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Cue-based reflexive reference resolution: Evidence from Korean reflexive caki

Namseok Yong

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CUE-BASED REFLEXIVE REFERENCE RESOLUTION:
EVIDENCE FROM KOREAN REFLEXIVE CAKI

by

NAMSEOK YONG

A dissertation submitted to the Graduate Faculty in the Linguistics Program in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York

2019
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Evidence from Korean reflexive caki

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Namseok Yong

This manuscript has been read and accepted for the Graduate Faculty in the Linguistics Program in satisfaction of the dissertation requirement for the degree of Doctor of Philosophy.

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THE CITY UNIVERSITY OF NEW YORK
Abstract

Cue-based reflexive reference resolution:
Evidence from Korean reflexive caki

by
Namseok Yong

Advisor: Irina A. Sekerina, Ph.D.

This dissertation aims to reveal cognitive mechanisms and factors that underlie the reflexive dependency formation. In recent years, a lot of attention has been paid to the question of how our mind works in building linguistic dependencies (including an antecedent-reflexive dependency) because relevant research has proved promising and illuminating in regard to the properties (e.g., system architecture, computational algorithms, etc.) of human language processor and its close connection with other cognitive functions such as memory (Lewis & Vasishth, 2005; Lewis, Vasishth, & Van Dyke, 2006; McElree, 2000; McElree, Foraker, & Dyer, 2003; Van Dyke & Johns, 2012; Wagers, Lau, & Phillips, 2009). Building upon this line of research, the present dissertation provides empirical evidence to show that the parser can directly access potential antecedents (stored in memory) in forming an antecedent-reflexive dependency, using various linguistic cues and contextual knowledge available at the reflexive. In order to make this claim, this dissertation examines the Korean mono-morphemic reflexive caki ‘self’ (also known as a long-distance anaphor), using acceptability judgment and self-paced reading methodologies, and
asks (i) what linguistic factors guide its reference resolution and (ii) how they are applied to cognitive processes for memory retrieval and phrase structure building.

A series of acceptability judgment experiments (Experiments 1 through 5) show that caki has a very robust referential bias: it strongly prefers a subject antecedent. Moreover, it is established that syntactic constraints (e.g., binding constraints) are not the only available source of information during caki’s reference resolution. Indeed, various non-syntactic sources of information (or cues) can also determine caki’s reference resolution. Three self-paced reading experiments (Experiments 6 through 8) provide evidence compatible with the direct-access content-addressable memory retrieval model (Lewis & Vasishth, 2005; Lewis et al., 2006; McElree, 2000; Van Dyke & McElree, 2011)

Based on these experimental findings, I present an explanation of why caki preferentially forms a dependency with a subject antecedent. I argue that caki’s subject antecedent bias is driven both externally (i.e., syntactic prominence of a grammatical subject and first-mention advantage) and internally (i.e., frequency-based prediction on caki-subject dependency relation). Finally, I showcase how a referential dependency between caki and a potential antecedent can be constructed by the cue-based retrieval parser (Lewis et al., 2006; Van Dyke & Lewis, 2003).
Acknowledgements

I owe a number of people an enormous debt of gratitude for getting to this point (i.e., writing “Acknowledgements” for my dissertation). Here, I would like to thank all those who helped me come this far.

First and foremost, I would like to express my deepest gratitude to my advisor Irina A. Sekerina. Without her, I am sure, I would never be able to finish my dissertation. She was always encouraging, cheerful, and showed me exactly where I stand in the journey of my dissertation research. Thanks to her direction and guidance, I could stay on the right track. Her vision and advice made me keep moving forward. For me, she is the best role model, mentor, and research advisor without a doubt. I thank God to have her as my advisor.

I would also like to thank the faculty members of my dissertation committee, Jason Kandybowicz, William McClure, and Jiwon Yun. Undoubtedly, their razor-sharp comments and suggestions greatly improved this dissertation. Furthermore, they kept encouraging me, inspiring me, and gave help in every respect.

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Last but not least, I would like to extend my deep gratitude to my parents, Yoonfoon Yong and Taeyeon Kim. I was able to know how strong the term “trust” is, thanks to them. My beautiful wife Songok Jo, without her sacrifice, I am sure I could not have reached the end of
this journey. Finally, my lovely kids Victoria, Jeremy, and James Yong. They were always my strongest supporters. This dissertation is dedicated to them.
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<tr>
<td>ACC</td>
<td>accusative</td>
</tr>
<tr>
<td>ASP</td>
<td>aspect</td>
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<tr>
<td>BENE</td>
<td>benefactive</td>
</tr>
<tr>
<td>CAU</td>
<td>causative</td>
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<tr>
<td>CL</td>
<td>classifier</td>
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<tr>
<td>COMP</td>
<td>complementizer</td>
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<td>declarative</td>
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<td>DE</td>
<td>attributive particle <em>de</em></td>
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<td>F</td>
<td>feminine</td>
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<td>future</td>
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<td>NL</td>
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1 Introduction:

Reflexive dependency and relevant cognitive mechanisms

1.1 Introduction

Successful comprehension of a sentence requires various cognitive tasks to be fulfilled in a proper manner and timing. They include, for example, building different levels or types of representations, establishing (un-)bounded dependencies between constituents, accessing and retrieving particular pre-stored lexical items from memory, and so forth (Crain & Fodor, 1985; Crocker, Pickering, & Clifton, 2006; Frazier, 1987; Frazier & Fodor, 1978; Kimball, 1973; Lewis & Vasishth, 2005; Phillips & Wagers, 2012; Trueswell & Tanenhaus, 1994; Van Dyke & Johns, 2012). Among those tasks, dependency formation and its principled derivations have received a great attention from researchers in both the theoretical and psycholinguistic literature due to their prevalence in and across languages and usefulness as a tool for understanding relevant cognitive mechanisms (Aoshima, Phillips, & Weinberg, 2004; Boland, Tanenhaus, Garnsey, & Carlson, 1995; Fodor, 1978; Phillips, 2006; Phillips, Wagers, & Lau, 2011; Stowe, 1986; Yoshida, 2006). Sample sentences that require dependency formation for interpretation are provided in (1).

(1) a. Relative clause:

   This is the Broadway musical, which I think Jane recommended.

b. Wh-question:

   What do you think Jane said Bill wants?
c. **Topicalization:**

\[ \text{The candies, Jane said Bill gave } t_i \text{ to her son.} \]

\[ \text{It is } \textit{the novel, that the editor hoped the public would embrace } t_i. \]

Each sentence in (1) contains a displaced phrase (italicized) which forms a chain or dependency relation with its canonical position (marked by \( t \)) (Chomsky, 1986). The displaced phrases in (1) are semantically understood as the direct object of the most deeply embedded verb. In the psycholinguistics literature, dependency relation found in sentences in (1) has been called \textit{filler-gap dependency} (Clifton & Frazier, 1989; Fodor, 1978; Frazier, 1987; Hawkins, 1999; Stowe, 1986; Sussman & Sedivy, 2003; Traxler & Pickering, 1996). The term \textit{filler} indicates a lexically specified phrase that is displaced from its base position in the sentence. However, \textit{gap} indicates a phonetically null position from which the filler is dislocated. In (1), all promoted phrases, i.e., those displaced from their initial syntactic position, are fillers and their base position is the gap.

Comparable dependencies are also observed in sentences with pronominal expressions such as pronouns or reflexives which normally depend for semantic interpretation on other lexical expressions (called \textit{antecedents}). But, note that, unlike the filler-gap dependency seen in (1), the pronominal dependency involves direct association between two overtly-specified lexical phrases, not between a lexical phrase (filler) and a phonologically-null position (gap). For example, in (2), a direct referential dependency is formed between two overt lexical items (with no displacement of an item involved), i.e., a pronoun and its antecedent.\(^1\)

\[ \text{In (2a), a disjoint reference is also possible: the pronoun } \textit{him} \text{ in the embedded clause refers to some other person (indexed with } k \text{) in discourse context. This interpretation is not of concern here.} \]

\(^1\)
(2)  a. Tom believes that Bill trusts him.  
   \[ \text{[him} = \text{Tom]} \]
   \[
   \begin{array}{llll}
   & \text{V} & & \\
   \text{[s NP V]} & & & \\
   & & & \\
   & & & \\
   & & & \\
   & & & \\
   \end{array}
   \]

   b. Tom believes that Bill trusts himself.  
   \[ \text{[himself} = \text{Bill]} \]
   \[
   \begin{array}{llll}
   & \text{V} & & \\
   \text{[s NP V]} & & & \\
   & & & \\
   & & & \\
   & & & \\
   & & & \\
   \end{array}
   \]

   Furthermore, as seen in (3), replacing the antecedent in (2) with another (that denotes a different discourse referent, e.g., Mike) leads to a change in the meaning of pronominal expressions in question, accordingly.

(3)  a. Tom believes that Bill trusts him.  
   \[ \text{[him} = \text{Tom]} \]
   \[
   \begin{array}{llll}
   & \text{V} & & \\
   \text{[s NP V] Mike} & & & \\
   & & & \\
   & & & \\
   & & & \\
   & & & \\
   \end{array}
   \]

   b. Tom believes that Bill trusts himself.  
   \[ \text{[himself} = \text{Bill]} \]
   \[
   \begin{array}{llll}
   & \text{V} & & \\
   \text{[s NP V] Mike} & & & \\
   & & & \\
   & & & \\
   & & & \\
   & & & \\
   \end{array}
   \]

   This clearly reveals that the semantics of pronouns and reflexives are determined by and, hence, are dependent upon the antecedent.

   Another important characteristic worth noting regarding pronoun and reflexive is that the antecedent for a reflexive is usually in complementary distribution with the antecedent for a pronoun (Chomsky, 1981). As shown in (4), a reflexive typically selects an antecedent out of a set of potential candidate NPs inside the local domain (i.e., roughly, the immediate clause containing the reflexive). On the other hand, a pronoun picks up an antecedent from a set of
candidates located *outside* the local domain containing the pronoun. That is, antecedents for reflexive and pronoun do not usually overlap in their distribution.

(4)  

a. Michael admired \{him_1 | himself_i\}.

b. We made Michael fond of \{him_1 | himself_i\}.

c. Michael asked us to admire \{him_i | himself_1\}.

d. Michael made us fond of \{him_i | himself_1\}.

Although there are a few cases in which this antecedent complementarity for pronoun and reflexive does not apply (Pollard & Sag, 1992; Reinhart & Reuland, 1993; Sekerina, Stromswold, & Hestvik, 2004)\(^2\), the high distributional consistency and systematicity of pronoun/reflexive dependency (P/RD) allude to the existence of grammatical constraints that govern P/RD resolution. This has been successfully identified and formalized by the classic Binding Theory (5) and its analogues (Chomsky, 1981; Büring, 2005 for overview).

(5) Binding Theory (Chomsky, 1981)

a. Principle A: An anaphor is bound in its governing category.

b. Principle B: A pronominal is free in its governing category.

\(^2\) Examples where both pronoun and reflexive are acceptable are provided in (i):

(i)  

a. John believes that pictures of \{him|hishelf_i\} are on sale.
[cited from Büring, 2005]

b. The boy has placed the box behind \{him|hishelf_i\}.
[cited from Sekerina et al., 2004]
Along with the semantic dependence of pronouns and reflexives on their antecedents and the syntactic restrictions on the distribution of the antecedent, the morphological identity (or phi-feature match) between the items in the dependency relation also serves as an important constraint on P/RD formation. Consider the sentences in (6).

\((6) \quad \text{a. Tom}_i \text{ believes that Bill}_j \text{ always trusts } \text{him}_i^{u^*j}.\)
\(\text{a'. Tom}_i \text{ believes that Bill}_j \text{ always trusts } \text{her}_i^{u^*j}.\)
\(\text{b. Tom}_i \text{ believes that Bill}_j \text{ always trusts } \text{himself}_i^{u^*j}.\)
\(\text{b'. Tom}_i \text{ believes that Bill}_j \text{ always trusts } \text{herself}_i^{u^*j}.\)

Replacing him in (6a) and himself in (6b) with their feminine counterparts (her in (6a') and herself in (6b')) leads to ungrammaticality due to the gender phi-feature mismatch between potential antecedents and pronominal expressions. This indicates that morphology also matters in P/RD formation: pronoun and reflexive should establish a dependency with an antecedent that shares congruent morphological features.

Given the observations so far, it seems obvious that the P/RD is established based on diverse types of linguistic constraints: (i) syntactic constraints (e.g., Binding Theory) on the distribution of the grammatically-accessible antecedent and (ii) morphological feature match between antecedent and pronoun/reflexive. From this, a major empirical question naturally arises: *How does the human language processor access and apply these constraints in establishing P/RD dependency?*

To find answers to this question, we first need to carefully observe mental processes that underlie P/RD formation. A fundamental cognitive characteristic involved in P/RD formation is
that it requires the human language processor (hereafter, the parser) to access and navigate contents in memory (Cunnings & Felser, 2013; Dillon, 2014; Just & Carpenter, 1992; Lewis et al., 2006; McElree, 2000; Parker, Shvartsman, & Van Dyke, 2017; Van Dyke & Johns, 2012). As noted above, pronouns and reflexives typically form a dependency with a linearly preceding antecedent. Importantly, the antecedent itself, unlike wh-phrases in (1) (Fodor, 1978), does not cue the parser to expect its referential dependent to appear later in the input string. Therefore, the parser cannot actively and predictively construct P/RD upon encountering the antecedent (Parker & Phillips, 2017; Parker et al., 2017). The P/RD can be formed only at or after the encounter of the pronoun or reflexive (which linearly follows its antecedent typically).

(7)  

\[
\begin{align*}
\text{a.} & \quad [\text{TP ANTECEDENT}[\Phi] \quad [\text{T} \quad \ldots \quad [\text{TP} \quad \ldots \quad \text{PRONOUN}[\Phi] \quad ]] \\
\text{b.} & \quad [\text{TP} \quad \ldots \quad [\text{TP ANTECEDENT}[\Phi] \quad [\text{T} \quad \ldots \quad \text{REFLEXIVE}[\Phi]]]
\end{align*}
\]

This means that the antecedent appearing in the left-to-right speech stream is acoustically inaccessible at the very moment when the pronoun or reflexive (which occurs temporally later than the antecedent) is perceived. A similar (but qualitatively different) issue also comes up in the written context. That is, the antecedent is not immediately available for parsing when the pronoun or reflexive is read. Here, a question arises: _How does the pronoun/reflexive form a dependency with a previously heard or read (thus, currently imperceptible) antecedent?_ A
promising answer to this question can be found in the literature on the role of memory in language comprehension.

In the recent literature on memory and language comprehension, it has been proposed that the number of items immediately available for parsing is very small in amount, especially when sentence processing is not aided by the memory system (Cowan, 2010; McElree, 2006). For example, McElree (2006) argued that sentence processing operates under a highly limited focus of attention (FOA), which may be as small as just one or two items. In other words, only a small subset of representations in memory, which fall within the FOA, are immediately available for parsing. If this is the case and the parser receives no immediate support from the memory system, it cannot establish a proper dependency between the pronoun/reflexive and the antecedent. For instance, in a case like (8), the grammatical antecedent for himself is not immediately available when the reflexive is first encountered in the input stream (at \( t_{n+2} \)). This is so because the antecedent does not fall within the FOA at \( t_{n+2} \). This implies that, in order to form a dependency between non-adjacent items, the previously seen items (lying outside the FOA) should be stored in memory and the parser has to restore or retrieve them from there for subsequent parsing (e.g., the dependency construction at the encounter of the reflexive).

(8)
Therefore, when the parser (with a fairly limited processing capacity) attempts to resolve a P/RD, it must inevitably rely on memory retrieval operations to integrate an incoming pronoun or reflexive with its antecedent in memory. From this, one can make a conclusion that the success of comprehending sentences with pronouns or reflexives depends on how efficiently and accurately comprehenders retrieve dependent linguistic representations from memory (Alcocer & Phillips, 2012; Lewis et al., 2006; Parker & Phillips, 2017; Parker et al., 2017).

How does the parser access and retrieve the desired information (e.g., antecedent for pronoun or reflexive) in memory? Concerning this issue, two major accounts of memory retrieval have developed in the literature: (i) retrieval by a search process (Gillund & Shiffrin, 1984; Knuth, 1965; McElree & Dosher, 1993) versus (ii) retrieval by an associative direct access, content-addressable mechanism (Clark & Gronlund, 1996; McElree, Foraker, & Dyer, 2003; Parker et al., 2017, to name a few). Detailed explanations of these accounts will be provided in the next section.

The present dissertation limits its focus on the investigation of on/offline reflexive dependency (RD) formation and aims to contribute to the growing body of knowledge on the cognitive mechanisms responsible for building and resolving RD by exploring comprehension processes during reading of sentences with a reflexive. For this research, Korean reflexive caki ‘self’ was selected as a target linguistic construct because it is by far the most common and the most studied reflexive form in Korean. However, its psycholinguistic nature and relevant parsing mechanisms are still not well understood. Moreover, its morphological and syntactic properties enable relatively less-confounded tests of online RD formation and further allow us to explore various psycholinguistic issues involved in on/offline comprehension of the reflexive.
First of all, the strict verb-final character of Korean generates a better linguistic environment where the RD can be immediately established without the confounding effect of the verb during antecedent retrieval. In previous psycholinguistic studies on reflexives (mostly, done with English reflexives), target experimental sentences contained the reflexive appearing in the post-verbal position. See (9) for sample sentences.

(9)  

a. The boxer told the skier that the doctor for the team would blame himself for the recent injury. (Nicol & Swinney, 1989)  
b. He remembered that the surgeon had pricked himself with a used syringe needle. (Sturt, 2003)  
c. John thought that Bill owed himself another opportunity to solve the problem. (Badecker & Straub, 2002)

It has been argued that the post-verbal reflexive may be endowed with a privileged access to the local subject NP (the typical antecedent of a post-verbal reflexive) due to the latest activation of the local subject upon encountering the verb. Dillon, Mishler, Sloggett, & Phillips (2013) pointed out that if subjects are retrieved by verbs for thematic integration, the retrieved subject would maintain a high level of memory activation, from which the immediately following reflexive can benefit in initiating the antecedent search/retrieval process (King, Andrews, & Wagers, 2012; Kush & Phillips, 2014). Consequently, referential behaviors of the post-verbal reflexive reported in previous studies may not fully display exact (psycho-)linguistic characteristics of reflexive and relevant parsing mechanisms. On the other hand, in Korean, reflexives (including caki ‘self’) are pre-verbal; they always linearly precede verbs in both typical mono-clausal (10) and bi-clausal
contexts (11). Thus, when the reflexive is first encountered and processed, verbs cannot initially influence the retrieval process in which an antecedent for the pre-verbal reflexive is searched in memory. Consequently, investigation into real-time dependency formation of Korean reflexives can provide a relatively noise-free, and hence more genuine picture of the phenomenon in question.

(10) a. 철수는 자기를 추천했다.
Chelswu-nun caki-lul chwuchenhay-ss-ta
C.-TOP self-ACC recommend-PST-DC
‘Chelswu recommended himself.’

b. 공원에서 철수가 순이에게 자기의 코트를 건넸다.
kongwen-eyse Chelswu-ka Swuni-eykey caki-uy kothu-lul kenney-ss-ta
park-LOC C.-NOM S.-DAT self-GEN coat-ACC pass-PST-DC
‘Chelswu gave Swuni self’s coat in the park.’

(11) 철수는 민수가 자기를 추천했다고 말했다.
Chelswu-nun Minswu-j-ka caki-j-lul chwuchenhay-ss-tako malhay-ss-ta
C.-TOP M.-NOM self-ACC recommend-PST-COMP say-PST-DC
‘Chelswu said that Minswu recommended self.’

3 In (11), caki can grammatically co-refer with a nonlocal antecedent (e.g., Chelswu in (11) above) as well as a local antecedent (Minswu in (11)), thereby creating a referential ambiguity (Cho, 1994; Gill, 1999; Han & Storoshenko, 2012; Kang, 2001; Kim, 2000; Sohng, 2004; Yoon, 1989). More detailed discussions on linguistic properties of caki and its comprehension will be provided in Chapter 2.
Second, *caki*’s peculiar syntactic characteristic that it can grammatically refer to a *nonlocal* antecedent (outside the local clause containing the reflexive, as seen in (11) and (12a)) provides us with an opportunity to understand the role of positional or structural cues in the RD resolution. More specifically, it allows us to study whether (and, if so, how) the linear or hierarchical distance between antecedent and reflexive can affect memory retrieval (i.e., locality effect), something which has not been actively discussed in previous studies on online RD formation (Chen, Jäger, & Vasishth, 2012; Dillon et al., 2014). As will be shown in Chapter 5 of this dissertation, findings from this line of study can serve as an important determinant in identifying how the parser accesses and retrieves information in memory.

(12) a. **Nonlocal antecedent:** \([TP_1\text{-TOP} \quad TP_2\text{-NOM} \ldots self_{ij} \ldots] \ldots\]

\begin{tabular}{l}
피고는  \\
phiko-nun  \\
television-reporter-TOP  \\
the accused-TOP  \\
신상정보를  \\
sinsangcengpo-lul
\end{tabular} \\
한  \\
han  \\
news media-NOM  \\
a  \\
유출했다고  \\
yuchwulhay-ss-tako  \\
argue-PST-DC

\begin{tabular}{l}
언론매체가  \\
enlonmaychey-ka  \\
on purpose  \\
ob  \\
주장했다  \\
kwacanghay-ss-ta.
\end{tabular} \\
고의로  \\
kouyo  \\
on purpose  \\
self-GEN

‘The accused argued that a news media leaked his personal information on purpose.’ (*caki* = *phiko* ‘the accused’)

b. **Local antecedent:** \([TP_1\text{-TOP} \quad TP_2\text{-NOM} \ldots self_{ij} \ldots] \ldots\]

\begin{tabular}{l}
피고는  \\
phiko-nun  \\
television-reporter-TOP  \\
the accused-TOP  \\
신상정보를  \\
sinsangcengpo-lul  \\
personal info-ACC  \\
‘The accused argued that a news media leaked his personal information on purpose.’ (*caki* = *phiko* ‘the accused’)
\end{tabular} \\
한  \\
han  \\
news media-NOM  \\
a  \\
유출했다고  \\
yuchwulhay-ss-tako  \\
argue-PST-DC

\begin{tabular}{l}
언론매체가  \\
enlonmaychey-ka  \\
on purpose  \\
ob  \\
주장했다  \\
kwacanghay-ss-ta.
\end{tabular} \\
고의로  \\
kouyo  \\
self-GEN

\[Caki\text{ co-refers only with an “animate” antecedent. Thus, in (12a), } caki \text{ forms a dependency only with an animate matrix subject } phiko \text{ ‘the accused’, but not with a (local) embedded subject } enlonmaychey \text{ ‘news media’ which is inanimate. The reverse is found in (12b).}\]
한 언론매체는 피고가 고의로 자기의 신상정보를 유출했다고 주장했다.

