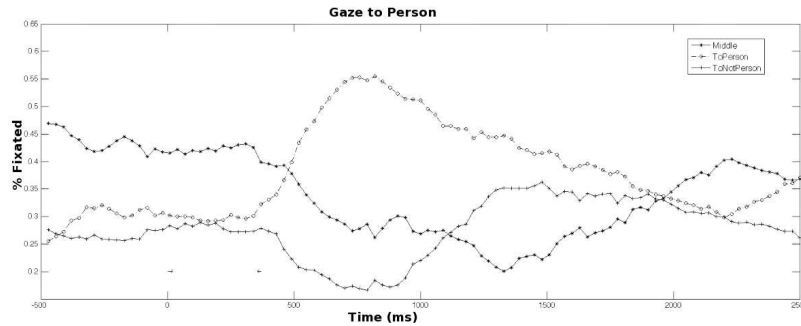
AN EXPERIMENTAL STUDY OF *caki* IN KOREAN / 89

FIGURE 2 Proportions of Fixations in Image after Proper Names

utterance of *caki* in the target sentence. Eye-tracking results for *caki* in all three Contextual Bias conditions are shown in Figure 3. Again, the duration of *caki* is indicated by the arrows, though the graph lines now correspond to looks to the target sentence subject, object, and the adjunct (middle) item. What we observe is that in all three bias conditions, there was a greater proportion of looks to the subject than the object or the adjunct after the utterance of *caki*. Similar results were obtained for *ku* and *kunye*. Figure 4 combines the proportions of fixations for all nine conditions, averaging over the 300ms to 1000ms time duration. While there are some small variations in the numbers the general trend is clear: regardless of Anaphor Type of the embedded clause subject or Contextual Bias, participants tend to look at the image of the subject upon hearing the embedded clause subject, even when either character is a potential antecedent.

To confirm this observation, we conducted a three-way ANOVA, comparing the variables of Contextual Bias, Anaphor Type, and Target of Fixation. The ANOVA revealed a main effect of Target of Fixation ($F(1,13) = 27.610$, $p = .000$) indicating that participants looked significantly more often at the image corresponding to the subject than anything else, regardless of Anaphor Type and Contextual Bias. There was no main effect of Anaphor Type or Contextual Bias. The ANOVA also revealed significant interactions between Anaphor Type and Target of Fixation ($F(2,26) = 4.179$, $p = .027$), and between Contextual Bias and Target of Fixation ($F(2,26) = 4.317$, $p = .024$). The first interaction is due to the slight increase in looks to the subject in the *caki* conditions than in the pronoun conditions. It may be that this is a
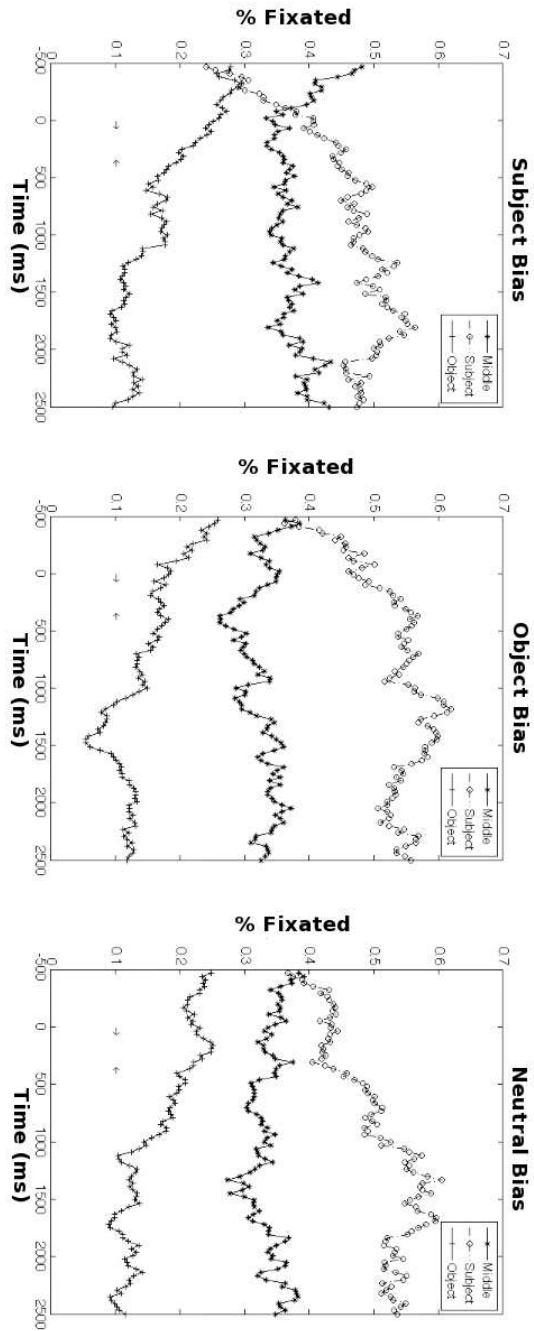
90 / Han, Storoshenko, & Walshe