A news media argued that the accused leaked his own personal information on purpose. (caki = phiko ‘the accused’)

Finally, in the theoretical literature, several attempts have been made to find an adequate theoretical explanation of the referential properties of reflexives in Korean, especially, of the morphologically-simple reflexive *caki* ‘self’ (Cho, 1994; Gill, 1999; Han & Storoshenko, 2012; Kang, 2001; Kim, 2000; Sohng, 2004; Yoon, 1989). However, few empirical studies have been conducted to explore the cognitive mechanisms involved in the reference resolution of Korean reflexives (Han, Storoshenko, Leung, & Kim, 2015; Han, Storoshenko, & Walshe, 2011; Kim, Montrul, & Yoon, 2009). It is still unclear how *caki* is processed in real time and whether and how different sources of linguistic information (e.g., morphological features, discourse saliency, word order, etc.) can influence the reflexive reference resolution in various linguistic contexts. This dissertation attempts to fill this gap by addressing these empirical issues.

In the chapters that follow, I will show that when the parser forms a dependency between *caki* and its antecedent, various kinds of linguistic constraints or factors can come into play. Furthermore, I will argue that the data obtained from a series of on/offline experiments in this
dissertation are better explained by a memory model which assumes that retrieval occurs through a cue-based direct-access retrieval mechanism.

1.2 Memory retrieval in sentence comprehension


(13) a. The reporter disliked the editor.

b. The reporter who the senator who John met attacked disliked the editor.

[Cited from Gibson, 2000]

Adopting Baddeley’s WM Model (Baddeley, 2000; Baddeley & Hitch, 1974), these studies commonly presumed that the amount of information retained actively in memory, i.e., memory capacity, decreases as the complexity of the sentence increases, or vice versa, because both memory and computation are believed to be supported by a single, limited pool of cognitive resources\(^5\). If the absolute amount of information required for successful comprehension (i.e.,

\(^5\) According to the WM Model, each individual differs in the total capacity of resource pool, which leads to individual differences in sentence comprehension. Some may have a relatively large total capacity of resources, but others may not. Individuals with low total capacity may more likely suffer comprehension difficulties than those with high total capacity, especially
computational load) exceeds the current WM capacity, this eventually results in comprehension breakdown, possibly due to the loss of inactive information and/or impaired (syntactic or semantic) processing. Let us consider (13) again, for example. According to this memory capacity approach, (13b) is correctly predicted to be more difficult to process than (13a). In (13b), processing intervening relative clauses (underlined) while keeping the initial NP the reporter active in WM significantly increases computational load, which in turn reduces the WM capacity. As a result, the initial NP is pushed out of the active WM space to undergo memory loss through decay even though it must be re-accessed later for thematic and syntactic integration at the main verb disliked. Such decayed (inactive) information is extremely difficult to be retrieved. Thus, the comprehender would experience processing difficulty or even failure in case the inactive information is lost. Reversely, a sentence can be interpreted without difficulty if its required propositions, interpretation, and/or syntactic structure can be maintained actively in memory. On this view, the success of sentence comprehension is highly dependent upon how much necessary information comprehenders can keep active in WM for subsequent parsing.

However, a growing body of recent studies have shown that the amount of active memory immediately available during (incremental) sentence processing is extremely limited, i.e., a size of only one or two words (Cowan, 2010; McElree, 2006), which makes the role of memory retrieval in sentence comprehension especially significant. On the contrary, this renders insignificant the previous struggles of researchers to measure and show the size of WM capacity and its individual variation (McElree, 2006; McElree et al., 2003; Parker et al., 2017; Van Dyke, Johns, & Kukona, 2014). What matters more is to determine how comprehenders retrieve information from memory, not how large the memory capacity is. This also suggests that the
success of sentence comprehension highly depends on how well and effectively comprehenders can gain access to and retrieve necessary information from memory.

Nowadays, the main focus of research on memory and sentence comprehension has moved from issues of memory capacity to issues of memory encoding and retrieval. Relevant major research questions include:

(i) *How is a linguistic input encoded and retrieved from memory?*

(ii) *What cognitive mechanisms are responsible for memory retrieval?*

Regarding memory retrieval mechanisms, two distinct theoretical approaches have gained visibility and attracted attention in the literature: *serial search* (Berwick & Weinberg, 1986; Gillund & Shiffrin, 1984; McElree et al., 2003) and *direct-access, content-addressable retrieval* (Lewis et al., 2006; McElree et al., 2003; Van Dyke & Johns, 2012; Van Dyke et al., 2014; Wagers et al., 2009).

1.2.1 Serial Search (SS) approach

According to the SS approach to sentence comprehension, a memory item is accessed by its *location*. More specifically, desired information in memory (i.e., retrieval target) is searched and retrieved via sequentially iterative (node-by-node) analysis and evaluation of the contents of hierarchically-structured memory representations, employing structural and/or relational
information such as dominance relations between nodes, syntactic categories, and dependency relations⁶ (cf. Figure 1.1).

![Figure 1.1 Schematic demonstration of SS process](image)

An important advantage of this approach is that memory access and retrieval are structure-guided, which allows the parser to selectively access and retrieve a target memory item in a specific structural position, in accordance with grammatical principles (e.g., principles of agreement or reflexive binding). Such structure-guided memory search is carried out until the retrieval target (i.e., a match to retrieval trigger/probe) is found, without the risk of retrieving a similar or compatible memory item in an irrelevant position (Knuth, 1965). For example, when a reflexive pronoun like *himself*, which should form a dependency with a preceding antecedent NP, is encountered in a sentence like (14), the parser is expected to initiate structure-guided memory search, based on the grammatical information available (including Binding Condition A).

⁶ Here the term *content* refers to the inherent linguistic characteristics of a previously encoded individual item in memory, such as its syntactic category label (e.g., NOUN, etc.), grammatical function (e.g., SUBJECT, etc.), lexical features (e.g., GENDER, NUMBER, PERSON, and ANIMACY), and Case (e.g., NOMINATIVE, ACCUSATIVE, etc.).
(14) [The soldier who the reporter met yesterday], criticized himself.

If the structural representation of the sentence is properly encoded in memory, the parser can securely retrieve the desired c-commanding antecedent (the soldier who the reporter met yesterday), as illustrated in Figure 1.2. Under this SS mechanism, the potential antecedent the reporter in the embedded relative clause can never be accessed and retrieved because it is ruled out by the grammar (binding constraint). Thus, a grammatically inaccessible antecedent in an irrelevant structural position does not cause interference during memory retrieval.

![Figure 1.2 Structured memory representation of (14)](image)

(The dotted arrows indicate the path of serial search)

Although the systematic, rule-governed, avoidance of interference can enhance retrieval accuracy, this approach has a disadvantage that the speed of memory retrieval can slow down as the target-trigger distance (or the number of pairwise memory comparisons/evaluations required to find the retrieval target) increases. Let us consider sentences in (15) for example.
In (15), the displaced NP *the scandal* must be retrieved from memory for syntactic and semantic integration when the verb *relished* is encountered. The SS approach predicts that the retrieval time (measured at the retrieval trigger) would be longer in (15b) than in (15a) because the linear (and also hierarchical) distance between the target *the scandal* and the trigger *relished* is larger in (15b) than in (15a). To put it differently, more nodes should be passed through and hence, it takes more time to access the target memory item in (15b) than in (15a).

However, several recent studies have consistently reported that memory search is implemented in *constant* time, regardless of the distance between the retrieval target and the trigger (i.e., no difference in retrieval time between (15a) and (15b); cf. Lewis & Vasishth, 2005; Lewis et al., 2006; McElree et al., 2003; Van Dyke & McElree, 2011). This finding is often interpreted as indicating that the target item is accessed directly in memory without structure-guided analysis of memory representation. The next section discusses another memory search mechanism, which has recently received growing attention in research on memory and sentence comprehension, namely the *direct-access, content-addressable retrieval* approach.

### 1.2.2 Direct-access, content-addressable retrieval (DCR) approach
The DCR approach assumes that memory retrieval is direct (not mediated) and content-addressable (Clackson & Heyer, 2014; Lewis & Vasishth, 2005; Lewis et al., 2006; McElree, 2000, 2006; McElree et al., 2003; Patil, Vasishth, & Lewis, 2016; Sekerina, Campanelli, & Van Dyke, 2016; Van Dyke & McElree, 2011). In this approach, memory search is conducted using the contents of memory items, but not using their location or structural position in memory representation, hence, *content-addressable*. This content-addressability of the model in question enables *direct access* to each individual memory item in parallel. Under these operating algorithms (content-addressability and direct-accessibility), a given item in memory is determined to be retrieved if its content features match the features of the retrieval trigger (i.e., retrieval cues), as schematically illustrated in Figure 1.3.

**Figure 1.3 Direct-access, content-addressable memory retrieval:**

Each feature of Item C (retrieval trigger) is matched simultaneously against each feature of all previously encoded memory items A and B. In this case, Item A{ab} is retrieved for subsequent parsing at Item C due to
its full feature match with retrieval cues \{ab\}. Item B\{bc\} is less likely to be retrieved because it only partially matches Item C.

Crucially, direct accessibility to items in memory ensures fast and constant-time implementation of memory retrieval (i.e., retrieval speed is fast and constant), which is desirable given that sentence processing is highly fast and incremental. Unlike the SS approach, the distance between the retrieval target and trigger (or the amount of information that needs to be structurally searched through) does not influence retrieval speed.

However, this approach is not without limitations: the retrieval process is prone to interference. As noted above, DCR allows direct, content-addressable access to items in memory, without taking into account their structural positions. This opens up the possibility that multiple memory items (even including item(s) irrelevant to the current processing task) may be considered as potential retrieval candidates if they sufficiently match retrieval cues. ⁷ Consequently, the likelihood of retrieving a target item may be reduced due to the interference of other similar distractors during retrieval (cf. Figure 1.4A). It is even possible that a grammatically-inaccessible item in an irrelevant position may be retrieved due to its near resemblance to the retrieval target (or retrieval cues), which leads to comprehension breakdown (cf. Figure 1.4B).

---

⁷ When multiple items in memory are associated with retrieval cues, the cue is called overloaded (Watkins & Watkins, 1975). Cue overload is a primary source of interference.
Figure 1.4 Interference during memory retrieval:

In structure [A], both A{abc} and B{bcd} match the retrieval cue C{bc}. Therefore, it is possible that retrieving A (to form a dependency with C) may be interfered with by B (which is also a grammatical retrieval candidate for C).

In structure [B], A is the only grammatical item that can form a dependency with C because the grammar typically prohibits C from forming a dependency with an item (e.g., B) in a syntactic island (e.g., relative clause). However, content-addressable retrieval allows access to an item inside an island. In other words, B is retrievable although it is a grammatically-inaccessible item.

Summary: Serial search vs. Direct-access, content-addressable retrieval

As discussed thus far, SS and DCR approaches exhibit quite different profiles regarding memory access and retrieval mechanisms. In the SS approach, items in memory are accessed by the structure-guided search process in which each individual node of a hierarchically structured
memory representation is evaluated in sequence until the target item matching the retrieval trigger is found. This search mechanism makes it easy for the parser to avoid interference from similar distractors. Therefore, it retains high accuracy in memory retrieval. However, search/scan time increases as the distance between retrieval target and trigger increases.

On the other hand, in the DCR approach, items in memory are contacted directly and simultaneously for retrieval, based on their content, not on their location. As a result, retrieval speed is fast and constant because it is not affected by the target-trigger distance. However, this strong advantage comes with a price: direct-access operations cannot avoid interference from other similar distractors, unlike the SS approach. Retrieval accuracy is predicted to decrease with an increase in the number of potential retrieval candidates sufficiently matching retrieval cues.

Importantly, contrasting predictions made by these two models with respect to retrieval speed and interference (cf. (16)) can be used as a diagnostic tool to examine which type of retrieval process is utilized in sentence comprehension.

(16) Model predictions:

<table>
<thead>
<tr>
<th></th>
<th>SS</th>
<th>DCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. Interference</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>b. Retrieval time</td>
<td>non-constant</td>
<td>constant</td>
</tr>
</tbody>
</table>

Several studies have reported empirical evidence in support of these predictions, using various types of sentences (e.g., relative clauses, cleft sentences, etc.) involving agreement/dependency between component constituents (e.g., subject-verb agreement, filler-gap dependency, antecedent-reflexive dependency, etc.). In the next section, I focus on discussing empirical
findings from the literature on reflexive pronouns and their dependency resolution, where mixed results have been reported.

1.3 Reflexive dependency resolution: empirical evidence

Several empirical studies on reflexive dependency formation have been devoted to investigating whether grammatical constraints like Principle A of Binding Theory (BT-A) is applied exclusively at an initial stage of sentence comprehension and can effectively serve as a filter to discriminate between grammatically accessible and inaccessible potential antecedents during memory search and retrieval (Badecker & Straub, 2002; Chen et al., 2012; Dillon et al., 2014; Nicol & Swinney, 1989; Parker & Phillips, 2017; Sturt, 2003). In this section, I discuss key findings from relevant processing studies that can shed light on the cognitive processes underlying memory retrieval.

1.3.1 Evidence: Structure-guided serial search in reflexive dependency formation

In the SS model, memory items are accessed using structural information, observing relevant grammatical constraints. Under this view, it is predicted that if the syntactic representation of a sentence is correctly encoded in memory, the parser would easily and accurately retrieve the grammatically correct antecedent of the reflexive by aid of grammatical constraints such as BT-A. Crucially, this means that a given memory item in a grammatically inaccessible position will
never be retrieved because it is ruled out by the grammar. Hence, no interference from other similar distractors is expected to emerge during memory retrieval. Only the grammatically accurate retrieval is allowed.

Several early studies have provided empirical evidence to support this prediction (Clifton, Frazier, & Deevy, 1999; Nicol, 1988; Nicol & Swinney, 1989). For example, Nicol (1988) tested whether the memory retrieval process is influenced by interference from grammatically inaccessible antecedents, using a cross-modal lexical priming (CMLP) paradigm. In the experiment, participants listened to sentences like (17) and were asked to make lexical decisions for (non)word items which were presented visually right after himself in (17).

(17)  

a. The boxer told the skier that the doctor for the team would blame himself* for the recent injury.  

b. The janitor told the landlord that the fireman with the gas mask would protect himself*.

She found that reaction times (RTs) to make lexical decisions were significantly faster when visual items (words) were semantic associates (e.g., nurse) of the embedded subject doctor, than when they were control words (semantically unrelated to doctor), i.e., priming effect. On the other hand, this priming effect was not found in conditions where semantic associates of NPs boxer and skier were visually presented at the asterisk. She interpreted these results as indicating that the syntactic constraint BT-A was applied immediately on antecedent retrieval such that only a grammatically accessible antecedent was retrieved at the reflexive. Other potential antecedents such as boxer and skier (placed outside of the local domain with the reflexive) were
never retrieved because they were ruled out by BT-A. This finding was further supported by another CMLP experiment carried out using sentences like (18), where the embedded clause contained a pronoun (e.g., \textit{him}).

(18) a. The boxer told the skier that the doctor for the team would blame \textit{him} * for the recent injury.
   
b. The janitor told the landlord that the fireman with the gas mask would protect \textit{him} *.

Results revealed no priming effect for the embedded subject \textit{doctor} but significant priming for both the matrix subject \textit{boxer} and the matrix indirect object \textit{skier} (located outside the embedded clause containing the pronoun). These findings were interpreted as showing that antecedent retrieval for pronoun \textit{him} obeyed a relevant grammatical constraint such as Principle B of Binding Theory. Furthermore, the lack of a priming effect for the NP \textit{doctor} also suggests that the priming effect found in (17) was not merely due to the recency of the embedded subject to the reflexive. Taken together, the empirical findings reported in Nicol (1988) show that the parser can accurately retrieve all and only grammatically accessible antecedents under the full supervision of relevant syntactic constraints (e.g., BT-A). Irrelevant retrieval candidates are ignored and never retrieved. In addition, given the finding that the embedded subject NP (\textit{doctor}) was re-activated only when the embedded clause contained the reflexive, but not when it had the pronoun, it seems that an antecedent of a reflexive is not actively maintained in memory. It is passively reactivated or retrieved from memory only upon encountering a reflexive in the input string.
Clifton et al. (1999) (Experiment 1 and 2) also reported similar results with sentences, like (19), manipulated for subject complexity (simple [N] vs. complex [N \textit{of/with} N]) and the type of direct object (reflexive vs. proper noun).

(19) a. The son (of the fireman) | hurt \textit{himself} | in a bad accident. \\
    \hspace{1cm} \text{REGION 1} \hspace{1cm} \text{REGION 2} \hspace{1cm} \text{REGION 3} \\

b. The son (of the fireman) | hurt \textit{Fred} | in a bad accident.

Using the phrase-by-phrase self-paced reading paradigm (region boundaries indicated by ‘|’), they investigated whether antecedent-reflexive dependency is established via the direct, structure-independent feature matching between antecedent and reflexive. If the dependency is formed by direct feature matching (as assumed in the DCR approach), both NP heads son and fireman should be activated in (19a) upon encountering the reflexive himself even though only the NP son (i.e., the head of the complex NP) is grammatically accessible (due to BT-A). This is so because they share common features such as syntactic category (\textit{noun}), gender (\textit{masculine}), number (\textit{singular}), person (3\textsuperscript{rd} person), and animacy (\textit{human}). It was predicted that the grammatically inaccessible NP fireman (activated in memory) should compete with the grammatically accessible NP son for selection as antecedent (i.e., interference effect). Thus, Region 2 of (19a) (i.e., VP with a reflexive; interference condition) should be slower in RTs than the same region of (19b) (i.e., VP without a reflexive; non-interference condition). Results showed that, unlike the prediction, (19a) was read significantly faster than (19b) in Region 2, possibly due to the introduction of more discourse referents in (19b) than in (19a). Crucially, no interaction effect was found between subject complexity and object form. Based on these results,
they concluded that an NP between the head of the subject and the reflexive does not interfere with binding the reflexive (or during memory retrieval).

Since the studies discussed above, several other empirical studies have been conducted, using various experimental techniques with higher resolution (e.g., eye-tracking, ERP, etc.) and have consistently reported evidence for the *early* application of BT-A in the processing of sentences with a reflexive, suggesting that grammatically inaccessible antecedent(s) may not be considered at all during antecedent retrieval (cf. Dillon, 2014, for overview). In a widely cited study, Sturt (2003) investigated the role of binding constraints in the real-time processing of sentences with a reflexive, as in (20) (Experiment 1).

(20)  *Jonathan* was pretty worried at the City Hospital.

a. He remembered that the surgeon had pricked *himself* with a used syringe needle.

b. He remembered that the surgeon had pricked *herself* with a used syringe needle.

There should be an investigation soon.

*Jennifer* was pretty worried at the City Hospital.

c. She remembered that the surgeon had pricked *himself* with a used syringe needle.

d. She remembered that the surgeon had pricked *herself* with a used syringe needle.

There should be an investigation soon.

As seen in (20), Sturt manipulated (i) *gender match of reflexive with accessible antecedent* ‘surgeon’ (match vs. mismatch) and (ii) *gender of inaccessible antecedent* (male vs. female), yielding four experimental conditions (21).
(21) a. [accessible-match /inaccessible-male]: [He (=Jonathan) … [surgeon … himself]]
b. [accessible-match /inaccessible-female]: [She (=Jennifer) … [surgeon … himself]]
c. [accessible mismatch/inaccessible-male]: [He (=Jonathan) … [surgeon … herself]]
d. [accessible mismatch/inaccessible-female]: [She (=Jennifer) … [surgeon … herself]]

For gender manipulation of accessible antecedent, he used nouns with stereotypical gender (e.g., surgeon tends to be associated with male representation whereas nurse with female). In the experiment, participants were asked to read sentences like (20) while their eye movements were recorded. It was predicted that, if the structural information (e.g., BT-A) is the only information available during antecedent retrieval, as argued in previous studies, no early gender effect for the inaccessible antecedent should be found. Sturt found that initial RTs for the reflexive were significantly influenced by the gender manipulation of the reflexive (to put it differently, whether the reflexive matches the accessible antecedent surgeon in the gender feature), but not by the gender manipulation of an inaccessible antecedent. He interpreted these findings as suggesting that the parser does not consider a grammatically inaccessible antecedent (in a structurally inaccessible position – i.e., where it cannot c-command the reflexive) at the early stages of reflexive dependency resolution. That is, there was no interference effect of a grammatically inaccessible antecedent, which is consistent with the predictions made by the structure-guided SS model.

More recently, Dillon et al., (2014) reported additional piece of time-course evidence that supports the use of a structure-guided search algorithms in establishing antecedent-reflexive
dependencies. Using a speed-accuracy tradeoff (SAT) paradigm\(^8\), they investigated the Mandarin Chinese reflexive *ziji* ‘self’, often called a *long-distance anaphor* due to its ability to form a dependency with an animate, sentient, nonlocal antecedent, as in (22) (Cole, Hermon, & Huang, 2001; Cole, Hermon, & Sung, 1990; Huang & Liu, 2001).

\[(22)\]  
\[\text{Zhangsan}_i \text{ renwei } \text{Lisi}_j \text{ zhidaow Wangwu}_k \text{ xihuan } \text{ziji}^{i/j/k}\]  
\[\text{Zhangsan think Lisi know Wangwu like self}\]  
\[\text{‘Zhangsan thinks Lisi knows Wangwu likes self.’} \quad [\text{ziji} = \text{Zhangsan, Lisi, or Wangwu}]\]

Using sentences in (23), they tested whether the locality of potential antecedents can affect the processing of the reflexive *ziji*. If the positional or structural information of potential antecedents is used during antecedent retrieval, as assumed in the SS model, processing advantage (e.g., faster RT) should be found when the reflexive in question refers to a local antecedent in the same clause because the local dependency would be easier to parse than the nonlocal dependency (i.e., locality effect). On the other hand, if the direct-access retrieval mechanism, which does not take into account positional properties of retrieval targets, is used for antecedent retrieval, the locality

---

\(^8\) In certain circumstances, we often attempt to spend more time to increase the accuracy of task performance. But, in other situations, we deliberately shorten response time at the cost of reducing the accuracy or quality of responses. This kind of inverse relationship between speed and accuracy has been described as the *speed-accuracy tradeoff* (SAT) (Martin & McElree, 2009; McElree, 2000; McElree, Foraker, & Dyer, 2003).

In psycholinguistic studies using the SAT paradigm, participants are typically asked to make binary sensicality judgments (*Accept* vs. *Reject*) at pre-designated time points after the onset of an item that triggers dependency formulation (e.g., reflexive). An important advantage of the SAT method is that it can effectively separate (i) speed of processing and (ii) accuracy of responses into two independent factors. In the standard reading time experimental methods (e.g., self-paced reading paradigm), RTs (averaged dependent variables) are confounded in that they conflate differences between processing speed and comprehension accuracy into a single mean value.
effect should not emerge (i.e., constant retrieval speed regardless of antecedent’s syntactic position).

(23)  a. **Long-distance animate ziji**

Coach Zhang, say [that report${}_{ij}$ (when team not perform well-time) underestimate ziji${}_{ij}$]

‘Coach Zhang says that that report underestimated *self* [=coach Zhang] when the team was doing poorly.’

b. **Local animate ziji**

Auto-biography, say [coach Zhang${}_{ij}$ (when team not perform well-time) underestimate ziji${}_{ij}$]

‘The auto-biography says that coach Zhang underestimated *self* [=coach Zhang] when the team was doing poorly.’

The SAT results revealed a time-course advantage for sentences with a local antecedent (23b), compared to those with a nonlocal antecedent (23a). One possible explanation of this fact, they proposed, is as follows: the parser spends more time establishing a nonlocal dependency because the nonlocal dependency can be formed only when it fails to find an antecedent in a local domain (e.g., an immediate local clause with a reflexive). In other words, the parser initially attempts to form a dependency with a *local* antecedent (i.e., local antecedent advantage). However, if there is no available antecedent in the local domain, then the parser tries to find other possible antecedents in the *nonlocal* domain. If true, this can be taken as evidence for the parser’s preference or bias for local syntactic dependencies and for the use of the serial search mechanism during retrieval.
1.3.2 Evidence: Direct-access, content-addressable retrieval

Although a considerable amount of empirical evidence shows that only a grammatically accessible antecedent can be accessed and retrieved upon encountering a reflexive, a growing body of research has converged on a consensus that a memory item is retrieved using the DCR mechanism. That is, a target memory is directly accessed, based on the cue(s) available at the time of retrieval. Here, the cues that the parser can rely on for retrieval may include various types of lexical features (e.g., phi-features) of the retrieval trigger and/or grammatical constraints that regulate memory retrieval processes. If multiple memory items exist that partially (or fully) match a retrieval trigger/probe in features, the best feature-matching item is eventually selected among them (Dillon, 2011; Hofmeister, 2007, 2011; Lewis & Vasishth, 2005; McElree, 2000; Sekerina et al., 2016; Van Dyke & Johns, 2012; Van Dyke & McElree, 2011).

Under this approach, antecedent-reflexive dependency formation can be viewed as a cognitive computational process in which, using cues available at the time of retrieval (i.e., at the point of encountering a reflexive), the parser directly accesses previously-encoded potential antecedents in memory that match the reflexive in features. Here, the retrieval cues include the reflexive’s inherent lexical features (e.g., person, gender, number, and animacy) and a syntactic constraint like BT-A. However, as noted above, this memory search mechanism is prone to interference from distractors (e.g., in the case of reflexive dependency, a non-c-commanding NP that matches the reflexive in features). There are some empirical studies that reported significant interference effects from grammatically inaccessible antecedents (Badecker & Straub, 2002;
For example, using a self-paced reading experimental paradigm, Badecker and Straub (2002) tested whether a grammatically inaccessible antecedent that matches the reflexive in non-syntactic features (e.g., gender, etc.) can cause interference during reflexive dependency formation in sentences like (24).

(24)  

a. Jane thought that Bill owed himself another opportunity to solve the problem.  

b. John thought that Bill owed himself another opportunity to solve the problem.

In (24), the reflexive *himself* grammatically co-refers with the embedded subject *Bill*, but not with the nonlocal matrix subject *Jane* in (24a) or *John* in (24b). Here note that the matrix subject *John* in (24b) matches the reflexive in non-syntactic features: gender [masculine], person [3rd person], number [singular], and animacy [animate]. On the other hand, the matrix subject *Jane* in (24a) does not match the reflexive in gender. Thus, if a memory item can be accessed based on non-syntactic cues (as well as syntactic constraints such as BT-A), it can be reasonably predicted that a similarity-based, inhibitory, interference (i.e., longer RTs) would occur at the reflexive in (24b) due to competition for selection between feature-matching potential candidates (*John* and *Bill*), but not in (24a). However, if the parser is blind to non-syntactic cues during memory retrieval, RTs at the reflexive would not differ between (24a) and (24b) because of lack of interference in (24b).

They found significantly slowed RTs (i.e., interference effects) at the reflexive (more precisely, at the second word following the reflexive) when the lexical features of the
grammatically inaccessible matrix subject were identical to those of the reflexive (24b). They interpreted this finding as supporting evidence for the use of the direct-access, content-addressable retrieval mechanism during antecedent retrieval.

More recent evidence on retrieval interference can be found in Parker & Phillips, 2017. A number of previous studies have consistently observed that reflexive dependency is immune to the so-called attraction effect, a type of similarity-based interference, whereas other types of linguistic dependency such as subject-verb agreement, negative polarity item (NPI) licensing, or VP-ellipsis are vulnerable to attraction (or facilitatory interference) from other distractors in a sentence (Dillon et al., 2013; Parker & Phillips, 2017; Wagers et al., 2009; Xiang, Dillon, & Phillips, 2009). Although lack of attraction for reflexives has been taken in the literature as indicating that antecedent retrieval for reflexives is guided by structural cues and not by non-syntactic cues, this can also be explained from different theoretical perspectives. That is, such

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9 The literature on memory retrieval in sentence comprehension has identified two different types of interferences: facilitatory vs. inhibitory interference. The facilitatory interference, also known as attraction is often observed in ungrammatical contexts where both retrieval target and distractor do not perfectly match retrieval cues, as in (i) (cited from Wagers, Lau, & Phillips, 2009).

(i) a. *The key to the cell unsurprisingly were rusty from many years of disuse.
   b. *The key to the cells unsurprisingly were rusty from many years of disuse.

Wagers et al. (2009) found higher acceptance rates and faster RTs (i.e., eased processing) after verb were in (ib) (with plural distractor cells) than in (ia) (with singular distractor cell).

The existence of a grammatically-inaccessible but partially feature-matched distractor (cells in (ib)) can temporarily mislead comprehenders into falsely considering an illegal dependency/agreement (cells–were) as being well-formed (this phenomenon is also often described as illusion of grammaticality; cf. Phillips, Wagers, & Lau, 2011, for more discussions). On the other hand, the inhibitory interference is often found in contexts with multiple feature-matching retrieval candidates, as in (24b) above, and has a defining behavioral signature, i.e., increased processing difficulty (reflected in longer RTs) at the point of retrieval due to interference from a grammatically-inaccessible potential candidate that matches retrieval cues.
contrasting retrieval profiles may result from the fact that the parser can actually access both structural and morphological cues during retrieval, but different linguistic dependencies have distinct retrieval preferences for weighting of available cues at retrieval, especially regarding morphological cues. For example, as for the reflexive dependency, syntactic cues may be prioritized over non-syntactic cues during retrieval. Thus, the parser first attempts to retrieve an antecedent that satisfies relevant syntactic restrictions, among possible retrieval candidates. On the other hand, for agreement dependency, all available cues are set to be equally weighted, which increases the likelihood of retrieving a grammatically-inaccessible, but (fully or partially) feature-matched antecedent in the structurally irrelevant position. If the latter theoretical approach holds true, it is possible to say that previous studies failed to find a reflexive attraction effect because they did not deploy “antecedent-reflexive mismatches” strong enough to produce an effect (most studies used 1-feature mismatch in gender or number). If the reflexive and the retrieval target mismatch in “multiple” features (e.g., 2-feature mismatch), reflexives should be more susceptible to attraction, just like the case in agreement dependency.

Using sentences like (25), Parker et al. tested this hypothesis by manipulating (i) the degree of feature mismatch between reflexive and target antecedent (e.g., 1-feature mismatch ‘schoolboy-herself’ versus 2-feature mismatch ‘memo-herself’) and (ii) the gender of a grammatically-inaccessible distractor (match ‘librarian-herself’ vs. mismatch ‘father-herself’).


The strict {librarian/father} said that the studious schoolboy reminded herself about the overdue book.

b. 2-feature target mismatch [in gender & animacy] / distractor (mis)match
The strict \{librarian/father\} said that the brief memo reminded herself about the overdue book.

Three eye-tracking while reading experiments consistently found that the attraction (or facilitatory interference) did not arise in the 1-feature mismatch conditions, like in other previous studies. On the other hand, it arose in the 2-feature mismatch conditions. Based on these findings, they concluded:

“reflexives are indeed susceptible to attraction, but only selectively, […] when the target subject is an especially poor match to the retrieval cues at the reflexive, retrieval is sensitive to items that are grammatically irrelevant for the purpose of dependency formation” (pp.284).

These results clearly show that both reflexive and agreement dependencies utilize the same memory access mechanism, i.e., (cue-based) direct-access retrieval, that allows the parser to access both structural and non-structural cues during retrieval and use them to retrieve a target in content-addressable memory.

In this section, I reviewed evidence regarding the nature of memory retrieval mechanisms in comprehension of sentences with reflexives: serial, structure-guided search versus cue-based, content-addressable direct-access retrieval. As discussed in the current section, the literature has witnessed mixed results: several studies reported evidence for the early and exclusive use of structural cues (such as BT-A) during antecedent retrieval. On the other hand, other studies showed that antecedent retrieval uses cue-based search algorithms that permit the parser to simultaneously access multiple retrieval candidates. Furthermore, in more recent studies (e.g,
Parker & Phillips, 2017), it is clearly shown that the reflexive dependency employs the same retrieval mechanism as other linguistic dependencies (e.g., subject-verb agreement) that have been known to be resolved via the operation of cue-based direct-access retrieval.

In the present dissertation, I report on data obtained from a series of empirical experiments (acceptability judgment and self-paced reading) that investigated on/offline reference resolution of Korean mono-morphemic reflexive \textit{caki} ‘self’. Based on the findings from these experiments, I argue that the antecedent-reflexive dependency in Korean is established using the cue-based, content-addressable, direct-access retrieval mechanism. Before I provide detailed explanations about the experiments and results, I first discuss in the next chapter the linguistic properties of the reflexive \textit{caki} that are relevant for the purposes of this dissertation.
2 Korean reflexive caki: its linguistic properties and comprehension

2.1 Inventory of reflexives in Korean

English possesses only one morphological type of reflexive, i.e., the bi-morphemic reflexives (pronoun + self; e.g., himself, herself, themselves, etc.). On the other hand, Korean has both morphologically simple and complex reflexives in its lexical inventory (Sohn, 1999), as shown in Table 2.1.

Table 2.1 Reflexives in Korean

<table>
<thead>
<tr>
<th>Form</th>
<th>Yale Romanization</th>
<th>Meaning</th>
<th>Morphological complexity</th>
</tr>
</thead>
<tbody>
<tr>
<td>자기</td>
<td>caki</td>
<td>self</td>
<td>mono-morphemic</td>
</tr>
<tr>
<td>자신</td>
<td>casin</td>
<td>self</td>
<td>mono-morphemic</td>
</tr>
<tr>
<td>자기자신</td>
<td>caki-casin</td>
<td>self</td>
<td>bi-morphemic</td>
</tr>
<tr>
<td>그/그녀/그들 자신</td>
<td>ku/kunye/kutul-casin</td>
<td>himself/herself/themselves</td>
<td>bi-morphemic</td>
</tr>
</tbody>
</table>

As for simple (mono-morphemic) reflexives such as caki and casin, although they are identical in morphological complexity, they differ from each other in terms of morpho-syntactic distribution (Kang, 1998; Katada, 1991; Kim, 2000). As illustrated in (26a), casin can be preceded by an adjective or personal pronoun to construct a complex (bi-morphemic) reflexive while caki cannot. Furthermore, as seen in (26b), casin can be preceded by caki, but not vice versa.
(26)  a. 현명한/그/그녀/그들/나/너  ‘자신/*자기

hyenmyengha-n/ku/kunye/kutul/na/ne  ‘casin/*caki

wise-REL/he/she/they/I/you  self/self

‘wise self/himself/herself/themselves/myself/yourself’

b. ‘자기 자신/*자신 자기

‘caki casin/*casin caki

(26a) and (26b) suggest that caki and casin are, in fact, entirely different syntactic entities. Based on the pattern of grammaticality observed in (26), casin can be assigned a noun category (N) in that it can be replaced with a typical noun (e.g., salam ‘person’) without affecting grammaticality. In contrast, caki cannot be treated as N because replacing salam ‘person’ with caki leads to ungrammaticality. Thus, it can be concluded that caki and casin do not compete for the same position in the hierarchy.

(27)  [NP 현명한  [ N = ‘사람/‘자신/*자기 ]]

hyenmyengha-n ‘salam/‘casin/*caki

wise-REL  person/self/self

If casin is a noun, which category does caki belong to? Regarding this, Kim (2000) argued that caki (and personal pronouns) should be treated as a functional head D(eterminer) that maximally
projects DP and selects an NP as its complement. As a result, reflexives in Korean can be
syntactically represented as follows:

(28) a. caki: \[DP [ D=caki]]

b. casin: \[DP [ D [NP [N=casin]]]]

c. caki/pronoun-casin: \[DP [ D=caki/pronoun [NP [N=casin]]]]

A further difference between caki and casin is found in the person type of antecedent that
the two can form a dependency with. That is, as shown in (29), caki co-refers only with an NP in
the third person whereas casin freely co-refers with antecedents in all three persons. This has
been explained in the literature as taking place due to the difference in the phi(φ)-feature
composition of the reflexives under discussion. That is, caki, like typical personal pronouns, has
been analyzed to have an inherent φ-feature (the third person) while casin does not. As a
consequence, the former ends up referring only to an antecedent that matches in person whereas
the latter, with no inherent φ-features, takes any antecedent, regardless of its person type.

(29) a. 나는/너는/톰은 언제나 자기를 믿는다.
na-i-nun/nej-nun/Tomk-un enceyna caki\textsuperscript{3i/j/k}-lul mit-nun-ta
I-TOP/you-TOP/Tom-TOP always self-ACC believe-IN-DC
‘Tom always believe(s) self’

b. 나는/너는/톰은 언제나 자신을 믿는다.
na-i-nun/nej-nun/Tomk-un enceyna casin\textsuperscript{3i/j/k}-ul mit-nun-ta
I-TOP/you-TOP/Tom-TOP always self-ACC believe-IN-DC
'I/you/Tom always believe(s) self'

When it comes to the binding properties of Korean reflexives, especially, in terms of their binding domain, all reflexives in Table 2.1 can be bound locally. However, interestingly and crucially, they differ with respect to long-distance binding. That is, as for the mono-morphemic *caki* and *casin* (30a), they show a strong tendency of forming a dependency with a *nonlocal* antecedent. However, it was reported in the literature that there exists a subtle difference in preference for nonlocal antecedents between *caki* and *casin*: *caki* has a very strong preference for nonlocal antecedents while *casin* exhibits a relatively less strong preference for nonlocal antecedents (Kim et al., 2009). On the other hand, *caki-casin* and *pronoun+casin* are preferentially bound by the *local* antecedent, as in (30b) (Choi & Kim, 2007; Cole et al., 1990; Han & Storoshenko, 2012; Kim et al., 2009; Pica, 1987).

(30) a. 빌은 메리에게 톰이 자기를/자신을 Bill-un Mary-eykey [Tom-i = caki_{ij}k-lul/casin_{ij}k-ul]

Bill-TOP Mary-DAT Tom-NOM self-ACC/self-ACC

너무 과신한다고 말했다.
nemwu kwasinhanta-ko malha-ss-ta.

much overtrust-COMP say-PST-DC

'Bill said to Mary that Tom has too much confidence in self.'

[caki = Bill > Mary, Tom; casin = Bill > Mary, Tom]\(^{10}\)

b. 빌은 메리에게 톰이 자기 자신을/그 자신을 Bill-un Mary-eykey [Tom-i]

\(^{10}\) ‘A>B’ indicates that A is referentially preferred over B.
Bill-un  Mary-eykey  [Tom-i  caki-casin=cj/ku-casin=cj-ul

Bill-TOP  Mary-DAT  Tom-NOM  self-ACC/self-ACC

너무  과신한다고  말했다.

nemwu  kwasinhanta-ko]  malha-ss-ta.

much  overtrust-COMP  say-PST-DC

'Bill said to Mary that Tom has too much confidence in self.'

[caki-casin/pronoun-casin = Tom > Bill, Mary]

Finally, despite the aforementioned differences among reflexives in Korean, they share a common property that they only refer to an animate antecedent, but not to an inanimate antecedent (31).

(31)  a.  그것은  언제나  자기/자신/자기자신을  탓한다.
   kukes-i-un  enceyna  caki=c/casin=c/caki-casin=c-(l)ul  thasha-n-ta
   It-TOP  always  self/self/self-ACC  blame-IN-DC
   ‘It always blames self.'

b.  위원회가  자기/자신/자기자신의  결정사항을  통보했다.
   wiywenhoy-i-ka  caki=c/casin=c/caki-casin=c-uy  kyelcengsahang-ul
   committee-NOM  self/self/self-GEN  decisions-ACC
   우리에게  inform-PST-DC

   ‘The committee informed us of its decision.’

   [Example (31b) cited from Kim & Yoon, 2009]
A brief summary of Korean reflexives is provided in Table 2.2.

<table>
<thead>
<tr>
<th>Form</th>
<th>Complexity</th>
<th>Structure</th>
<th>Φ-feature</th>
<th>Animacy</th>
<th>Dependency</th>
</tr>
</thead>
<tbody>
<tr>
<td><em>caki</em></td>
<td>simple</td>
<td>D</td>
<td>YES (3rd P)</td>
<td>YES</td>
<td>nonlocal&gt;local</td>
</tr>
<tr>
<td><em>casin</em></td>
<td>simple</td>
<td>N</td>
<td>NO</td>
<td>YES</td>
<td>nonlocal&gt;local</td>
</tr>
<tr>
<td><em>caki-casin</em></td>
<td>complex</td>
<td>D+N</td>
<td>YES (3rd P)</td>
<td>YES</td>
<td>local</td>
</tr>
<tr>
<td><em>pronoun-casin</em></td>
<td>complex</td>
<td>D+N</td>
<td>NO</td>
<td>YES</td>
<td>local</td>
</tr>
</tbody>
</table>

Among these reflexives, this dissertation limits its focus to the examination of the monomorphemic reflexive *caki* ‘self’ and its comprehension. In the next section, I discuss in more detail what linguistic constraints are involved in *caki*’s reference resolution.

2.2 Linguistic features of *caki*

2.2.1 Basic lexical properties of *caki*

As briefly noted above, *caki* only refers to a third-person, animate NP (mostly placed in the subject position), suggesting that it is sensitive to the person and animacy features of antecedents (Han & Storoshenko, 2012; Sohn, 1999; Sohng, 2004). For example, *siwica* ‘protester’ in (32a),
which is the 3rd-person animate NP, can serve as antecedent of caki while the inanimate siwi ‘protest’ in (32b) and the first-person nay ‘I’ in (32c) cannot.11

(32) a. 한 시위자가 법원 앞에서 자기의 입장을 발표했다.
han siwica/_ka pepwen aph-eyse caki_/uy ipcang-ul palphyoha-ss-ta.
a a protester-NOM court front-at self-GEN stance-ACC announce-PST-DC
‘A protester announced self’s stance in front of a court of law.’

➔ siwica ‘protester’ [3 person, singular, animate] = caki

b. *한 시위가 법원 앞에서 자기의 입장을 발표했다.
han siwi/_ka pepwen aph-eyse caki_/uy ipcang-ul palphyoha-ss-ta.
a a protest-NOM court front-at self-GEN stance-ACC announce-PST-DC

➔ siwi ‘protest’ [3 person, singular, inanimate] ≠ caki

c. *내가 법원 앞에서 자기의 입장을 발표했다.
nayi/_ka pepwen aph-eyse caki_/uy ipcang-ul palphyoha-ss-ta.
I-NOM court front-at self-GEN stance-ACC announce-PST-DC

➔ nay ‘I’ [1 person, singular, animate] ≠ caki

11 Caki also can refer to an NP in the second person. However, unlike typical reflexives, caki referring to a 2nd-person NP can appear alone without an antecedent, as presented in (i), and it generally has the function of intimate address (Han & Storoshenko, 2012; Sohng, 2004).

(i) 자기는 참 잘생겼어.
caki-nun cham calsayngkyesse
you-TOP very handsome
‘You are very handsome.’

Caki of this type is not the concern of the present dissertation.
However, *caki* is insensitive to the gender and number feature of antecedent. That is, it refers to a [3RD-PERSON] [ANIMATE] antecedent, regardless of its gender (33a-b) and number (33c-d)\textsuperscript{12}.

\[(33)\]  
\[\begin{align*}
\text{a.} & \quad \text{철수가} & \text{자기를} & \text{과신했다.} \\
& \quad \text{Chelswu}_{[\text{MASCULINE, SG}]}-\text{ka} & \text{caki}_{[\text{-ul}]} & \text{kwasinha-ss-ta} \\
& \quad \text{C.-NOM} & \text{self-ACC} & \text{overtrust-PST-DC} \\
& \quad \text{‘Chelswu was too confident of himself.’} \\
\text{b.} & \quad \text{영희가} & \text{자기를} & \text{과신했다.} \\
& \quad \text{Yenghui}_{[\text{FEMININE, SG}]}-\text{ka} & \text{caki}_{[\text{-ul}]} & \text{kwasinha-ss-ta} \\
& \quad \text{J.-NOM} & \text{self-ACC} & \text{overtrust-PST-DC} \\
& \quad \text{‘Yenghui was too confident of herself.’} \\
\text{c.} & \quad \text{그 학생은} & \text{자기를} & \text{믿지 못 했다.} \\
& \quad \text{ku} & \text{haksayng}_{[\text{SG}]}-\text{un} & \text{caki}_{[\text{-ul}]} & \text{mit-ci} & \text{mos ha-ss-ta} \\
& \quad \text{the student-TOP} & \text{self-ACC} & \text{trust-NL} & \text{cannot do-PST-DC} \\
& \quad \text{‘The student could not trust himself (or herself).’} \\
\text{d.} & \quad \text{그 학생들은} & \text{자기를} & \text{믿지 못 했다.} \\
& \quad \text{ku} & \text{haksayng-tul}_{[\text{PL}]}-\text{un} & \text{caki}_{[\text{-ul}]} & \text{mit-ci} & \text{mos ha-ss-ta} \\
& \quad \text{the student-PL-TOP} & \text{self-ACC} & \text{trust-NL} & \text{cannot do-PST-DC} \\
& \quad \text{‘The students could not trust themselves.’}
\end{align*}\]

A summary of the discussion so far is provided in Table 2.3.