FIGURE 3 Proportions of Fixations in Image after *caki* for each Bias

reflection of the fact that while *caki* is gender-neutral, *ku* and *kunye* are not, although we'll see later that this gender effect on pronouns can be overridden by context. The second interaction is due to the increase in the looks to the subject in the Object Bias conditions with all anaphor types. We have no explanation for this other than the speculation that the increase in looks to the subject here is spurious.

We then turned to the analysis of the behavioural results. For this, the mean score on each of the nine conditions was calculated for each participant. Recalling our scoring scheme, a mean closer to 1 would translate to more frequent selection of subjects as antecedents for the embedded subject, and a mean closer to 0 would translate to more frequent selection of objects. Because the target sentences were counterbalanced with respect to the gender of the subjects, *ku* and *kunye* selections based purely upon gender agreement would be reflected by a mean of 0.5. The mean scores in each condition, averaged over all participants is reported in Figure 5.

Regardless of the Contextual Bias, subjects were selected as the antecedent for *caki* 99% of the time. For *ku*, there was an effect of the contextual manipulation, as objects were selected more often in the Object Bias condition. There was a similar effect for *kunye*, though it was much less pronounced. A 2-way ANOVA was conducted on the means for each participant comparing the factors of Anaphor and Contextual Bias. A main effect of Anaphor Type was observed ($F(2,52) = 305.180$, $p = .000$), with all three levels significantly different on pairwise comparisons. Similarly, there was a main effect of Contextual Bias ($F(2,52) = 7.788$, $p = .001$), though on pairwise comparisons, it was only the case that the Object Bias was significantly different from the other two. There was no significant difference between the Subject and Neu-
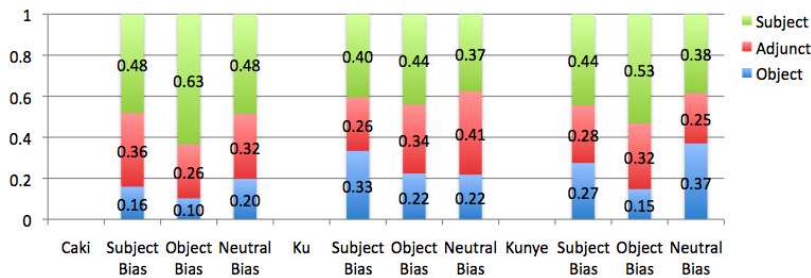

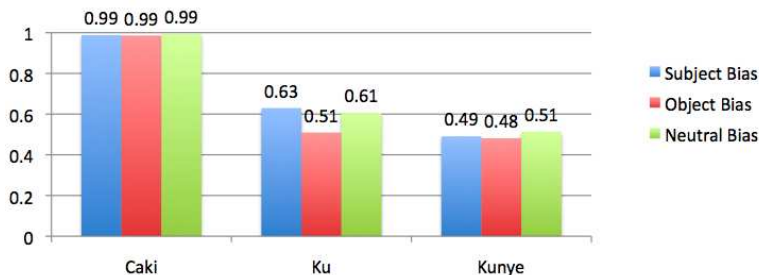FIGURE 4 Proportions of Fixations in all Conditions

92 / HAN, STOROSHENKO, & WALSHE

FIGURE 5 Average Means for each Anahpor/Bias Combination

tral Bias conditions. Finally, a significant interaction between Anaphor Type and Contextual Bias was found ($F(4,104) = 5.809$, $p = .000$), with *ku* showing the greatest sensitivity to Contextual Bias, less so for *kunye*, and virtually none at all for *caki*.