\textsuperscript{12} Chelswu and Yenghui are typical male and female Korean names, respectively. Gender is understood semantically. Nouns in Korean do not morphologically inflect for gender (Sohn, 1999).
### Table 2.3 Morphological constraints of *caki*

<table>
<thead>
<tr>
<th>Feature</th>
<th>Constraint</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>NO</td>
<td>–</td>
</tr>
<tr>
<td>Number</td>
<td>NO</td>
<td>–</td>
</tr>
<tr>
<td>Person</td>
<td>YES</td>
<td>3&lt;sup&gt;rd&lt;/sup&gt; person</td>
</tr>
<tr>
<td>Animacy</td>
<td>YES</td>
<td>Animate</td>
</tr>
</tbody>
</table>

2.2.2 Syntactic/distributional properties of *caki*

At the sentence/discourse level, *caki* shows rather peculiar referential behaviors: in some contexts, it behaves as predicted by the traditional Binding Theory (e.g., BT-A) while, in other contexts, it does not. Referential (or interpretive) complexity observed for *caki* has attracted considerable attention from researchers in past decades and several attempts have been made in the theoretical literature to figure out how the grammar constrains *caki*’s dependency formation (Cho, 1994; Han & Storoshenko, 2012; Hong, 1989; Kang, 2001; Kim, 2000; O’Grady, 1987; Park, 1986; Sohng, 2004; Yoon, 1989). In what follows, I will provide some linguistic examples that document unique patterns of referential dependency between *caki* and its antecedent.

#### 2.2.2.1 Caki can refer to a non-c-commanding antecedent.
Reflexives typically form dependencies with local antecedents in c-commanding positions\textsuperscript{13}. In many cases, *caki* takes a local antecedent in a c-commanding position, as exemplified in (34).

\begin{equation}
\begin{align*}
\text{(34)} & \quad \text{a. } & \text{민수는 } & \text{자기를 } & \text{과신했다.} \\
& & \text{Minswu}_{i}\text{-nun } & \text{*caki*}_{i}\text{-lul } & \text{kwasinhay-ss-ta} \\
& & \text{M.-TOP } & \text{self-ACC } & \text{overestimate-PST-DC} \\
& & \text{‘Minswu had much confidence in self.’} \\
\end{align*}
\end{equation}

\begin{equation}
\begin{align*}
\text{b. } & \quad \text{[민수의 변호사]는 } & \text{자기를 } & \text{과신했다.} \\
& \quad \text{[Minswu}_{i}\text{-uy pyenhosa]{-nun } & \text{*caki*}_{\text{uyj}}\text{-lul } & \text{kwasinhay-ss-ta} \\
& \quad \text{M.-GEN } & \text{lawyer-TOP } & \text{self-ACC } & \text{overestimate-PST-DC} \\
& & \text{‘Minswu’s lawyer had much confidence in self.’} \quad \text{[*caki* = Minswu’s lawyer]} \\
\end{align*}
\end{equation}

\begin{equation}
\begin{align*}
\text{c} & \quad \text{[민수의 변호사]는 } & \text{그를 } & \text{과신했다.} \\
& \quad \text{[Minswu}_{i}\text{-uy pyenhosa]{-nun } & \text{ku}_{i\text{yj}}\text{-lul } & \text{kwasinhay-ss-ta} \\
& \quad \text{M.-GEN } & \text{lawyer-TOP } & \text{that (person)-ACC } & \text{overestimate-PST-DC} \\
& & \text{‘Minswu’s lawyer had much confidence in him.’} \\
& & \text{[*ku*-*lul* ‘him’ = Minswu(i) or another referent in the previous discourse]} \\
\end{align*}
\end{equation}

\begin{equation}
\begin{align*}
\text{d. } & \quad \text{[민수가 고용한] 변호사가 } & \text{자기를 } & \text{과신했다.} \\
& \quad \text{[Minswu}_{i}\text{-ka koyongha-n] pyenhosa}_{j}\text{-ka *caki*}_{i\text{yj}}\text{-lul } & \text{kwasinhay-ss-ta} \\
\end{align*}
\end{equation}

\textsuperscript{13} The term *c-command* (constituent-command), first introduced by Reinhart (1976), is a syntactic concept that defines structural relations between nodes in a syntax tree (see Büring, 2005 for overview). In this dissertation, I adopt the definition of c-command provided in (i).

\begin{equation}
\begin{align*}
\text{(i) } & \quad \text{A c-commands B iff} \\
& \quad \text{a. Neither A nor B dominates the other, and} \\
& \quad \text{b. The first branching node that dominates A also dominates B.} \\
\end{align*}
\end{equation}
M.-NOM  hire-REL  laywer-NOM  self-ACC  overestimate-PST-DC

‘The lawyer who Minswu hired had much confidence in self.’

In (34a), caki refers to the subject Minswu. Here, the subject c-commands the reflexive. In (34b), caki can only refer to Minswu-uy pyenhosa ‘Minswu’s lawyer’ (the entire possessive NP), not the possessor NP Minswu. This can be explained using the notion of c-command. That is, the possessor NP Minswu cannot be an antecedent for caki because it does not c-command the reflexive. (34c) is exactly the same as (34b), except for the type of pronoun in the direct object position: reflexive in (34b) vs. 3rd-person non-reflexive pronoun in (34c). As indicated by sub-indices, the 3rd-person pronoun ku can co-refer with the possessor Minswu, unlike caki. A possible conclusion that can be drawn from (34a) through (34c) is that both pronouns selectively choose their antecedent, suggesting that they are rule-governed: caki accurately hits the target (i.e., c-commanding antecedent), following BT-A. This is further supported by (34b): caki’s reference to a possessor NP Minswu is ungrammatical even though the NP (Minswu) meets morphological requirements of caki (i.e., [3-PERSON], [ANIMATE]). In (34d), caki co-refers only with a local NP (Minswu-ka koyongha-n pyenhosa ‘the lawyer who Minswu hired’) in the c-commanding position, but not with an NP (Minswu) inside the relative clause where it cannot c-command the reflexive. This further indicates that the binding constraint plays a role in caki’s dependency formation.

However, interestingly, caki is sometimes found in sentences where it picks up a non-c-commanding NP as its antecedent. For example, in (35), caki is interpreted to refer to a possessor NP (John in (35a) or Suni in (35b)) even though neither expression c-commands the reflexive.
This is somewhat unexpected given that the relevant binding constraint (BT-A) disallows reflexives to refer to non-c-commanding antecedents.

(35)  

a. 존의 책이 자기의 방에 있다.  
    John-uy chayk-i caki@$i$-uy pang-ey iss-ta  
    John-GEN book-NOM self-GEN room-at be-DC  
    ‘John’s book is in self’s room.’  
    (Hong, 1989)  

b. 순이의 신발은 자기의 발보다 훨씬 크다.  
    Suni-uy sinpal-j-un caki@$i$-uy pal-pota hwelssin ku-ta  
    Suni-GEN shoes-TOP self-GEN foot-than a.lot big-DC  
    ‘Suni’s shoes are a lot bigger than self’s feet.’  
    (Kim, 2000)

A rough conclusion that can be drawn from the data in (35) is that the syntactic binding constraint alone may not be enough to guide caki’s antecedent selection. There may be other (non-syntactic) factors or constraints which affect its reference resolution. Furthermore, it may also suggest that the applicability of the binding constraint may vary slightly or substantially from one language to another.

2.2.2 Caki can bind an antecedent outside of its local domain.

Another referential deviation with respect to caki is found in (36).

(36) 존이 매리가 자기를 사랑한다고 생각한다.
John-i [Mary-ka caki-ul salangha-n-tako] sayngkakha-n-ta
J.-NOM M.-NOM self-ACC love-PRS-COMP think-PRS-DC

‘John thinks that Mary loves self.’

(Yoon, 1989)

(36) shows that, contrary to the fact that BT-A restricts the reflexive to search for its antecedent in the local domain, caki can form a dependency with an NP (e.g., John) outside the local, embedded clause. Because of this ability, caki has often been classified as a long-distance anaphor (LDA) (Cole et al., 2001 for overview). Here, it should be noted that although (36) is, in principle, referentially ambiguous in that more than one NP can grammatically bind the reflexive (i.e., matrix and embedded subject NP), previous empirical studies have shown that native Korean speakers prefer the nonlocal antecedent over the local antecedent (Han et al., 2015, 2011; Kim et al., 2009). See Chapter 3 for a more detailed discussion.

2.2.2.3 Non-subject NP can serve as antecedent of caki.

Caki’s preference for a nonlocal antecedent in the subject position shown in (36) should not be taken as indicating that caki always refers to a subject antecedent (i.e., caki is strictly subject-oriented).14 As demonstrated in (37), caki can indeed have non-subject antecedents: indirect object NP Mary in (37a) and SOURCE NP Swuni in (37b).

14 It has been claimed in the literature that LDAs in many other languages generally co-refer only with an NP in the subject position, as exemplified in (i) (Cole, Hermon, & Huang, 2001; Xue, Pollard, & Sag, 1994). However, as discussed in this section, Korean LDA caki differs from those in other languages in that it can also refer to non-subject antecedents.

(i) a. Zhangsan_i gei-le Lisi_j yizhang ziji[v_j de xiangpian.
This non-subject antecedent potential of *caki* can also be found in mono-clausal contexts such as (38). In (38a), *caki* can grammatically refer to the accusative-marked NP *Tom*. In (38b), the sentence in (38a) is often analyzed as a causative sentence due to the semantic nature of the verb *ponay*—‘to send somebody (to a location)’. Under this view, (38a) can be understood as meaning that *John caused Tom to go to self’s home.* In this reading, the accusative-marked direct object (e.g., *Tom-ul*) takes an agent role, more precisely, a secondary agent of the action denoted by the verb *ponay*—Therefore, *caki*, which has a strong subject antecedent bias (or a bias for an agent NP sitting in SpecTP), can easily form a dependency with a surface direct object in the causative construction like (38a) (cf. (i) for syntactic representation of (38a))
same reflexive form can select as its antecedent any one of NPs that precede it (i.e., John, Mary, and Chris). The latter two NPs are non-subjects.

(38)  

a. 존은 톰을 자기의 집으로 보냈다.  

John-un Tom-ul caki-ul-uy cip-ulon ponay-ss-ta  
J.-TOP T.-ACC self-GEN home-to send-PST-DC  

‘John sent Tom to self’s house.’  
(Park, 1986)

b. 존이 메리를 크리스에게 자기의 방에서 소개했다.  

John-i Mary-lul Chris-eykey caki-uyz-uy pang-eyse  
J.-NOM M.-ACC C.-DAT self-GEN room-in  

sokayhay-ss-ta  
introduce-PST-DC  

‘John introduced Mary to Chris in self’s room.’  
(Hong, 1989)

Here note that although the sentences in (37) and (38) are referentially ambiguous (in that both the subject and non-subjects can serve as caki’s antecedent), this ambiguity may not always be detected by native speakers because the subject NP is more preferred than the non-subject NP as caki’s antecedent, according to previous studies (Han & Storoshenko, 2012; Han et al., 2015). Moreover, based on the data of caki’s ability to refer to non-subject antecedents, one can reasonably infer that caki’s (nonlocal) subject preference may not result from the grammar, but rather from some other processing-related or lexically-related factors (e.g., primacy effect, discourse prominence of (the matrix) subject, etc.). For more evidence, consider (39) below.
(39) a. 존은 메리에게 자기들이 이길거라고 말했다.


‘John told Mary that selves (=John & Mary) would win.’ (Huang, 2000)

b. 존은 메리에게 자기들의 사진들을 보여주었다.

John-un Maryj-eykey caki-i-tul-uy sacin-tul-ul poyecwu-ess-ta
J.-TOP M.-DAT self-PL-GEN photo-PL-ACC show-PST-DC

‘John showed Mary pictures of themselves(=John & Mary).’ (Sohng, 2004)

As shown in (39), caki can be morphologically pluralized by attaching the plural suffix -tul to form caki-tul ‘selves’. Interestingly, the plural caki-tul in (39) is interpreted as referring to both the subject John and the indirect object Mary together (often called split antecedents). This clearly shows that a part of caki-tul’s antecedent can come from a non-subject argument in a non-causative sentence. If caki were strictly subject-oriented, this interpretation would never be allowed, contrary to fact.

2.2.2.4 Caki can be discourse-bound.

Finally, caki can be discourse-bound. That is, it can find its antecedent in a previous discourse, as seen in (40). Even, in limited spoken contexts, its antecedent is not always linguistically expressed, as in (41).
(40) A: 존이 사람을 보냈니?

John-i salam-ul ponay-ss-ni
John-NOM man-ACC send-PST-INT

‘Did John send a man?’

B: 아니, 자기가 직접 왔어.

ani, caki-ka cikcep o-ass-e
no, self-NOM in.person come-PST-DC

‘No, self (=John) came in person.’

(Yang, 1982)

(41) (John is looking for a pen.)

Mary (to herself): 자기(의) 앞에 있는 데.

caki(-uy) aph-ey issnuntey

self(-gen) front-at be

‘(The pen) is in front of self (=John).’

(Hong, 1989)

2.2.2.5 Interim summary

Thus far, I have shown caki’s morphological characteristics and its diverse referential behavior in selecting an antecedent for dependency formation. (42) provides the summary.

(42) a. Caki forms a dependency with a third-person, animate antecedent.

b. Caki can refer to both local and nonlocal antecedents, although nonlocal antecedents are preferred.
c. *Caki* can refer to a non-subject antecedent, although subjects are preferred.

d. *Caki* can sometimes refer to a non-c-commanding antecedent.

e. *Caki* can be discourse-bound.

*Caki*’s reference potential to construct a dependency with a nonlocal and/or non-c-commanding antecedent pose great challenges to the traditional binding theory of reflexives. Unsurprisingly, this has led to a number of theoretical studies to clarify the grammatical principles governing *caki*’s reference resolution (Cole et al., 1990; Cole & Sung, 1994; Han & Storoshenko, 2012; Sohng, 2004). For example, Sohng (2004) proposed that *caki*’s peculiar referential behavior, like (42b-d), can be derived from syntax alone, in which core concepts of classic binding theory (e.g., c-command) are maintained and additional syntactic devices like “successive cyclic anaphor head movement” and “feature checking” are deployed to establish a dependency between (non)local antecedent and *caki* (cf. Cole et al., 1990; Cole & Li-May Sung, 1994), as showcased in Figure 2.1.
On the other hand, other studies have argued that *caki* is not licensed in the syntax but in non-syntactic components of the grammar such as in the semantics or via discourse-pragmatics, given the fact that the traditional syntactic approach to reflexives cannot explain (42d) and (42e). For example, Hong (1989) proposed that *caki*’s antecedent selection is constrained by a pragmatic constraint, which Hong called the *consciousness condition*. That is, *caki* selects as its antecedent an animate NP denoting a discourse referent who is conscious of the situation or who is in control of the information among interlocutors. Consider (43) for example.

---

**Figure 2.1 Successive cyclic head movement of *caki* (Sohng, 2004)**
In (43), John is an oblique NP that takes a SOURCE thematic role. Hong argued that caki’s reference to John is very unlikely in (43a) whereas the same is acceptable in (43b). More specifically, John in (43a) does not play any agentive role to provide the speaker with a certain impression. The impression is built by the speaker’s observation, not by John’s. In this sense, John cannot be considered as being conscious of the situation. On the contrary, John in (43b) can be interpreted as taking an agentive role from the fact that John must know that he won the game before he reports his winning to someone else. Thus, he must be conscious of the situation. A constraint of this type is purely pragmatic, with no reference to the structural status of potential
antecedents (cf. Maling, 1984; Sells, 1987 for similar approach; cf. also Han & Storoshenko, 2012 for semantic analysis of caki’s reference resolution).

It is still a matter of debate as to what parts of grammar (e.g., syntax, semantics, pragmatics, etc.) have primary responsibilities for guiding caki’s dependency formation. However, what is clear, at least, is that caki must find an antecedent for interpretation and the process of antecedent selection is influenced by a range of factors, possibly from distinct components of the grammar. Although further research is required to determine the linguistic status of those factors (e.g., where do they originate, and how do they operate during reference resolution?), it seems to be the case that the complicated referential behavior of caki can be best explained by assuming that diverse linguistic factors come into play (possibly simultaneously) during antecedent selection.

2.3 Comprehension of caki

Although a number of theoretical studies have been extensively conducted to understand what grammatical constraints govern caki’s reference resolution, psycholinguistic inquiry into caki still remains a relatively uncharted area of research. In this section, I review some empirical studies on caki and discuss the implications of their findings.

Fundamental issues explored in previous psycholinguistic studies on caki can be boiled down to two key words: (i) locality (nonlocal vs. local) and (ii) subjectivity (subject vs. non-subject) of antecedent.
2.3.1 Locality of antecedent

As noted in the previous section, *caki*, as a long-distance anaphor (LDA), prefers to co-refer with a more distantly located antecedent even in a context, like (44), where it can form a local dependency with a (temporally more recent and linearly closer) potential antecedent in the same clause.

(44) \[ \text{NP1-TOP} \rightarrow \text{[NP2-NOM} \text{caki-ACC} \text{V]} \]

This seemingly counterintuitive antecedent choice of LDA *caki* has received serious attention in recent years. Relevant research questions are:

(i) Whether *caki*’s nonlocal antecedent preference can be empirically supported or not; If yes, what linguistic factors can affect its antecedent selection?

(ii) Does *caki* show a clear preference for a nonlocal antecedent even in the initial pass of processing?

Among the most relevant empirical studies that attempted to answer question (i) above, the majority came from the field of second language acquisition (Kim et al., 2009; Kim, Montrul, & Yoon, 2010; Kim & Yoon, 2008; but see Joo, 2017 for children’s acquisition of *caki*). The main focus of these studies was on revealing processing (and, ultimately, acquisition) differences between native speakers and L2/heritage speakers of Korean, rather than on systematically examining the cognitive processes or mechanisms that underlie the dependency resolution of *caki* itself. For example, in Kim et al. (2009), they investigated, using a truth value (true or false)
judgment task with pictures, whether and how Korean-English bilingual heritage speakers show different interpretive patterns from native Korean speakers when they interpret locally and nonlocally-bound reflexives of various types (caki, casin, and caki-casin). In the experiment, participants were asked to read bi-clausal sentences like (45) and judge whether each sentence correctly described the picture provided (i.e., is the sentence a true description of the picture?). Pictures represented either locally-bound or nonlocally-bound interpretations of the reflexive (cf. Figure 2.2).

(45) 철이는 민수가 자기를 그렸다고 말했다.
C.-TOP M.-NOM self-ACC draw-PST-DC-COMP say-PST-DC
‘Cheli said that Minswu drew him(self).’

⇒ Local binding: caki = Minswu
Nonlocal binding: caki = Cheli
The results revealed that Korean heritage speakers maintain the referential difference between local and long-distance reflexives, although not to the same degree as native speakers. Heritage speakers showed a higher tendency to treat reflexives (including caki) as being locally-bound, when compared with late bilinguals and native speakers, possibly due to the transfer effect of English (in English, reflexives are typically locally-bound). As for native speakers (and late bilinguals), they showed a strong preference to consider caki as being nonlocally-bound. This finding patterns with those reported in previous theoretical studies: caki prefers a nonlocal antecedent over a local antecedent in a referentially ambiguous bi-clausal context like (45).

Here it should be noted that the data reported in the Kim et al.’s study (2009) do not show what has happened in the initial phase of reference resolution because they were collected using a judgment task. To look more closely at the initial process of establishing reflexive dependency, more refined experimental techniques (e.g., eye-tracking, etc.) are required. Up to the present,
however, only a few studies have been conducted with more elaborate experimental designs and apparati.

For example, Choi & Kim (2007), who employed an eye-tracking paradigm, investigated how the referential ambiguities of Korean reflexives (i.e., caki and casin) are resolved during online processing. In the experiment, Korean native speakers read sentences like (46) while their eye movements were monitored and recorded.

(46) Sample experimental stimuli with *caki* (Choi & Kim, 2007:264)

a. 하루는 회사원이 안내원이 자기를
   halwu-nun hoysawen-i annaywen-i *caki*-lul
   one day-TOP employee-NOM receptionist-NOM self-ACC
   별안간 회피했다고 말했다.
   pyelankan hoyphihay-ss-ta-ko malhay-ss-ta
   suddenly avoid-PST-DC-COMP say-PST-DC
   ‘One day an employee said that a receptionist suddenly avoided self.’

b. 하루는 회사원이 안내원이 자기를
   halwu-nun hoysawen-i annaywen-i *caki*-lul
   one day-TOP employee-NOM receptionist-NOM self-ACC
   별안간 과시했다고 말했다.
   pyelankan kwasihay-ss-ta-ko malhay-ss-ta
   suddenly show-off-PST-DC-COMP say-PST-DC
   ‘One day an employee said that a receptionist suddenly showed off self.’
The sentences in (46) are temporarily ambiguous in that the pre-verbal reflexive caki can refer to either the matrix subject (hoysawen ‘employee’) or the embedded subject (annaywen ‘receptionist’), but the referential ambiguity is resolved when the embedded verb (hoyphiha- ‘to avoid’ vs. kwasiha- ‘to show off’) is processed. The verb hoyphiha- ‘to avoid’ in (46a) does not allow caki to refer to the embedded subject (a receptionist cannot avoid himself or herself). Thus, (46a) is disambiguated at the embedded verb by taking the matrix subject as caki’s antecedent. On the other hand, the most plausible interpretation of caki in (46b) with the (egocentric) verb kwasiha- ‘to show off’ is to consider it to refer to the embedded subject (i.e., a receptionist shows off herself, not the other person). The results showed that (46a) (nonlocal antecedent condition) was read significantly faster than (46b) (local antecedent condition) at the embedded verb region for eye movement measures such as total reading time and first-pass reading time. Based on these findings, they concluded that caki has a preference for a nonlocal antecedent and that this information is immediately available (probably at the reflexive) in the early stage of the processing, given the faster reading time at the embedded verb in the nonlocal antecedent condition. If the information that caki prefers a nonlocal antecedent was not available until the embedded verb, no difference would be found in reading time at the embedded verb between (46a) and (46b), contrary to fact.

16 Choi & Kim also measured the re-reading time and the mean regression frequency. However, they could not find any meaningful differences at critical regions in the target sentence (i.e., reflexive region and embedded verb region). Rough descriptions of each eye movement measure are as follows: the total reading time is used to determine overall processing difficulty or burden at the region of interest; the first-pass reading time is referred to as “early measure” that is considered to represent the initial phase of processing; the re-reading time and mean regression frequency reflects reanalysis in sentence comprehension (cf. Rayner, 1998 for overall review).
2.3.2 Subjectivity of antecedent

One of crucial characteristics of LDAs widely observed in many languages (e.g., Chinese, Icelandic, etc.) is that they are subject-oriented (Cole et al., 2001, 1990; Cole & Sung, 1994; Hermon, 2009; Pica, 1987). However, as noted above, caki differs from other languages with LDAs in that it can form a dependency with a non-subject NP (e.g., indirect object) as well as a subject NP (cf. (37)-(39) above). Although early studies on caki argued that it is strictly subject-oriented, a growing number of theoretical studies have revealed that it can indeed co-refer with a non-subject antecedent (Madigan, 2006; Sohng, 2004; Yoon, 1989). This non-subject antecedent potential of caki has also gained empirical support (e.g., Han et al., 2015).

Han et al. (2015) investigated, using the visual world eye-tracking paradigm, whether caki’s subject preference is found in the initial processing of the sentence and whether the semantics of the clause-final verb affects its interpretation. In the experiment, participants (Korean native speakers) listened to short descriptions of actions like (47) (including the target sentence with caki) while they looked at corresponding visual images on the computer screen (cf. Figure 2.3).

(47) a Scene-setting sentences:

진수와 영희가 농구장에 있다.
Jinswu-wa Yenghuy-ka nongkwucang-ey iss-ta.
J.-and Y.-NOM basketball court-at be-DC

‘Jinswu and Yenghuy are at the basketball court.’

그들은 농구를 하려고 한다.

Kutul-un nongkwu-lul ha-leyko ha-n-ta.

They-TOP basketball-ACC do-intend do-PRE-DC

‘They are going to play basketball.’

b. **Target sentence 1:**

진수가 영희한테 농구대 옆에서 [자기]가
Jinswu-ka Yenghuyj-hanthey nongkwutay yep-eyse self$_{ij}$-ka
J.-NOM Y.-to hoop beside-at self-NOM

슛을 더 많이 성공시킬 거라고] 말했다.
syus-ul te manhi sengkong-siki-lke-lako malha-yess-ta

shoot-ACC more much success-CAU-FUT-COMP say-PST-DC

‘Jinswu said to Yenghuy beside the hoop that self will shoot more baskets.’

c. **Target sentence 2:**

하지만 실제로 개는 캐틀 [자기]가
Haciman silceylo kyay-nun syus-ul te manhi
But actually the kid-TOP shoot-ACC more much

성공시키지 않았다.
sengkong-siki-ci anh-ass-ta

success-CAU-NL NEG-PST-DC

‘But actually the kid didn’t shoot more baskets.’
As seen in (47), two target sentences (47b) and (47c) follows the scene-setting sentences (47a). The first target sentence (47b) was referentially ambiguous in that caki can refer to either the matrix subject Jinswu or the matrix indirect object Yenghuy. The type of matrix verb in (47b) was also manipulated to see whether different verbal semantics can influence online processing of caki. The verbs used include malha- ‘to say’, tut- ‘to hear’, and myenglyengha- ‘to order’. Say-type verbs render the subject argument the so-called logophoric center or source of information (SOI: reporter or provider of information; cf. Büring, 2005) whereas hear-type verbs render a non-subject argument (typically, indirect object) the source of information, as schematically represented in (48).

(48)  
\begin{align*}
\text{a.} & \quad \text{say-type verb (cf. (47b))} \\
& \quad [\text{NP1-NOM} \quad \text{NP2-TO} \quad [\text{caki-NOM} \quad \text{win-FUT-COMP}] \quad \text{said}] \\
& \quad \text{‘NP1 told NP2 that self would win.’} \\
& \quad \Rightarrow \quad \text{NP1 = SOURCE OF INFORMATION} \\
\text{b.} & \quad \text{hear-type verb} \\
& \quad [\text{NP1-NOM} \quad \text{NP2-FROM} \quad [\text{caki-NOM} \quad \text{win-FUT-COMP}] \quad \text{heard}] \\
& \quad \text{‘NP1 heard from NP2 that self would win.’} \\
& \quad \Rightarrow \quad \text{NP2 = SOURCE OF INFORMATION}
\end{align*}
If *caki* is sensitive to such a pragmatic cue (e.g., SOI) and hence prefers the SOI NP as its antecedent (cf. Kaiser, Runner, Sussman, & Tanenhaus, 2009), it would more likely select the matrix subject NP1 as its antecedent in (48a), and the matrix indirect object NP2 as antecedent in (48b). However, as illustrated in (49), the verb *myenglyengha*- ‘to order’ restricts *caki* in the embedded subject position to co-refer with the matrix indirect object NP2, regardless of the pragmatic status (e.g., SOI) of potential antecedents.\(^{17}\)

(49) \textit{order-type verb}

\begin{tabular}{llllll}
철이가 & 민수한테 & 자기가 & 집 & 안으로 \\
Cheli-ka & Minswu-hanthey & \textit{caki}-\textit{uj}-ka & cip & an-ulo \\
Cheli-NOM & Minswu-DAT & self-NOM & house & inside-to \\
들어가라고 & 명령했다. \\
tuleka-lako & myenglyenghay-ss-ta \\
go-COMP & order-PST-DC \\
\end{tabular}

‘Cheli ordered Minswu that self go inside the house.’

Note that the effect of verb semantics would not be observed initially at the reflexive in (47b) because the verb comes after the reflexive. Thus, to view the effect, one should check whether the initial interpretation of the pre-verbal reflexive changes at or after the manipulated verb.

The second target sentence (47c) was added for this purpose, which included an informal gender-neutral pronoun *kaya* (lit. ‘the kid’). This pronoun co-referred with the reflexive in (47b). It was

\(^{17}\) In (49), *Cheli* is the commander. Given that an instruction for action (e.g., *going inside the house*) is provided by the commander *Cheli*, it is the commander *Cheli* that can serve as the SOI.
predicted that the change in the initial interpretation of caki (provoked by the verb) could be confirmed by the interpretive pattern of the pronoun kyay in (47c).

Results revealed a significantly higher subject advantage at caki (more precisely, at the 1201-1800ms time slot from the onset of caki), regardless of the verb.\textsuperscript{18} \textsuperscript{19} Furthermore, at the pronoun kyay in the second target sentence, they found a significant main effect of the verb (onset of kyay - 1,800ms divided into three slots): in the say condition, caki showed a significant subject advantage across time slots. However, no subject or object advantages were found in both hear and order conditions (i.e., no effect of SOI). Based on these findings, they concluded that “caki-interpretation is a function of both the subject and the verb effect, and the two effects are in competition with each other. The subject effect persists even after the verb has been processed, […] it may override the lexical/syntactic requirement of the verb […]” (Han et al., 2015:21). This further suggests that caki’s antecedent selection is constrained by multiple factors that interact with each other.

\textsuperscript{18} They used “subject-picture advantage” scores as the dependent measure. Those scores were calculated by subtracting the proportions of fixations to the display panel representing the matrix indirect object from the proportions of fixations to the display panel representing the matrix subject, following Kaiser et al. (2009). For statistical analysis, they divided the 1,800ms time period (from onset of caki to 1,800ms) into three slots: 0-600ms, 601-1,200ms, and 1201-1800ms. A significant subject advantage of caki was found in the third time slot.

\textsuperscript{19} It is somewhat unexpected that a significant subject advantage for caki did not occur at the earlier time slots (i.e., 0-600ms and 601-1200ms), given that programming an eye movement to a particular image on the screen typically takes around 200-300ms (Matin, Shao, & Boff, 1993; Rayner, 1998). For this, Han et al. speculated that this relatively late effect may emerge due to the focus function of the nominative case marker (which introduces a new discourse referent). Thus, native speakers may not temporarily treat either of the characters on the screen as a potential referent. However, this may also be interpreted as indicating that both potential antecedents for caki (i.e., both characters on the screen) may be considered (more precisely, retrieved from memory) simultaneously. As a result, the advantages (for subject and object) cancel each other out.
Although the Han et al. study clearly showed that the subject is preferred by caki even in initial processing, it did not show where this subject preference came from, how caki searched and retrieved an antecedent (from memory), or what cognitive mechanisms were used. Regarding the former issue, Han et al. argued that caki’s non-subject antecedent potential makes it untenable to explain the source of its subject preference from a purely structural perspective (e.g., caki’s antecedent must be located in the subject position). Instead, they proposed that caki is sensitive to the subject because its antecedent should be what they call the perspectival center, the person participating in the event or state whose perspective the speaker identifies with (Huang & Liu, 2001; Kuno, 1987; Sells, 1987 for similar view). For example, in the say-condition (cf. (47b) above), the source of the proposition denoted by the embedded clause (‘he or she will shoot more baskets’) is the matrix subject. Thus, the speaker would be able to easily posit that the proposition in question is reported from the perspective of the matrix subject. Arguably, caki more likely forms a dependency with such a perspectival center. However, when it is considered that the pragmatic status of a potential antecedent (such as perspectival center) can be determined only after the relevant verb is processed, it is unclear how the parser can know which antecedent is a perspectival center right at the moment when caki is encountered (recall that the reflexive always comes before the verb in the same clause). What is clear, at least, from this study is that caki indeed has a preference for the subject and it manifests early in the processing of the reflexive (even before the verb). Furthermore, although the source of this subject effect still remains unknown, we should accept that, whatever it is, caki is sensitive to certain (linguistic or nonlinguistic) aspects of the grammatical subject and this sensitivity (if any) should be one that can be overridden or cancelled out by other competing factors or cues.
2.4 Present research

In this dissertation, I report findings from a series of experiments, more specifically, acceptability judgement and self-paced reading experiments, which systematically investigated the on/offline comprehension of caki to answer the following research questions:

[1] What linguistic factors can affect the interpretation of caki?
Most previous studies on caki have focused on investigating caki (as long-distance anaphor) – mostly in referentially ambiguous contexts (e.g., bi-clausal sentences) where it can co-refer grammatically with either a local or a nonlocal antecedent – in order to see how it is interpreted in such contexts and what grammatical constraints are operational in caki’s reference resolution. Thanks to these research efforts, we now know it is empirically true that caki has a strong nonlocal subject antecedent preference although this can be overridden if necessary. However, it is still not clear what linguistic cues or factors are responsible for this interpretive pattern of caki. In the next chapters, I will report results of five acceptability judgment experiments (Chapter 3) and two self-paced reading experiments (Chapter 4) which especially paid attention to the issue of caki’s subject orientedness.

[2] What cognitive mechanisms are involved in caki’s antecedent selection and retrieval?
As noted above, although caki’s interpretive characteristics (i.e., nonlocal subject antecedent preference) have been empirically confirmed or corroborated by previous studies, little is known about what cognitive mechanisms underlie caki’s reference resolution. Concerning this issue, more specific research questions include:
[i] Does the parser initially navigate and retrieve caki’s antecedent solely on the basis of structural information or constraints?

[ii] If not, what other sources of information are available initially during caki’s antecedent retrieval?

To answer these questions, a self-paced reading experiment was conducted that examined whether non-syntactic features of a grammatically *incorrect* (or *inaccessible*) antecedent (e.g., one in a syntactic island) influence the online processing of the reflexive in question. Results will be discussed in detail in Chapter 5.
3 Off-line interpretation of *caki* and affecting factors

3.1 Introduction

In the present chapter, I report the results of five acceptability judgment experiments which were conducted to explore what linguistic factor(s) can influence and guide the interpretation of *caki*, especially when it appears in the referentially ambiguous mono-clausal context containing two grammatically accessible potential antecedents (PAs), as schematically represented in (50). Based on the findings of these experiments, I then attempt to develop some theoretical insights into the mechanism that underlies *caki*’s reference resolution.

\[
\begin{array}{c}
\text{Potential antecedent 1} \\
[\ldots \text{NP1-NOM} \ldots \text{NP2-DAT} \ldots \text{caki}_{ij} \text{-GEN} \text{NP3-ACC} \text{V} \ldots]
\end{array}
\]

As discussed in Chapter 2, a major finding of previous empirical studies on *caki* was that it shows a strong nonlocal subject antecedent preference in the bi-clausal context. However, it

\[20\text{ Like English double object construction in (i), in which the indirect object asymmetrically c-commands the direct object (Barss & Lasnik, 1986; Larson, 1988), an indirect object in Korean DOC also establishes asymmetric c-command relation with a following direct object (ii).}\]

(i) a. I showed Mary herself.
   b. *I showed herself Mary   \hfill \text{(Larson, 1988)}

(ii) a. na-i-nun Mary-i-hanthey kewul-lo caki-i_{ij}-lul po-yecwu-ess-ta
   I-TOP M.-DAT mirror-with self-ACC show-BENE-PST-DC
   ‘I showed Mary herself with a mirror.’
   b. *na-i-nun caki_{ij}-hanthey kewul-lo Mary_{i}-lul po-yecwu-ess-ta
   I-TOP self-DAT mirror-with M.-ACC show-BENE-PST-DC
has not been systematically empirically examined how it is interpreted in other different linguistic settings. The present study attempted to fill this gap by investigating caki’s reference resolution in the mono-clausal structure or the equivalent (e.g., periphrastic causatives in Korean). Another practical reason to choose this simple structure as the target sentential environment (inside which the contained reflexive caki must find its antecedent) was due to the concern that uncontrolled biases or unmeasured confounders might exist with respect to bi-clausal sentence processing (e.g., parsing difficulty, structural reanalysis, etc.). Examining caki in mono-clausal contexts removes this potential risk. Five factors selected for empirical investigation and relevant research questions are provided in Table 3.1.

<table>
<thead>
<tr>
<th>Exp.</th>
<th>Factor</th>
<th>Research questions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Semantic gender of PA</td>
<td>What is the baseline reading of the mono-clausal caki? Does the semantic gender affect the antecedent choice?</td>
</tr>
<tr>
<td>2.</td>
<td>Person of PA</td>
<td>Does the morphological feature of PA, especially person, affect the antecedent choice?</td>
</tr>
<tr>
<td>3.</td>
<td>Order of mention of PA</td>
<td>Is the first-mentioned PA is preferred more often than the second-mentioned PA in the antecedent choice?</td>
</tr>
<tr>
<td>4.</td>
<td>Subjecehood of PA</td>
<td>What aspect of the subject makes itself the most available candidate for antecedent selection? Can the subjecehood of a PA be treated as a cue for caki’s antecedent retrieval?</td>
</tr>
<tr>
<td>5.</td>
<td>Source-ness of PA</td>
<td>Does the discourse-pragmatic feature of a PA, especially informational soureness, affect the antecedent selection?</td>
</tr>
</tbody>
</table>

All experiments conducted in the present study employed the identical procedure. Moreover, they all targeted the same population of language users (i.e., Korean native speakers residing in
South Korea). In the sub-sections that follow, I describe commonalities among the five experiments.

3.1.1 Participants

136 Korean native speakers were recruited who resided in Seoul, South Korea (see Table 3.2). All participants signed an informed consent. They were remunerated for their participation. The study was approved by the IRB of the Graduate Center of the City University of New York.

<table>
<thead>
<tr>
<th>Table 3.2 Number of participants in each experiment</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of</strong></td>
</tr>
<tr>
<td>Participants</td>
</tr>
</tbody>
</table>

3.1.2 Design

In each experiment, the acceptability judgment data were collected using a paper-and-pencil questionnaire. Each questionnaire contained experimental and filler trials presented in the same format. As illustrated in (51), each experimental trial consisted of two consecutively-presented sentences (S1 and S2), followed by 5-point Likert scale (where ‘1’ indicates ‘very unacceptable’ and ‘5’ indicates ‘very acceptable’). (Experiment 1 used a 7-point scale).

---

21 The number of participants recruited per experiment was determined based on the number of experimental conditions (ECs). As seen in Table 3.2 above, Experiment 4 (with 6 ECs) recruited more participants than other experiments (with 4 ECs) to assign the same number of participants to each condition. See relevant experiment sections below for more detailed discussion.
S1 was a simple ditransitive sentence with caki that could refer to either of the two preceding NPs (subject NP1 and indirect object NP2), resulting in two readings of S1 (R1 and R2). S2 was a paraphrase of S1 whose meaning corresponded to one of S1 readings. S2 paraphrases were created by simply substituting caki contained in S1 with a two-word NP [NP N ponin] (where N corresponds to either the subject or the indirect object in S1 and ponin is a nominal intensifier roughly meaning ‘one’s own’ or ‘oneself’). Thus, S2 was structurally identical to S1 (i.e., simple ditransitive) but it was not referentially ambiguous because it did not include a reflexive. In each trial, participants were asked to evaluate how properly the S2 paraphrases the S1 and to provide their decision by circling one of numbers on the Likert scale.22

As seen in (51), nominal arguments in S1 were in the canonical order of Subject-Indirect Object-Direct Object (L. Kim, 2015). The genitive-marked caki was placed to the left of the direct object (NP3) to form a complex possessive NP (caki-GEN NP3-ACC). Crucially, in that

---

22 In collecting the data, the present study did not use a multiple-choice method due to the potential masking effect: A given option may be chosen simply because it is relatively better or more preferred than the remaining options. If so, the availability of the unselected option(s), although less preferred, can be masked by selecting a (preferred) option. Hence, it is improper to use the multiple-choice method in exploring the ambiguous reflexive. The experimental method adopted in this study removed such masking effect by forcing participants to consider only one reading of S1 and to rate the acceptability of that reading.
position, *caki* is referentially ambiguous and can refer to either NP1 or NP2. The animacy of arguments was also controlled in such a way that both subject (*AGENT*) and indirect object (*RECIPIENT*) were always animate while direct object (*THEME*) was inanimate to set up a discourse context in which an inanimate *THEME* is delivered (or shown) to a *RECIPIENT* by an *AGENT*. Finally, three additional adjunct adverbials (e.g., *ecey* ‘yesterday’, *pang-eyse* ‘room-at’, or *sulceck* ‘furtively’) were inserted into all experimental sentences to make them sound more natural (cf. (52)).

(52) Positions of adjunct adverbials (ADVs)

\[
\begin{array}{cccc}
NP1-\text{NOM} & ADV1 & NP2-\text{DAT} & ADV2 & caki-\text{GEN} & NP3-\text{ACC} & ADV3 & V_{\text{ditran}} \\
\end{array}
\]

\[
yesterday & \text{room-at} & \text{furtively}
\]

Filler trials were identical in format to experimental trials. Either simple or complex sentences of various types that did not contain *caki* were presented as S1, some of which were either syntactically or semantically ambiguous while others were not. Each S1 filler was followed by a paraphrase (S2). However, unlike the experimental trials, some of S2s in filler trials were correct while others were not. Ten filler trials, which did not involve ambiguity of any types, were carefully chosen to determine if rating responses from each participant were reliable. A half of the 10 filler sets contained correct paraphrases without leaving the least doubt about their grammaticality (Good fillers) while the other half did not (Bad fillers). Thus, it was expected that the good fillers would be judged (very) acceptable by participants while the bad fillers would be rated as being (very) unacceptable. The summary of the set-up of 5 experiments is provided in Table 3.3.
Table 3.3 Summary of the set-up of Experiment 1-5

<table>
<thead>
<tr>
<th></th>
<th>Exp.1</th>
<th>Exp.2</th>
<th>Exp.3</th>
<th>Exp.4</th>
<th>Exp.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental trials</td>
<td>8</td>
<td>8</td>
<td>8</td>
<td>12</td>
<td>8</td>
</tr>
<tr>
<td>Filler trials</td>
<td>32</td>
<td>32</td>
<td>32</td>
<td>24</td>
<td>32</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>40</td>
<td>40</td>
<td>40</td>
<td>36</td>
<td>40</td>
</tr>
<tr>
<td>Factors/levels</td>
<td>2×2</td>
<td>2×2</td>
<td>2×2</td>
<td>3×2</td>
<td>2×2</td>
</tr>
<tr>
<td>Questionnaire versions</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>6</td>
<td>4</td>
</tr>
</tbody>
</table>

In each experiment, two independent experimental factors were manipulated that included the linguistic property of PAs in S1 (Factor I) and the type of paraphrase to appear with S1 (Factor II). Factor I had two (Experiments 1-3 and 5) or three levels (Experiment 4) while Factor II always had two levels. The orthogonal crossing of the two factors produced either four (2×2) or six (3×2) experimental conditions.

Using the Latin Square design, experimental sentences were distributed across four or six versions of questionnaires in such a way that each version included only one condition of each experimental item in a set, and in any given version, each condition appeared the same number of times. Each version of questionnaire contained the same number of filler trials, which were pseudo-randomly distributed so that two experimental trials never appeared consecutively.

3.1.3 Procedure

Each participant was seated in a quiet room and given one version of the questionnaire. They were told to evaluate how similar the sentential meaning of S2 (paraphrase of S1) is to their own
reading of S1 with *caki* (i.e., the acceptability of S2 as the paraphrase of S1) and to indicate their judgment by marking one of numbers on the scale. Before the main experiment began, participants were presented with three practice trials to familiarize themselves with the experimental procedure.

3.1.4 Data Treatment

Before conducting the main statistical analysis, participants’ rating data were screened based on the value of response reliability (VOR). For this, I first analyzed participants’ ratings for ten (pre-designated) filler sentences; five of them were followed by obviously *good* paraphrases (good filler trials) and the other five were followed by obviously *bad* paraphrases (bad filler trials). The formula presented in (53) was used to calculate the VOR. If participant’s rating for a “good” filler trial fell below 4 (excluding), his or her response was considered *unreliable*. Along the same lines, if participant’s rating for a “bad” filler trial fell above 2 (excluding), it was also treated as being *unreliable*.\(^\text{23}\)

\[
VOR(\%) = \left(1 - \frac{\text{N of unreliable responses}}{10}\right) \times 100
\]

All response data from participants with VOR below 80% were eliminated from main statistical analyses. The summary of VORs calculated in each experiment is provided in Table 3.4.