4. Discussion and Conclusion

Returning to our first research question in section 2, our experiment showed that it is possible to manipulate context and affect the choice of antecedent for an ambiguous pronoun. From the eye-tracking results, we conclude that there is a default setting to consider sentential subjects upon first hearing a pronoun or *caki*, reflected in the observation that there was a greater proportion of fixations on the images of subjects than objects (or adjuncts) regardless of Anaphor Type and Contextual Bias. However, the results for the behavioural test clearly showed an effect of context for pronouns. Though the average means for *ku* and *kunye* hovered around 50% due to the gender agreement effect, we observed subjects being chosen most often in the Subject and Neutral Bias conditions. For *ku*, this effect was so strong that it overrode gender considerations, and there were selections of a female antecedent. The same overriding of gender was present for *kunye*, though to a lesser extent. In debriefing, participants were very conscious of this gender effect, reporting that it was possible for both *ku* and *kunye* to have gender-mismatched antecedents, and even speculated that this had been the underlying research question of the experiment. So, the eye-tracking and the behavioural results taken together show that for pronouns, in the early stage of processing, the sentential subject is considered as a default antecedent, but this default selection can be overriden in the later stage of processing by contextual effects despite strong gender

agreement effects.

Adding strength to our conclusion that subjects are a default antecedent was the finding that there was no significant difference between the Subject and Neutral Bias conditions in the behavioural data. If subjects are default antecedents, then adding emphasis to the subject should have no effect on the final decision of which antecedent to choose. Placing additional emphasis on the locative adjunct, adding no more input about either potential antecedent, yielded results that were the same as in the Subject Bias condition, revealing the effect of the default interpretation. Where neither potential antecedent was emphasised, the result was the same as though the default has been emphasised.

Turning to our second research question, we clearly see that it is not the case that *caki* is subject to the same effect of context. Devoid of any confounds of gender, the default subject antecedent is in full force with *caki*, resulting in 99% selections of subject antecedents across the board in the behavioral data. This finding corresponds with the general tendency in the literature to consider *caki* a subject-oriented anaphor.

This however does not mean that the subject is the only grammatically possible antecedent for *caki*. It merely means that the subject was the preferred choice by our participants in the given forced-choice task. In fact, there was still not 100% acceptance of subjects as antecedents for *caki*. In all three Contextual Bias conditions, there were selections of the indirect object as the antecedent for *caki*. While the effect was so small in our experiment that it could be dismissed as extraneous noise in the data, such readings are repeatedly reported in existing literature, and our experiment attests to the possibility of such readings. What is clear though is that antecedent resolution of *caki* is not subject to those factors which can influence pronouns, speaking to the larger question of whether or not *caki* should be considered a pronoun or a bound anaphor. Our conclusion is that the results of this experiment can be added to the case for claiming that *caki* should not be grouped together with referential pronouns, despite the putative evidence for making this claim outlined in Section 2. Having established that *caki* is not subject to the same contextual influences as pronouns, future research will focus on determining what are the factors which will induce a non-subject reading for *caki*.

Acknowledgments

References

Cho, D. 1996. Anaphor or Pronominal. *Language Research* 32:621–636.

Chomsky, N. 1981. *Lectures on Government and Binding*. Dordrecht: Foris.

Cole, P., and L. Sung. 1994. Head Movement and Long-distance Reflexives. *Linguistic Inquiry* 25:355–406.

Cooper, R. 1974. The Control of Eye Fixation by the Meaning of Spoken Language: A New Methodology for the Real-time Investigation of Speech Perception, Memory and Language Processing. *Cognitive Psychology* 6:84–107.

Huang, Y. 2000. *Anaphora*. Oxford University Press.

Kim, S. 2000. Acceptability and Preference in the Interpretation of Anaphors. *Linguistics* 38:315–353.

Madigan, S., and M. Yamada. 2006. Asymmetry in Anaphoric Dependencies: A Cross-linguistic Study of Inclusive Reference. In *University of Pennsylvania Working Papers in Linguistics 13-1: Proceedings of Penn Linguistics Colloquium 30*, 183–196.

Runner, J., R. Sussman, and M. Tanenhaus. 2003. Assignment of Reference to Reflexives and Pronouns in Picture Noun Phrases: Evidence from Eye Movements. *Cognition* B1–B13.

Runner, J., R. Sussman, and M. Tanenhaus. 2006. Processing Reflexives and Pronouns in Picture Noun Phrases. *Cognitive Science* 30:193–241.

Sohng, H. 2003. Topics in the Syntax of East Asian Languages: Long-distance Anaphora and Adverbial Case. Doctoral Dissertation, University of Washington.

Tanenhaus, M., M. Spivey-Knowlton, K. Eberhard, and J. Sedivy. 1995. Integration of Visual and Linguistic Information in Spoken Language Comprehension. *Science* 268:1632–1634.

Yang, D. 1985. On the Integrity of Control Theory. In *Papers in Korean Linguistics: Commemorating the Eightieth Birthday of Prof. Hyonggi Kim*. Research Society of Omun. Taejon, Korea.