\(^{23}\) It was assumed that, for the good filler trials, participants would judge them as fairly acceptable (hence, expected ratings ≥ 4) while, for the bad filler trials, they would judge them as fairly unacceptable (hence, expected ratings ≤ 2).
### Table 3.4 Summary of VORs

<table>
<thead>
<tr>
<th></th>
<th>Exp.1</th>
<th>Exp.2</th>
<th>Exp.3</th>
<th>Exp.4</th>
<th>Exp.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grand VOR (%)</td>
<td>88</td>
<td>94</td>
<td>96</td>
<td>90</td>
<td>97</td>
</tr>
<tr>
<td>Number of participants with</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>VOR below 80%</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>VOR above 80%</td>
<td>21</td>
<td>19</td>
<td>24</td>
<td>42</td>
<td>20</td>
</tr>
</tbody>
</table>

#### 3.2 Experiments

##### 3.2.1 Experiment 1: Gender

Experiment 1 explored whether the semantic gender of PAs can influence antecedent selection of *caki* in the referentially ambiguous mono-clausal context. Previous studies (Han et al., 2011; Sohng, 2004) showed that *caki* in the bi-clausal context refers to an antecedent, regardless of the gender type (masculine vs. feminine) of the antecedent. Based on this finding, it was predicted that *caki* in the mono-clausal context would also select an antecedent without consulting its gender property. Hence, the relevant reference resolution would not be affected by the gender feature manipulation in the mono-clausal context and the interpretive patterns of *caki* would reflect the baseline interpretation of the reflexive.

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24 The gender feature of proper/common nouns in Korean is *not* morphologically realized. Instead, their gender is encoded lexically, as in English (e.g., *Tom* [MALE] vs. *Susan* [FEMALE]).
3.2.1.1 Materials

Eight experimental items were created in the format illustrated in (54). Each item was composed of four experimental sentence-paraphrase pairs generated by crossing two factors (with two levels each): Gender of PAs (gender match vs. gender mismatch) and Paraphrase (subject vs. object paraphrase).

(54) a. S1: Gender match (GM: male-male)/mismatch (GMIS: female-male)

아버지/어머니가 어제 아들에게 방에서 자기의 백일사진을 슬쩍 보여주었다.

(subject paraphrase)

Father/mother-NOM yesterday son-DAT room-at self-GEN photo-ACC

duration show-BENE-PST-DC

‘Yesterday, father/mother furtively showed (his/her) son a self’s photo in a room.’

b. S2: Paraphrase (PA1=father (in GM) or mother (in GMIS); PA2=son in all conditions)

i. Subject (PA1) paraphrase:

PA1_i-ka ecey PA2_j-eykey pang-eyse PA1 ponin_i*j-uy ...

PA1-NOM yesterday PA2-DAT room-at PA1 oneself-GEN ...

‘Yesterday, PA1 (furtively showed) PA2 a photo of PA1 in a room.’

ii. Object (PA2) paraphrase:

PA1_i-ka ecey PA2_j-eykey pang-eyse PA2 ponin*$i*j-uy ...

‘Yesterday, PA1 (furtively showed) PA2 a photo of PA2 in a room.’
Each experimental sentence (S1) contained a ditransitive verb (e.g., *poye-cwu-ta* ‘show’ or *ponay-cwu-ta* ‘send’) which always appeared at the clause-final position\(^{25}\). In addition, three adjunct expressions were inserted between core lexical components of the sentence. In particular, the indirect object (PA2 *atul* ‘son’ in (54) and the reflexive were separated by an adjunct expression in all conditions to prevent the indirect object from being chosen as antecedent of *caki* simply because the indirect object is linearly close to the reflexive. The gender was manipulated by altering the biological gender of the subject PA (either masculine or feminine) while keeping the object PA masculine in all conditions. This resulted in two distinct experimental conditions: *Gender match* (Male - Male) and *Gender mismatch* (Female - Male).

3.2.1.2 Results and discussion

Table 3.5 summarizes 21 participants’ acceptability judgments from four experimental conditions. A \(2 \times 2\) repeated measure analysis of variance (RM ANOVA) was conducted, in which the factors were PA gender (Gender match *vs.* Gender mismatch) and Paraphrase (Subject *vs.* Object paraphrase).

\(^{25}\) Benefactive ending -cwu- was added to the verb stem (e.g., *poye*-'show'; *ponay*-'send') to make the indirect object more accessible to the reflexive, based on the previous finding (Joo, 2017) that the beneficiary referent tends to be more salient than the non-beneficiary referent in discourse. If subject is still preferred to non-subject as antecedent of *caki* in (54), despite the presence of the benefactive ending, this could be interpreted as showing that *caki* has a fairly strong subject bias.
Table 3.5 Mean and SD of acceptability judgments in 4 conditions (Gender × Paraphrase)

<table>
<thead>
<tr>
<th></th>
<th>Gender Match</th>
<th>Gender Mismatch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject paraphrase</td>
<td>6.05 (1.07)</td>
<td>6.12 (0.89)</td>
</tr>
<tr>
<td>Object paraphrase</td>
<td>2.24 (0.97)</td>
<td>2.31 (1.09)</td>
</tr>
</tbody>
</table>

*7-point Likert scale was used in collecting data (1 = very unacceptable; 7 = very acceptable).

Statistical analysis revealed that native Koreans rated the subject paraphrase as significantly more acceptable than the object paraphrase, regardless of the gender of PAs (Main effect of Paraphrase: $F_1(1, 20)=192.81, p<0.001$; $F_2(1, 7)=230.27, p<0.001$), which establishes that just like the bi-clausal caki, the mono-clausal caki also prefers the subject over the object antecedent. The semantic gender of PAs did not make any difference in acceptability (no effect of Gender: $Fs<1$), indicating that PAs’ gender feature is not a factor that can affect the antecedent choice. There was no interaction between the two factors ($Fs<1$).

Experiment 1 revealed that the mono-clausal caki, just like the bi-clausal one, strongly prefers the subject over the object antecedent, regardless of their gender. Given the null effect of gender and the absence of other potentially affecting factors, the conclusion is that the observed subject antecedent bias of the mono-clausal caki reflects the baseline interpretation of the reflexive.

3.2.2 Experiment 2: Person

Sohng (2004) previously established that caki refers only to a third-person (3P) antecedent, as seen in (55).
In (55), caki cannot refer to the first-person NP (nay-ka ‘I-NOM’) even though that NP is the subject. In this case, it has to refer to an object antecedent that is in 3P, contra the general strong subject antecedent bias.

Experiment 2 examined whether PAs’ person feature can affect the antecedent choice of caki. If the subject is always treated by the grammar as the only possible antecedent of caki, its object reference would be judged exclusively as ‘very unacceptable’, even in the case like (55) where caki has no choice but to refer to an object NP. However, if the grammar has no such restriction, object paraphrases to sentences like (55) would be judged very acceptable, comparable to acceptability level of caki’s reference to a 3P subject PA.

3.2.2.1 Materials

Eight experimental items were generated in the format illustrated in (56). To examine whether and how the person type of PAs interacts with reflexive reference, the person feature of PAs was manipulated, resulting in two experimental conditions: Person match (PM) and Person mismatch (PMIS). In PM, all PAs were in 3P (3S3O) while, in PMIS, the subject PA was in 1P and the object PA was in 3P (1S3O). Each item consisted of four experimental sentence-paraphrase pairs.
constructed by crossing two independent factors: PA Person and Paraphrase. All PAs used were gender-neutral (e.g., *chinkwu* ‘friend’).

(56) a. **S1: Person match (PM) vs. Person mismatch (PMIS)**

동생이/내가 어제 친구에게 교실에서 자기의 성적표를 몰래 보여주었다.

Tongsayng,-i/nay,,-ka ecey chinkwu,,-eykey kyosil-eyse caki,,-i,,-j,-uy

younger.sibling/-I-NOM yesterday friend-DAT classroom-at self-GEN

성적표를 몰래 보여주었다.

sengcekpyo-lul mollay poye-cwu-ess-ta.

report card-ACC furtively show-BENE-PST-DC

‘Yesterday, (my) younger sibling/I furtively showed a friend a self’s report card in the classroom.’

b. **S2: Paraphrase** (PA1=younger sibling in PM or I in PMIS; PA2=friend in PM and PMIS)

i. **Subject (PA1) paraphrase:**

PA1,-i/-ka ecey PA2,,-eykey kyosil-eyse PA1 ponin,,-i,,-j,-uy …

PA1-NOM/-NOM yesterday PA2-DAT classroom-at PA1 oneself-GEN

‘Yesterday, *PA1* showed *PA1*’s report card to *PA2* …’

ii. **Object (PA2) paraphrase:**

PA1,-i/-ka ecey PA2,,-eykey kyosil-eyse PA2 ponin,,-i,,-j,-uy …

‘Yesterday, *PA1* showed *PA2*’s report card to *PA2* …’

---

26 ‘-i’ and ‘-ka’ are nominative case markers in Korean. The former is suffixed to a noun that ends in a consonant whereas the latter to a noun ending in a vowel.
3.2.2.2 Results and discussion

Participants’ acceptability judgments are summarized in Table 3.6.

Table 3.6 Mean and SD of acceptability judgments in 4 conditions (Person×Paraphrase)

<table>
<thead>
<tr>
<th></th>
<th>PM: 3S3O</th>
<th>PMIS: 1S3O</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject paraphrase</td>
<td>4.68 (0.45)</td>
<td>2.47 (1.09)</td>
</tr>
<tr>
<td>Object paraphrase</td>
<td>1.61 (0.61)</td>
<td>3.63 (1.09)</td>
</tr>
</tbody>
</table>

The acceptability judgment means from 19 participants were entered into $2\times2$ RM ANOVA with two factors: PA Person (PM vs. PMIS) and Paraphrase (Subject vs. Object paraphrase). Statistical results revealed no reliable effect of PA’s person ($F_{S}<1$), but a significant main effect of Paraphrase ($F_{1}(1, 18)=12.238, p<0.01$; $F_{2}(1, 7)=25.676, p<0.01$): participants judged the subject paraphrase as significantly more acceptable than the object paraphrase. A highly significant interaction was also found between the two factors ($F_{1}(1, 18)=76.564, p<0.001$; $F_{2}(1, 7)=234.986, p<0.001$): when both PAs were in 3P, the subject PA was more preferred than the object PA (replicating Experiment 1). However, when PAs were mismatched in person (1P Subject-3P Object), the 3P object PA was preferred to the 1P subject PA.

The present experiment demonstrated that, despite caki’s strong subject antecedent bias, the subject PA was dispreferred as an antecedent of the reflexive when it was not in 3P. Instead, the object PA in 3P, although less preferred, was chosen as antecedent. This indicates that the person feature of PAs can be accessed during antecedent retrieval and the non-subject NP indeed can serve as a grammatically licit antecedent, in contrast to the previous literature (Chang, 1977; Lee, 1973).
However, note that caki’s reference to the 3P object PA in PMIS (1S3O/Object) was not judged equally acceptable as its reference to the 3P subject PA in PM (3S3O/Subject). This is surprising, given that the object reference is the only grammatical option that the reflexive can take in PMIS. While it is unclear why this is so, one conjecture is that the relatively lower acceptability of 1S3O/Object may come from the subject bias of caki. The strong subject antecedent preference of caki may give participants a false illusion that caki’s non-subject reference is improper (even in the context where caki must refer to an object antecedent). I will return to this point in the general discussion.

3.2.3 Experiment 3: Word order

The results of Experiment 2 established that the mono-clausal caki is strongly biased toward a subject antecedent in the third person. Why is it so? One possible answer is that caki’s subject antecedent bias may arise due to discourse prominence of the 1st-mentioned 3P subject. Previous studies reported that when a sentence contains two NPs (e.g., John and Tom in (57)), the first-mentioned NP John is generally better remembered and more rapidly retrieved from memory than the 2nd-mentioned NP Tom (Gernsbacher & Hargreaves, 1988; S. Kim, Lee, & Gernsbacher, 2004).

(57) John hit Tom in the backyard.

Recall that all experimental sentences used in Experiments 1 and 2 began with a nominative subject NP (caki’s preferred antecedent). Therefore, it is possible that the subject bias of caki
may be triggered simply by the privileged status of the 1st-mentioned subject PA in discourse (or memory). The current experiment addressed this issue by examining whether *caki’s* antecedent choice can be influenced by the surface order of PAs in the mono-clausal sentence. Based on the facts that the 1st-mentioned NP is more accessible and retrievable from memory than the 2nd-mentioned NP and that reflexive reference involves immediate memory retrieval of previously seen lexical items, it was predicted that the 1st-mentioned PA, regardless of its grammatical role (e.g., subject vs. non-subject), would be chosen as the antecedent of *caki* more often than the 2nd-mentioned PA.

3.2.3.1 Materials

Eight experimental items were constructed that were formally isomorphic to those in Experiments 1 and 2, except that the current items began with a temporal adverbial (e.g., *ecey* ‘yesterday’), not directly with a nominative-marked NP. This formal change was made to eliminate the possibility that a clause-initial expression (subject PA in Experiments 1 and 2) is topicalized. To see if there exists an interaction between PA order and antecedent selection, the surface order of PAs was manipulated to produce two PA sequences: canonical (PA1[NOM]-PA2[DAT]) vs. scrambled order (PA2[DAT]-PA1[NOM]). Crossing the two factors (PA order and Paraphrase) produced four experimental conditions, as illustrated in (58).

---

27 Unlike languages that have a fairly strict word order restriction (e.g., English), Korean allows for relatively free scrambling of constituents (e.g., NP), owing to particles amalgamated with NPs to signal their grammatical functions (Sohn, 1999). Note that although Korean sentences can surface with various word orders, all sentential variants are understood by natives as denoting the same event (but cf. Jackson, 2008, for arguments that scrambling may adjust the information structure of the affected sentence).
(58) a. **S1: Canonical vs. Scrambled order of PAs**

i. **Canonical PA order** (PA1-NOM  PA2-DAT):

어제 소녀가 남동생에게 슬쩍 자기의 백일 사진을 

ecey sonye-ka namtongsayng-eykey sulccek caki-uy paykil sacin-ul

yesterday girl-NOM younger brother-DAT secretly self-GEN photo-ACC

다락방에서 보여주었다.

talakpang-eyse poyecwu-ess-ta.

attic-at show-PST-DC

‘Yesterday, (the) girl secretly showed younger brother self’s photo in the attic.’

ii. **Scrambled PA order** (PA2-DAT  PA1-NOM):

어제 남동생에게 소녀가 슬쩍 자기의 …

ecey namtongsayng-eykey sonye-ka sulccek caki-uy …

yesterday younger brother-DAT girl-NOM secretly self-GEN …

b. **S2: Paraphrase** (PA1= girl; PA2= younger brother)

i. **Subject (PA1) paraphrase:**

ecey PA1-ka PA2-eykey sulccek PA1 ponin-uy …

yesterday PA1-NOM PA2-DAT secretly PA1 oneself-GEN …

‘Yesterday, PA1 secretly showed PA2 PA1’s …’

ii. **Object (PA2) paraphrase:**

ecey PA1-ka PA2-eykey sulccek PA2 ponin-uy …

‘Yesterday, PA1 secretly showed PA2 PA2’s …’
3.2.3.2 Results and discussion

The summary of participants’ acceptability judgments is provided in Table 3.7.

Table 3.7 Mean and SD of acceptability judgments in 4 conditions (PA order × Paraphrase)

<table>
<thead>
<tr>
<th></th>
<th>Canonical PA order</th>
<th>Scrambled PA order</th>
</tr>
</thead>
<tbody>
<tr>
<td>Subject paraphrase</td>
<td>4.69 (0.44)</td>
<td>4.50 (0.71)</td>
</tr>
<tr>
<td>Object paraphrase</td>
<td>1.58 (0.62)</td>
<td>1.77 (0.83)</td>
</tr>
</tbody>
</table>

The judgment data from 24 participants were entered into the 2×2 RM ANOVA with the factors of PA order (canonical vs. scrambled order) and Paraphrase (subject vs. object paraphrase). Statistical results revealed a reliable main effect of Paraphrase, $F_1(1, 23) = 256.136, p < 0.001; F_2(1, 7) = 249.016, p < 0.001$, and no main effect of PA order ($F$’s<1). Regardless of whether the subject PA was first-mentioned or not, it served as the antecedent of *caki*. There was no interaction between the two factors ($F_1(1, 23) = 2.810, p = 0.107; F_2(1, 7) = 2.526, p = 0.156$).

The results showed that *caki* consistently selected a subject PA as antecedent, regardless of the surface location of the subject in sentences. This indicates that *caki*’s subject preference found in previous experiments does not emerge simply because the subject PA is mentioned first in the input string. What matters is the *subjecthood* of the antecedent, and not its surface position.

3.2.4 Experiment 4: Subjecthood
A most significant and consistent finding from Experiment 1 through 3 is that *caki* strongly prefers the subject antecedent in referentially ambiguous contexts (with two grammatical PAs), regardless of word order. This point is further supported by the fact that some Korean natives *falsely* selected the person-mismatching PA in the subject position as *caki’s* antecedent (cf. Experiment 2). This means that the *subjecthood* of antecedent plays a major role in the antecedent selection process. In other words, it acts as a strong (sometimes, irresistible) source of dependency generation between *caki* and its antecedent.

However, note that the notion “subject” has been defined in various ways, from different (theoretical) perspectives. For example, setting aside its lexical profile, it is usually described in syntax as the NP or DP sitting in a specifier (position) of a head T (SpecTP). Thematically, it is a nominal item assigned the verb’s *external* theta(θ)-role (e.g., AGENT, EXPERIENCER, etc.). In terms of *Case*, it is characterized as the NP assigned *nominative Case* (Baker, 1985; Chomsky, 1981; Williams, 2009; Zubizarreta, 1985). Pragmatically, it is usually a topic of a sentence, is a first-mentioned nominal, and is relatively salient in discourse, compared to other non-subject NPs (Gernsbacher & Hargreaves, 1988). All these properties considered, the subject could be roughly understood as a composite construct comprised of a variety of different linguistic features, as illustrated in (59).

\[(59) \quad \left[ \begin{array}{c} [Cat] \\ [Phi] \\ [\theta] \\ [Case] \end{array} \right] \begin{array}{c} \text{NP/DP} \\ \text{gender, number, person, animacy} \\ \text{External} \\ \text{Nominative} \end{array} \quad \text{in SpecTP} \]
Here, a question arises: which of the features in (59) is used when *caki* accesses the “subject” antecedent? Does *caki* use all of them or just some of them, in identifying the subject? First, we already have solid evidence (from Experiment 1 and 2) to show that PA’s phi feature (especially, person) affects *caki*’s antecedent selection. Thus, *caki* must access it during antecedent retrieval. PAs’ syntactic category information must also be accessed and evaluated because the reflexive co-refers only with a nominal expression. However, note that both the category and the phi-features of PA are “lexical” in nature. Although it is true that they must be accessed during antecedent retrieval, they are not core determinants of *subjecthood* of antecedent.

What about the case morphology and the theta-role information? Seemingly, they appear promising as a means of determining PA’s grammatical function (e.g., subjecthood). But, if we posit that the parser may favor to employ cues that are most reliable and cost-effective (and ideally, invariable) to enhance processing efficiency, it seems unlikely that the parser would heavily rely on these pieces of information in determining PAs’ grammatical function, probably due to their inconsistencies in use (although they can still be accessed for secondary or supporting use). In case of the case morphology, for example, although the subject NP is normally marked by a nominative case particle in Korean, other case particles such as a dative case particle *-eykey* can also appear with the subject, as shown in (60). Also note that, in (60), the NP ton ‘money’ is attached by the nominative case particle even though it is not the subject. The presence of cases like (60) reduces reliability of nominative case particle as a cue because its detection (on the surface of nominal expression) itself does not guarantee that the NP it attaches to is the subject.
As for the theta-role, it is also less reliable as a cue because, although the subject normally takes an AGENT theta role, it can take other different theta roles as well. Consider (61) for example, in which a nominative-marked subject NP takes a non-AGENT role.

(61) 영희가 철수에 의해 자기의 새 후임에게 소개되었다.
Yenghuy-ka Chelswu-eyuyhay caki-uy say hwuim-eykey
Y-NOM C.-by self-GEN new successor-DAT

sokaytoy-ess-ta.

be introduced-PST-DC

‘Yenghuy was introduced to self’s new successor by Chelswu.’

(61) is a passive sentence in which the nominative-marked subject has the THEME/PATIENT role. Also note that caki in this sentence can indeed refer to the THEME subject NP. This suggests that the thematic information alone may not suffice to exactly pinpoint the subject antecedent for caki, among a set of potential candidates, because it can indeed take any of theta roles (such as AGENT, EXPERIENCER, THEME, etc.).
The most reliable cue, among those in (59), seems to be the positional information of the subject, i.e., SpecTP. SpecTP is the position fixed in the structural hierarchy, as shown in (62). Thus, if the syntactic representation of a sentence is correctly built up and encoded (in memory), the parser could easily locate the subject position, even without considering linguistic properties of an occupying item (e.g., Case, theta role, etc.).

(62)\[
\text{SpecTP} \quad \text{TP} \\
\quad \quad \quad \quad N_{\text{Subject}} \\
\quad \quad \quad \quad T' \\
\quad \quad \quad \quad T \\
\quad \quad \quad \quad \ldots
\]

Based on foregoing discussion, a following working hypothesis (63) can be made:

(63) \textit{SpecTP} is a positional cue (or, possibly, a lexically-encoded, weighted, feature) that \textit{caki} majorly relies on in establishing a referential dependency with an NP. Thus, \textit{caki} first attempts to form a dependency with an NP in SpecTP, whenever possible, which results in the subject antecedent preference.

The present experiment tested this hypothesis, using Korean periphrastic causative sentences, like (64a). This structure is identical to ditransitive sentences (64b) in terms of the number of argument NPs and concomitant case particles. The only difference between the two is the type of verbal morphology. Note that, seemingly, both structures look alike. However, in the theoretical literature, the (periphrastic) causatives have been analyzed as bi-clausal, with the initial nominative-marked NP (\textit{causer}) as a matrix subject and the dative-marked NP (\textit{causee}) as the
embedded subject, as represented in (64c), while the ditransitives like (64b) have not (Kim, 2005; O’Grady, 1991 for detailed discussions on Korean causatives).

(64)  

a. **Periphrastic causative**

 존이 수잔에게 돈을 주게 했다.  
John-NOM Susan-DAT money-ACC give-COMP do-PST-DC  
‘John made Susan give (some) money (to someone).’  
(O’Grady, 1991)

b. **Ditransitive**

 존이 수잔에게 돈을 주었다.  
John-NOM Susan-DAT money-ACC give-PST-DC  
‘John gave (some) money to Susan.’

c.  

\[
\begin{array}{ll}
\text{TP}_1 \ N1-\text{NOM} & [T \ [VP_1 \ [TP_2 \ N2-\text{DAT} \ [T \ [VP_2 \ N2-\text{ACC} \ V \ key \ ]] \ V_{DO} \ ]]] \\
<\text{CAUSER}> & <\text{CAUSEE}> \\
\text{Surface subject} & \text{Secondary subject}
\end{array}
\]

The periphrastic causatives in Korean provide an interesting testing ground as the examination of caki in this context will allow us to determine if it is valid to assume that the positional SpecTP is indeed a cue that independently plays a role in caki’s reference resolution. From this, the following predictions were formulated for the present experiment:

(i) In both causatives and non-causatives, the initial nominative-marked NP (subject PA) would be preferred over the second dative-marked NP (object PA) because:
a. In non-causatives, only the subject PA is in SpecTP. Thus, \textit{caki} would first attempt to form a dependency with that PA, leading to the subject bias.

b. In causatives, both the subject PA and the object PA are in SpecTP (with the former as the matrix subject and the latter as the embedded subject; cf. (64c)). Previous studies (Han et al., 2011; Kim et al., 2009) showed that \textit{caki} prefers a nonlocal (matrix subject) antecedent over a local (embedded subject) antecedent in bi-clausal contexts. Based on this finding, it is predicted that the (nonlocal) subject PA would be favored over the (local) object PA.\footnote{It still remains unknown why the nonlocal subject antecedent is preferred over the local subject antecedent. Both are in SpecTP. Thus, if SpecTP is the only source of information or cue available during the antecedent selection/retrieval, it is expected for very high referential ambiguity to be detected (contrary to the facts). This may suggest that there would exist other additional factors that affect \textit{caki}’s interpretation. I discuss this potential further in the general discussion section.} Hence, the subject antecedent bias emerges.

(ii) The object PA in causatives would be judged relatively more acceptable than the object PA in non-causatives (such as ditransitives), even though both are grammatical PAs for \textit{caki}. This is so because the causative object PA is considered as being in SpecTP (hence, more preferred by \textit{caki}) whereas the ditransitive object PA is not.

3.2.4.1 Materials

Twelve experimental items were created in the format illustrated in (65). Each item consisted of six target-paraphrase pairs constructed by crossing two factors: Sentence type (causative \textit{vs.} benefactive \textit{vs.} plain ditransitive) and Paraphrase (subject \textit{vs.} object paraphrase).
Although the main focus of the present experiment was on how caki is interpreted in the causative context (compared to in the dative context), benefactive sentences were also included to explore whether the benefactivity can increase the accessibility of the beneficiary dative-marked NP so that the beneficiary/recipient NP could be chosen as the antecedent of caki (Joo, 2017). Here, note that all experimental sentences (causative, benefactive, and ditransitive) contained a dative-marked NP. However, as stated above, only the dative NP in the causative sentence can be treated as the (secondary) subject while the same forms in benefactive and ditransitive sentences cannot (cf. (65)).

(65) a. Causative: [ … NP$_i$-NOM [NP$_j$-DAT … caki$_i$/j-GEN NP-ACC … V-CAU ] ]

b. Benefactive: [ … NP$_i$-NOM [NP$_j$-DAT … caki$_i$/j-GEN NP-ACC … V-BENE ] ]

c. Ditransitive: [ … NP$_i$-NOM [NP$_j$-DAT … caki$_i$/j-GEN NP-ACC … V ] ]

Ditransitive sentences were identical to experimental sentences with canonical word order from Experiment 3, except that, in this experiment, all PAs were typical proper nouns of people. Causative and benefactive sentences were constructed by simply adding, respectively, a causative ending -kye hata and a benefactive ending -cwu- to the stem of simple ditransitive verbs. Sample sentences are provided in (66).

(66) a. **S1: Plain ditransitive [D] vs. Causative [C: -key hata] vs. Benefactive [B: -cwuta]**

어제 철수가 영희에게 오후 무렵 자기의 학생증을

ecey Chelswu-ka Yenghui$_j$-eykey ohwumwulyep caki$_i$/j-uy haksayngcung-ul

yesterday C.-NOM Y.-DAT afternoon.around self-GEN student ID-ACC
우편으로 발송했다/발송하게 했다/발송해 주었다.

wupyen-ulo palsonghay-ss-ta[D]/palsongha-key hay-ss-ta[C]/palsonghay-cwu-ess-ta[B].

by mail send-PST-DC /send-CAU-PST-DC /send-BENE-PST-DC

‘[D/B]: Chelswu sent Yenghui self’s student ID by mail in the afternoon yesterday.’

‘[C]: Chelswu made Yenghui send self’s student ID by mail in the afternoon yesterday.’

b. **S2: Paraphrase** (PA1= Chelswu; PA2= Yenghui)

i. **Subject (PA1) paraphrase:**

<table>
<thead>
<tr>
<th>ecey</th>
<th>PA1-ka</th>
<th>PA2-eykey</th>
<th>ohwumwulyep</th>
<th>PA1 ponin-uy …</th>
</tr>
</thead>
<tbody>
<tr>
<td>yesterday</td>
<td>PA1-NOM</td>
<td>PA2-DAT</td>
<td>afternoon.around</td>
<td>PA1 onself-GEN …</td>
</tr>
</tbody>
</table>

‘Yesterday PA1 sent PA1’s student ID to PA2 … ’

ii. **Object (PA2) paraphrase:**

<table>
<thead>
<tr>
<th>ecey</th>
<th>PA1-ka</th>
<th>PA2-eykey</th>
<th>ohwumwulyep</th>
<th>PA2 ponin-uy …</th>
</tr>
</thead>
</table>

‘Yesterday PA1 sent PA2’s student ID to PA2 … ’

3.2.4.2 Results and discussion

The summary of 42 participants’ acceptability judgments is provided in Table 3.8.

**Table 3.8 Mean and SD of acceptability judgment in 4 conditions (S-type×Paraphrase)**

<table>
<thead>
<tr>
<th></th>
<th>Ditransitive</th>
<th>Causative</th>
<th>Benefactive</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Subject paraphrase</strong></td>
<td>4.40 (0.77)</td>
<td>4.12 (0.72)</td>
<td>4.44 (0.75)</td>
</tr>
<tr>
<td><strong>Object paraphrase</strong></td>
<td>1.74 (0.97)</td>
<td>2.01 (0.98)</td>
<td>1.76 (0.81)</td>
</tr>
</tbody>
</table>
The judgment data from 42 participants were entered into the 3x2 RM ANOVA, where factors were Sentence type (simple ditransitive vs. causative vs. benefactive) and Paraphrase (subject vs. object paraphrase). Participants judged caki’s subject reference as significantly more acceptable than its object reference in all sentence types (Main effect of Paraphrase: $F_1(1, 41) = 238.551, p < 0.001$; $F_2(1, 11) = 539.596, p < 0.001$). However, the sentence type did not lead to meaningful differences in acceptability judgments ($F$’s$<1$). Importantly, significant interaction was found between the two factors ($F_1(2, 82) = 5.410, p < 0.01$; $F_2(2, 22) = 4.057, p < 0.05$). Planned comparisons showed that in the subject paraphrase condition, both simple ditransitive and benefactive sentences were judged more acceptable than causative sentence (ditransitive vs. causative: $F_1(1, 41) = 6.093, p < 0.05$, $F_2(1, 11) = 2.832, p = 0.121$; causative vs. benefactive: $F_1(1, 41) = 9.663, p < 0.05$, $F_2(1, 11) = 3.362, p = 0.094$; ditransitive vs. benefactive: $F$’s $< 1$).

On the other hand, in the object paraphrase condition, the mean judgment for causative sentence was numerically higher than those for ditransitive and benefactive sentences although the difference was not statistically significant (ditransitive vs. causative: $F_1(1, 41) = 2.062, p = 0.159$, $F_2(1, 11) = 2.868, p = 0.118$; causative vs. benefactive: $F_1(1, 41) = 2.716, p = 0.107$, $F_2(1, 11) = 3.084, p = 0.107$; ditransitive vs. benefactive: $F$’s $< 1$).

Like in Experiment 1 through 3, the strong subject antecedent preference was also found in the present experiment. Furthermore, caki’s subject reference in the causative condition was rated as relatively less acceptable than that in other conditions due to the increased acceptability of the alternative interpretation of the reflexive (i.e., caki’s reference to object PA; native speakers showed a trend of judging caki’s object reference as more acceptable in the causative condition than in other conditions). Recall that the dative-marked object PA in the causative sentence is the (secondary) subject of the clause that denotes the caused event. Thus, the
enhanced acceptability for *caki*’s reference to causative object can be understood as indicating that the subject function of causative object has made itself more visible or accessible during the antecedent selection/retrieval. All these results point to the following:

(67) *The subjecthood of an NP has increased the chance of generating a dependency with the reflexive caki.*

As discussed above, the simplest way to translate the “subject phenomenon” would be to recognize it from the structural point of view, that is, *the subjecthood is an independent linguistic feature or characteristic given to an item (e.g., NP) that occupies the SpecTP position in a syntactic hierarchy.* This is so because the positional/structural information such as SpecTP is most reliable and stable in that it is (nearly) impervious to other types of information (from different components of the grammar) or linguistic properties of an item that fills the position (e.g., SpecTP). However, note that I do not suggest that SpecTP is the one and only source of information available for *caki*’s reference resolution. As already shown in previous experiments, other types of information (e.g., person) should be accessed and used in selecting an antecedent. Thus, a more reasonable position would be to assume that diverse types of linguistic information (or cues) are indeed employable in *caki*’s reference resolution but, importantly, a difference exists in the strength of available cues (or cue weightings). The high acceptability of *caki*’s subject reference and the grammatical illusion observed in Experiment 2 (i.e., some native speakers judged the “ungrammatical” reference of *caki* to the 1st-person subject antecedent as rather acceptable) indicate that the structural/positional cue SpecTP should be given a priority over other available cues. Bearing these in mind, I suggest that (67) should be re-written as (68).
(68)  *caki* establishes a dependency with an NP in SpecTP, until otherwise requested.

(68) tells that *caki* will first (rather blindly) form a dependency with an NP in SpecTP, leading to the subject antecedent preference. However, if other available features or grammatical constraints no longer allow for *caki*’s reference to an NP in SpecTP, then *caki* has to find an alternative or retrieve another antecedent from a set of possible candidates. If a comprehender fails to override the weighted control of the cue SpecTP in the situation where he or she must cancel its effect, ungrammaticality would result.

However, although assuming SpecTP as an independent structural cue employable during *caki*’s antecedent selection provides us with advantages in explaining its strong subject antecedent bias, this does not resolve a locality issue with respect to *caki*. That is, *caki* prefers the nonlocal antecedent over the local antecedent (cf. Chapter 2 for detailed discussions). For example, in the present experiment, it was predicted that *caki* would select the causative subject PA more often than the causative object PA as its antecedent because the former is a nonlocal subject antecedent while the latter is a local one (cf. (64c) above). The positional cue SpecTP simply says that both PAs are possible (relatively more wanted) antecedents for *caki* as they are all in SpecTP. However, it does not provide a clue to the locality of a more desirable antecedent. One possible, tough speculative, explanation of this will be provided in the general discussion section.

3.2.5  Experiment 5: Sourceness
As seen in Experiment 4, caki’s reference behaviors can be well explained based on the positional or structural nature of PAs. However, there have been attempts in the previous theoretical literature to steer away from syntactic maneuver and analysis, but instead to understand reference resolution of LDAs including caki (Maling, 1984; Sells, 1987) from the pragmatic perspective. According to this view, LDAs (often called logophors or exempt anaphors) are considered exempt from relevant syntactic regulations (e.g., binding theory) but subject to discourse/pragmatic constraints like logophoricity, consciousness, or source of information (SOI; cf. Büring, 2005). For example, as exemplified in (69), the LDA sig in Icelandic is interpreted to form a dependency with a subject NP Hann that is the source of information (SOI).

(69) a. Hanni sagði að sig vantaði hæfileika.
    he said that self lacked ability
    ‘He said that he lacked ability.’

    b. *Honum vár sagt að sig vantaði hæfileika.
   him was said that self lacked ability
   ‘He was told that he lacked ability.’ (Maling, 1984)

If sig simply refers to a subject NP (in SpecTP), regardless of the pragmatic function of that NP, both sentences in (69) must be judged grammatical. However, as seen in (69b), the subject reference of sig in the passive sentence is ungrammatical. Note that the major difference between (69a) and (69b) is that the subject in (69a) is the source of reported discourse (he lacked ability) while it is not in (69b). The same phenomenon is also observed in East Asian languages such as
Japanese (Sells, 1987) and Korean (Han & Storoshenko, 2013). This indicates that the pragmatic feature of a PA (e.g., SOI) may also be accessed and employed for the successful reference resolution, along with other types of linguistic information.

However, previous studies centered on the LDAs occurring in the bi-clausal circumstance, and it is not known whether the logophoric nature of the LDA can also be found in the mono-clausal setting. The present experiment investigated whether a discourse-pragmatic factor such as the SOI of PAs can have an effect on the antecedent selection of *caki* even in the mono-clausal context. Furthermore, it explored whether (and if so, how) the SOI feature of PAs interacts with *caki*’s propensity to co-refer with the subject.

3.2.5.1 Materials

Eight experimental items were created in the format illustrated in (70). Each item was composed of four experimental sentence-paraphrase pairs established by crossing two independent factors: SOI (subject vs. object source) and Paraphrase (subject vs. object paraphrase).

To manipulate the SOI of PAs, two distinct types of verbal predicates (*say*-type vs. *hear*-type) were used, following Han & Storoshenko (2013). In sentences with the *say*-type verbal predicate (e.g., *kwittumhaycwu*—‘give a person the cue’, *allyecwu*—‘inform’, *malhaycwu*—‘say’), the subject PA was the SOI. However, in sentences with the *hear*-type verbal predicate (e.g., *cenhaytut*—‘listen to’), the indirect object PA was. In addition, the type of particles attached to the indirect object was also manipulated: In *say*-type sentences, the particle attached was *-eykey* ‘to’ while in *hear*-type sentences, it was *-lopwuthe* ‘from’.
(70) a. **S1: Target with caki**

i. **Subject Source (say-type predicate):**

동생이 어제 친구에게 교실에서 자기의 IQ 를

`tongsayng-i ecey chinkwu-eyekey kyosil-eyseo caki-uy IQ-lul`

younger sibling-NOM yesterday friend-to classroom-at self-GEN IQ-ACC

슬쩍 말해주었다.

`sulccek malhay-cwu-ess-ta.`

secretly say-bene-PST-DC

‘Yesterday, younger sibling secretly told a friend self’s IQ in the classroom.’

ii. **Object source (hear-type predicate):**

동생이 어제 친구로부터 교실에서 자기의 IQ 를

`tongsayng-i ecey chinkwu-lopwutee kyosil-eyseo caki-uy IQ-lul`

younger sibling-NOM yesterday friend-from classroom-at self-GEN IQ-ACC

슬쩍 전해들었다.

`sulccek cenhaytul-ess-ta.`

secretly hear-PST-DC

‘Yesterday, younger sibling secretly heard from a friend self’s IQ in the classroom.’

b. **S2: Paraphrase** (PA1 = younger sibling; PA2 = friend)

i. **Subject (PA1) paraphrase:**

`PA1-i ecey PA2-eykey/-lopwutee kyosil-eyseo PA1 ponin-uy …`

PA1-NOM yesterday PA2-to/-from classroom-at PA1 oneself-GEN …

‘Yesterday, PA1 secretly [said/heard] to/from PA2 PA1’s IQ …’

ii. **Object (PA2) paraphrase:**
‘Yesterday, PAi secretly [said/heard] to/from PA2 PA2’s IQ …’

3.2.5.2 Results and discussion

The summary of acceptability judgments in four experimental conditions is provided in Table 3.9.

<table>
<thead>
<tr>
<th>Mean and SD of acceptability judgments in 4 conditions (SOI×Paraphrase)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Subject source</strong></td>
</tr>
<tr>
<td>Subject paraphrase</td>
</tr>
<tr>
<td>Object paraphrase</td>
</tr>
</tbody>
</table>

The judgment data from 20 participants were entered into $2 \times 2$ RM ANOVA with two factors: PA’s SOI (Subject vs. Object source) and Paraphrase (Subject vs. Object paraphrase). Results revealed a reliable main effect of Paraphrase ($F_1(1, 19) = 146.830, p < 0.001; F_2(1, 7) = 76.673, p < 0.001$), but no main effect of PA’s SOI ($F_1 < 1, F_2(1, 7) = 1.075, p = 0.334$): Participants judged caki’s subject reference significantly more acceptable than object reference, regardless of the SOI of PAs. Crucially, the significant interaction was found between the two factors in the subject-based, but not in the item analysis ($F_1(1, 19) = 5.009, p < 0.05; F_2(1, 7) = 2.470, p = 0.160$). Planned comparison showed that the distinct SOI of PAs did not cause difference in acceptability judgment in the subject paraphrase condition ($F_1's < 1$), whereas caki’s reference to the source object PA was more acceptable than its reference to the non-source object PA in the object paraphrase condition ($F_1(1, 19) = 3.276, p = 0.086; F_2(1, 7) = 6.731, p < 0.05$).
The results of the present experiment also confirm that *caki* prefers an NP in SpecTP as its antecedent, regardless of the pragmatic feature of PAs. This suggests that the pragmatic feature like SOI is not strong enough to override *caki*’s subject bias. However, a weak interaction between the PA’s SOI and the paraphrase was found. This may be interpreted as indicating that *caki* may possibly access the discourse/pragmatic feature of antecedent during retrieval (or in the later stage of interpretation), but its effect may be minimized (or even ignored) due to the presence of a strong competing feature (or cue), namely, SpecTP.

Furthermore, note that morphosyntactic identity of a PA is early detectable. For example, the feature [PERSON] is the lexical information specified in the lexical entry. Hence, this must be immediately available when *caki* launches to search its antecedent. In case of the subjecthood of an antecedent, it also can be detected rapidly and easily by the case particle (e.g., nominative case suffix) that the antecedent appears with. In addition, the subject NP is normally the first-mentioned, pre-verbal, argument of the sentence. In other word, the subject is an earliest possible argument detectable in the input string. On the other hand, the pragmatic identity (like SOI) of a PA is determined rather late, i.e., when the clause-final verb is processed, not when a PA itself is encountered (cf. (71)).

(71)  
\begin{align*}
\text{a.}& \quad \text{PA}_1\text{-NOM} \quad \text{PA}_2\text{-TO} \quad \text{caki}_{i,j}\text{-GEN} \quad \ldots \quad \text{V}_{\text{SAY}} \\
& \quad <\text{SOI}> \quad \text{AC} \\
\text{b.}& \quad \text{PA}_1\text{-NOM} \quad \text{PA}_2\text{-FROM} \quad \text{caki}_{i,j}\text{-GEN} \quad \ldots \quad \text{V}_{\text{HEAR}} \\
& \quad <\text{SOI}> \quad \text{AC}
\end{align*}
This late availability of the pragmatic cue may also be considered as a possible reason for its weakness in effect on *caki*’s reference resolution. Interestingly, as seen in Experiment 2 and 4, the person and the SpecTP (subjecthood) features were the cues that induced relatively large effects on *caki*’s antecedent selection/retrieval. On the other hand, the SOI was the feature that produced the least (or even null) effect, as shown in the present experiment (cf. (72) for summary).

(72)

<table>
<thead>
<tr>
<th>Availability</th>
<th>Effect size</th>
</tr>
</thead>
<tbody>
<tr>
<td>Person</td>
<td>immediate</td>
</tr>
<tr>
<td>Subjecthood</td>
<td>immediate</td>
</tr>
<tr>
<td>SOI</td>
<td>delayed</td>
</tr>
</tbody>
</table>

Note that the antecedent-reflexive dependency may already be established *before* the pragmatic identity of PAs is evaluated at the clause-final verb. If there is no necessary and inevitable reason to revise the initial dependency between *caki* and its antecedent (formulated based on the person and SpecTP cue), the initial dependency may be sustained (with minimum impact from pragmatics) even after the clause-final verb is processed.

3.3 General Discussion and Conclusion

3.3.1 The overall summary
The current study explored what linguistic factors can influence *caki*’s antecedent selection and retrieval in the referentially ambiguous mono-clausal context. The factors examined included PAs’ gender (Experiment 1), person (Experiment 2), linear surface order (Experiment 3), subjeethood (Experiment 4), and SOI (Experiment 5). Results of all five acceptability judgment experiments are summarized in Table 3.10.

Table 3.10 Summary of Experiment 1-5

<table>
<thead>
<tr>
<th>Exp</th>
<th>Factors</th>
<th>Effect</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>PA gender (M-M vs. F-M)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Paraphrase</td>
<td>✓</td>
<td>Subject was preferred to Object: SU &gt; OB</td>
</tr>
<tr>
<td></td>
<td>Gender × Paraphrase</td>
<td>×</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>PA person (3P-3P vs. 1P-3P)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Paraphrase</td>
<td>✓</td>
<td>SU &gt; OB</td>
</tr>
<tr>
<td></td>
<td>Person × Paraphrase</td>
<td>✓</td>
<td>When SU=3P &amp; OB=3P, SU &gt; OB; When SU=1P &amp; OB=3P, SU &lt; OB</td>
</tr>
<tr>
<td>3</td>
<td>PA order (SU-OB vs. OB-SU)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Paraphrase</td>
<td>✓</td>
<td>SU &gt; OB</td>
</tr>
<tr>
<td></td>
<td>Order × Paraphrase</td>
<td>×</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>S type (CAU vs. BENE vs. plain)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Paraphrase</td>
<td>✓</td>
<td>SU &gt; OB</td>
</tr>
<tr>
<td></td>
<td>S type × Paraphrase</td>
<td>✓</td>
<td>When <em>caki</em>=SU, caus &lt; bene = plain; When <em>caki</em>=OB, No diff. in acceptability</td>
</tr>
<tr>
<td>5</td>
<td>PA SOI (SU vs. OB source)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Paraphrase</td>
<td>✓</td>
<td>SU &gt; OB</td>
</tr>
<tr>
<td></td>
<td>Sourceness × Paraphrase</td>
<td>✓</td>
<td>When <em>caki</em>=SU, No diff. in acceptability; When <em>caki</em>=OB, trend: SU source &lt; OB source</td>
</tr>
</tbody>
</table>

A consistent and robust result found across all experiments was that *caki* preferably takes an NP in the subject position as its antecedent, regardless of the word order (Experiment 3) and the
discourse/pragmatic characteristic (i.e., SOI) of PAs (Experiment 5). Furthermore, Experiment 1 showed that the gender feature of PAs does not affect *caki*’s antecedent choice because *caki* is not specified for gender. On the other hand, as revealed in Figure 3.1, the person manipulation of PAs resulted in the largest acceptance rate for *caki*’s object reference (which is a less preferred reading of *caki*). This clearly suggests that the lexical feature of the reflexive in question (e.g., 3rd PERSON) serves as a constraint (or cue) on antecedent selection. Taken together, it was empirically proved in the present study that the person feature of the antecedent (as 3rd person) and its structural position in the syntactic hierarchy (as SpecTP) play a central role in *caki*’s antecedent selection and retrieval.

![Figure 3.1 Results of Experiment 2 through 5](image)

3.3.2 Implications for the cognitive model on *caki*’s dependency formation
The findings of the present study have important implications for how the relevant cognitive system should operate with respect to caki’s reference resolution.

(i) *The system should be able to access various types of linguistic information and use them in establishing the antecedent-reflexive dependency.*

As shown in this study, the successful interpretation of caki requires access to multiple sources of information such as the lexically-driven information (e.g., person), structure-based (positional) information (e.g., SpecTP), and/or, if any, discourse-pragmatic information (e.g., SOI). Therefore, the system should be sensitive enough to detect and evaluate various sources of information for processing. Here, an important question is raised: Does the system access these different sorts of information *simultaneously* during an initial processing phase or *serially* (e.g., syntax-first strategy) over a period of time? In terms of the antecedent-reflexive dependency formation (that requires access to memory system), this question can be rephrased as: Does the parser simultaneously access and use different types of information (or retrieval cue) when retrieving an antecedent for reflexive? In the following chapters, I will report and discuss the findings from online experiments carried out to answer this question.

(ii) *The system should be designed or programmed to generate the subject antecedent bias.*

The strong subject antecedent preference of caki was found across all experiments in this study even though various experimental manipulations were carried out to see whether they can affect caki’s antecedent selection (more precisely, whether they can weaken caki’s strong subject bias).
A striking example of caki’s subject bias can be found in Experiment 2: some native speakers judged caki’s reference to 1st-person subject PA (cf. (73)) as rather acceptable (even though it should be rated as extremely unacceptable, in principle).

(73) 내가 어제 친구에게 교실에서 자기의 성적표를 …

nayj-ka ecey chinkwu-eykey kyosil-eyse cakiu/k-uy sengcekpyo-lul …

I-NOM yesterday friend-DAT classroom-at self-GEN report card-ACC …

‘Yesterday, I [showed] a friend a self’s report card in the classroom.’

Also note that the mean judgment rate of ungrammatical 1S3O/*SUBJECT ($M = 2.47$, $SD = 1.09$) was higher than even that of grammatical 3S3O/OBJECT (caki’s reference to 3rd-person object antecedent (less preferred but grammatical interpretation); $M = 1.61$, $SD = 0.61$), as shown in Figure 3.2.
This reflects that the drive for caki to establish a dependency with a subject NP (in SpecTP) is indeed very strong (more specifically, stronger than the person constraint) to the extent that an incorrect connection between dependent elements (e.g., 1st-person subject - caki) is mistakenly considered as being correct, i.e., a case of an illusion of grammaticality (Phillips et al., 2011). Here, the question is: what makes the subject NP (in SpecTP) so wanted in caki’s reference resolution? To put differently, what is the real source of this happening? Is it the grammar per se that causes it? Or does this happen simply due to the inherent nature of the reflexive? Apparently, the relevant cognitive system must be equipped with a means (or an operating algorism) of making biased decisions about the antecedent retrieval. I attempt to answer this question in Chapter 6 where I discuss a possible operating mechanism involved in caki’s reference resolution.

However, the offline data reported in the present study do not tell us much about the real-time process involved with the antecedent choice of caki because they only show participants’
final interpretive decisions on the reflexive. This raises the need to conduct online studies to see when and in what order, if any, diverse types of linguistic information (e.g., syntax, morphology, semantics, etc.) are accessed and integrated during the antecedent selection, which would further deepen our understanding of the online comprehension of caki and relevant cognitive mechanisms. In the following chapters, I will report results of online experiments and discuss their implications.
4 Online interpretation of caki: Gender and Person

4.1 Introduction

In the previous chapter, I demonstrated that the systematic manipulation of linguistic properties of antecedent (e.g., person, subjecthood, or SOI) can weaken the subject antecedent preference of caki in the referentially ambiguous context. This indicates that the dependency resolution between caki and antecedent involves the comprehensive consultation of diverse linguistic characteristics of potential antecedent(s). Put differently, various distinct sources of linguistic information, not just syntactic information, should engage for the successful interpretation of the reflexive in question.

However, the judgment data display only comprehenders’ final interpretive decision (on the reflexive) made after all relevant grammatical constraints and/or processing factors are identified and applied (Schütze & Sprouse, 2013). It still remains unknown what happens in the early stage of the dependency resolution between caki and its antecedent. Regarding this issue, many important research questions arise. For example:

(a) What types of linguistic information (or retrieval cues) does the parser initially employ in retrieving an antecedent?

(b) When are those cues available?

(c) Are those cues weighted equally in terms of cue strength? If not, which cue(s) play(s) a more crucial role than others during antecedent retrieval?
(d) *caki* shows a strong subject preference. What is the source of the subject preference?

What makes the subject so special in the reflexive-antecedent dependency resolution?

(e) Does this bias affect online antecedent retrieval? If so, how?

To answer these questions, we need to look carefully at how *caki* is processed in real time. Here and in the following chapter, I report findings from a series of self-paced reading experiments that investigated online comprehension of *caki* in various clausal contexts. Especially, in this chapter, which is a continuation of the offline work from Chapter 3, I explore whether (and if so, how) the manipulation of the gender and person phi-feature of potential antecedents (PAs) affects the online reference resolution of *caki* appearing in the referentially ambiguous Korean ditransitive sentences, like (74).

(74) 어제 존이 톰에게 방에서 자기의 사진을 갑자기 보여주었다.

yesterday J.-NOM T.-DAT room-at self-GEN photo-ACC suddenly

‘Yesterday, John suddenly showed Tom a picture of himself in the room.’

4.1.1 Retrieval of the antecedent from memory in referential dependencies
How does the parser search for an antecedent during memory retrieval? To develop a cogent theory that can answer this question, we first need to take into account when the reflexive dependency begins to be formed. Let us look at the sentences in (75).

(75) a. \[ \text{Who}_i \text{ did John see } \underline{\text{_____}} i \text{ in the mirror?} \]
    \[ \text{Filler} \quad \text{Gap} \]

b. \[ \text{John}_i \text{ again saw } \underline{\text{himself}} i \text{ in the mirror.} \]
    \[ \text{Antecedent} \quad \text{Reflexive} \]

(75a) is a \textit{wh}-interrogative construction where the \textit{wh}-word \textit{who} (often called a \textit{filler}) is displaced from the direct object position, leaving a trace (or gap) behind (Fodor, 1978; Frazier, 1987; Frazier, Clifton, & Randall, 1983). On the other hand, (75b) contains a reflexive in the direct object position where it co-refers with the subject NP (antecedent in SpecTP). Note that both sentences require proper formulation of dependency between items for interpretation: filler-gap dependency (FGD) in (75a) \textit{vs.} reflexive dependency (RD) in (75b) (Frazier, Ackerman, Baumann, Potter, & Yoshida, 2015). However, RD differs from FGD in terms of the timing at which the presence of dependency is detected by the parser. In (75a), the parser can detect and predict the existence of FGD as soon as the \textit{wh}-word (i.e., head of dependency) is encountered at the beginning of sentence. However, in (75b), it cannot identify the existence of RD until the reflexive itself (i.e., tail of dependency) is encountered in the input string. This is so because no early cues are available that enable the parser to predict the dependency in advance before the reflexive appears (cf. (76) for summary).
(76) a. FGD: [ … Filler … Gap … ]
   \[ Trigger \]
   \[
   \begin{array}{c}
   \text{Head} \\
   \text{Tail}
   \end{array}
   \]

b. RD: [ … Antecedent … reflexive … ]
   \[ Trigger \]
   \[
   \begin{array}{c}
   \text{Head} \\
   \text{Tail}
   \end{array}
   \]

Then, what types of linguistic information or cues would be available when the RD is initially formulated at the encounter of reflexive? Furthermore, how does the parser retrieve a (previously seen) antecedent stored in the memory, using those cues available at the reflexive? Concerning these issues, several early experimental studies revealed that reflexives (especially, those in the argument position) are immune to non-syntactic constraints or factors in the initial stage of the processing (cf. Chapter 1 for more detailed discussion). Only the syntactic information, such as the binding constraints, is exclusively applied to the initial phase of RD formation (Clifton & Frazier, 1989; Nicol & Swinney, 1989; Sturt, 2003). As a consequence, an NP in the structurally irrelevant position (where it cannot c-command the reflexive) is never initially considered as a PA for the reflexive (due to the violation of Condition A of Binding Theory). This is compatible with the early model of memory retrieval, i.e., structure-guided serial search (SS), according to which a target memory item is searched serially node-by-node on the basis of the syntactic representation of the sentence (Knuth, 1965).

However, a growing body of research in the recent literature has converged on a consensus that a memory item is retrieved by the so-called direct-access, content-addressable retrieval (DCR) mechanism (Dillon, 2011; Lewis & Vasishth, 2005; Lewis et al., 2006; McElree, 2000; Parker & Phillips, 2017; Parker et al., 2017; Sekerina et al., 2016; Van Dyke & Johns,
That is, a target memory is directly accessed, based on the cue(s) available at the time of retrieval. Here, the cues that the parser can rely on for retrieval may include various types of lexical features (e.g., phi-features) of the retrieval trigger (e.g., pronouns or verb) and/or grammatical constraints that regulate the memory retrieval process. If there exist multiple memory items that partially (or fully) match a retrieval trigger in features, the best matched item is eventually selected among them. Under this approach, the RD formation can be understood as a cognitive computational process in which, using the retrieval cues available at the reflexive (retrieval trigger), the parser directly accesses and selects a memory item (in this case, antecedent NP) that best matches the reflexive in features. Here, the retrieval cues include reflexive’s inherent lexical features (e.g., person, gender, number, and animacy) as well as syntactic constraints such as the binding theory (Chomsky, 1981). Note that retrieval cues are a subset of features of the target memory item to be retrieved, as represented in Figure 4.1 (Lewis et al., 2006; Ratcliff, 1978).

**Figure 4.1 Reflexive dependency formation via direct, cue-based memory access:**
The reflexive fully matches NP1 in features [A, B, C]. However, it partially matches NP2 in features [A, B]. Hence, NP1 is more likely to be selected as antecedent due to its higher feature match, compared to NP2.
To sum up, the two models of memory retrieval, i.e., SS and DCR, make qualitatively different predictions about (i) how the memory search is conducted and (ii) what types of information (or cue) is available in the initial stage of RD formation. Furthermore, they also make clearly different predictions as to whether the grammatically incorrect PA can be initially accessed by the parser – a possible consequence of access to a grammatically incorrect PA during antecedent retrieval is the interference effect. The summary of predictions made by these models are provided in Table 4.1.

<table>
<thead>
<tr>
<th></th>
<th>SS</th>
<th>DCR</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Search mechanism</strong></td>
<td>node-by-node serial search</td>
<td>cue-based direct access</td>
</tr>
<tr>
<td><strong>Retrieval cue</strong></td>
<td>syntactic cue only</td>
<td>syntactic and non-syntactic cues</td>
</tr>
<tr>
<td><strong>Access of incorrect PA (interference effect)</strong></td>
<td>NO</td>
<td>YES</td>
</tr>
</tbody>
</table>

4.1.2 Retrieval of the antecedent for *caki* in Korean referential dependencies

Now, let us proceed to the consideration of the online reference resolution of the Korean reflexive *caki*, bearing in mind the following questions:

(i) *How does the reflexive caki in Korean find its antecedent in the memory?*
(ii) More specifically, what retrieval mechanism (SS vs. DCR) is employed for caki’s antecedent retrieval from memory?

If the memory search with respect to caki is carried out as the SS model proposes, the parser should not be able to initially access and use (non-syntactic) lexical cues, such as person and animacy. Instead, it should rely exclusively on the syntactic cue or constraint such as the binding constraint in searching and retrieving caki’s antecedent. Thus, the interference from irrelevant PA(s) would not be expected to appear. On the other hand, if the memory search is initially made based on all the cues available at the retrieval trigger (e.g., reflexive), as the DCR model posits, the early effect of lexical cues would be detected. In addition, an interference effect would be expected to occur in the referentially ambiguous context. In this section, as a first step to find answers to foregoing queries, I attempt to characterize which types of information can function as retrieval cues to drive caki’s antecedent retrieval from memory.

As already noted in Chapter 2, caki typically co-refers with a third-person animate NP (mostly, in SpecTP). To put differently, caki is sensitive to the person and animacy features of antecedent. On the other hand, as observed in Experiment 1 from Chapter 3, caki is not sensitive to the gender and number features of antecedent (Sohng, 2004). See, for example, sentences in (77) where caki refers to the (3rd-person animate) subject antecedent, regardless of its gender (77a-b) and number (77c-d).

(77)  a. 철수가 자기를 과신했다.
Chelswu [M, sgl]-ka caki [j]-lul kwasinha-ss-ta.
C.-NOM self-ACC overtrust-PST-DC
‘Chelswu was too confident of himself.’

b. 영희가 자기를 과신했다.

Yenghui[F, sg]-ka caki-lul kwasinha-ss-ta.

Y.-NOM self-ACC overtrust-PST-DC

‘Yenghui was too confident of herself.’

c. 그 학생은 자기를 믿지 못 했다.

ku haksayng[sg]-un caki-lul mit-ci mos ha-ss-ta.

the student-TOP self-ACC trust-NL cannot do-PST-DC

‘The student could not trust himself (or herself).’

d. 그 학생들은 자기를 믿지 못 했다.

ku haksayng-tul[pl]-un caki-lul mit-ci mos ha-ss-ta.

the student-pl-TOP self-ACC trust-NL cannot do-PST-DC

‘The students could not trust themselves.’

Consequently, caki takes an NP as its antecedent when the NP contains [3RD PERSON] and [ANIMATE] in its feature matrix. [GENDER] and [NUMBER] are also members of the feature matrix of the NP. However, they do not affect caki’s antecedent choice. Given that the cue-based parser retrieves a target item from memory based on the cues (and relevant grammatical constraints) available at the point of retrieval, it can reasonably be said that when caki is encountered, the parser retrieves its antecedent based on the cues [3RD PERSON] and [ANIMATE] (cf. Figure 4.2).
Figure 4.2 Tree diagram of (77a)

If non-syntactic cues such as person and animacy are available during antecedent retrieval (as DCR predicts), *Chelswu* should be retrieved as *caki’s* antecedent because it is the only grammatically accessible antecedent that matches the reflexive in features.

Here note that *caki* appears linearly (and temporally) before the clausemate verb so that the former is always processed ahead of the latter, unlike typical reflexives in English. This implies that, in Korean, the incremental parser cannot benefit from the cues supplied by the verb right at the moment when the (pre-verbal) reflexive is encountered (cf. at T2 in (78a)). Thus, *caki* should retrieve an antecedent, relying on the cues available only at the (pre-verbal) reflexive.

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29 As already pointed out in Chapter 1, it has been argued in the literature (Dillon, 2011; Dillon, Mishler, Sloggett, & Phillips, 2013; King, Andrews, & Wagers, 2012) that the RD resolution in English can be additionally supported (and facilitated) by the verb that linearly precedes the reflexive (cf. (78b)). This is so because, when the verb is encountered, the subject is reactivated in memory for thematic integration (based on the verb’s argument structure), which increases the level of memory activation of the subject (antecedent). The prominence of the subject in memory
may enhance the chance of its being finally selected as antecedent when the *post-verbal* reflexive is encountered in the input string.

Of course, the verb can affect the interpretation of *caki* when it is physically encountered in the input string (e.g., at T3 in (78a)). Consider (i) for example. The only difference between (ia) and (ib) is the verb used. Interestingly, in (ia), the subject John is favored over the object Tom as *caki*’s antecedent whereas in (ib) the opposite is true because of an underlying semantic proposition of the verb *return*. *caki*’s reference to the subject is semantically implausible in (ib). If John is the owner of the key, he cannot “return” it to somebody else, but maybe “lend” it.

(i) a. 존이 톰에게 자기의 열쇠를 주었다.
John-NOM Tom-DAT self-J GEN key-ACC give-PST-DC
‘John gave Tom a self’s key.’

b. 존이 톰에게 자기의 열쇠를 돌려주었다.
John-NOM Tom-DAT self-FROM J GEN key-ACC return-PST-DC
‘John returned Tom a self’s key.’
However, the consideration of caki’s referential behaviors in the context where two PAs precede the reflexive motivates us to further assume the presence of another type of cue or constraint that can impact on caki’s reference resolution. Let us look at the sentences in (79).

(79) a. 
\[
\begin{array}{ccc}
\text{PA1} & \text{PA2} & \text{caki} \\
철수의 변호사가 & 지나치게 자기를 & 과신했다.
\end{array}
\]

Chelswu_i-uy pyenhosa_j-ka cinachikey caki_uy-lul kwasinhay-ss-ta.
C.-GEN lawyer-NOM excessively self-ACC overtrust-PST-DC

‘Chelswu’s lawyer was too confident of himself.’

\[ caki = \{\text{Chelswu, pyenhosa}\} \]

b. 
\[
\begin{array}{ccc}
\text{PA1} & \text{PA2} & \text{caki} \\
철수 & 선임한 변호사가 & 지나치게 자기를
\end{array}
\]

Chelswu_i-ka senimha-n pyenhosa_j-ka cinachikey caki_uy-lul
C.-NOM appoint-REL lawyer-NOM excessively self-ACC

과신했다.
kwasinhay-ss-ta.
overtrust-PST-DC

‘The lawyer who Chelswu appointed was too confident of himself.’

\[ caki = \{\text{Chelswu, pyenhosa}\} \]

(79a) is a simple sentence where a possessive expression (NP1’s NP2) appears in the subject position. The two NPs in the possessive expression, which linearly precedes caki, are all animate and in the third person: Chelswu and pyenhosa ‘lawyer’. On the other hand, (79b) is a complex sentence in which an object-extracted relative clause (Chelswu-ka ___ senimha-n) modifies the
subsequent head noun (*pyenhosa*) in the matrix subject position. Like (79a), (79b) also contains two 3rd-person animate NPs before the reflexive: the embedded subject *Chelswu* and the head noun *pyenhosa*. If the parser relies only on the lexical cues available at the reflexive in retrieving an antecedent, both *Chelswu* and *pyenhosa* in (79a) and (79b) should be available to legitimately serve as antecedents of *caki*. However, this prediction is not borne out. In (79a) and (79b), *caki* co-refers only with *pyenhosa* ‘laywer’, but not with *Chelswu*, although they are all animate and in the third person. This indicates that not all (linearly preceding) 3rd-person animate NPs can be the antecedent for the reflexive in the same sentence.

This reference phenomenon has been well-established and explained in the generative grammar (Büring, 2005). In this framework, the RD formation is a rule-governed process, which has been formalized in the Binding Theory (Chomsky, 1981). According to this theory, a reflexive must be c-commanded by and co-indexed with its antecedent in the local domain (roughly, an immediate local clause with the reflexive). In other words, only a co-indexed NP that c-commands the reflexive can legitimately function as an antecedent and violating this constraint leads to ungrammaticality. As presented in Figure 4.3, *Chelswu* in both (79a) and (79b) does not c-command the reflexive while *pyenhosa* can. Therefore, the former is ruled out by the binding constraint.
If this syntactic constraint can be exploited during the early stage of the processing, along with other non-syntactic cues such as person and animacy, the parser could retrieve a target antecedent more accurately and effectively. Indeed, several previous studies showed an early effect of the binding constraint during memory retrieval: A grammatically incorrect antecedent is initially rapidly filtered out by the binding constraint (Badecker & Straub, 2002; Clackson, Felser, & Clahsen, 2011; Dillon et al., 2013; Nicol & Swinney, 1989; Parker & Phillips, 2017; Runner, Sussman, & Tanenhaus, 2006; Sturt, 2003; Xiang et al., 2009). \[31\]

It seems obvious that the syntactic constraint like Principle A of Binding Theory (Chomsky, 1981) plays a decisive role in the reflexive reference resolution. However, it is still a subject of debate how the parser exploits “relational” syntactic concept such as c-command that plays a crucial role in the binding theory and whether such relational or configurational notions can be treated the same as non-relational features like person or gender. In the relevant literature, different solutions to this question have been proposed (Alcocer & Phillips, 2012). In this dissertation, I do not presume a specific type of algorithm by which the parser encodes and utilizes c-command.
Consequently, the successful online resolution of Korean reflexive *caki* requires the parser to rapidly and accurately retrieve an antecedent from memory at the encounter of the reflexive. When the parser retrieves an antecedent out of a set of PAs, it selectively uses linguistic cues available at the reflexive: [3RD PERSON], [ANIMATE], and binding constraints (but not [GENDER] and [NUMBER]).

4.2 Experiments

Results of offline grammaticality judgment experiments reported in Chapter 3 clearly showed that non-syntactic cues can modulate the final interpretation of *caki*. However, as pointed out above, they do not reveal online processes involved in the reference resolution of the reflexive in question. In the current experiments, I focus on examining the role of gender and person features in the online dependency resolution of *caki* in the referentially ambiguous mono-clausal context to address the following research questions:

(i) *Is caki still insensitive to the (semantic) gender of antecedent in the initial pass of the processing?*

(ii) *Does the person cue also affect the early stage of caki’s reference resolution?*

The gender and person features were chosen for manipulation because we can make more accurate and reasonable predictions, based on the previous offline data (from Experiments 1 and 2 in Chapter 3). Moreover, they are important test contexts in which one could show that the parser “selectively” exploits cues available at the reflexive during antecedent retrieval. As
demonstrated in Chapter 3, the gender and person features are the cues placed at either end of the spectrum in terms of how the caki’s subject antecedent bias is modulated. This is so because, among the features examined, the gender feature had a null effect on caki’s antecedent choice whereas the person was the only feature that did affect it. If caki shows the same sensitivity or insensitivity to those features in the early stage of the processing (i.e., null effect for gender but true effect for person), this would allow us to make a strong case for the argument that the parser can initially access and employ non-syntactic cues in a selective way (e.g., [3rd PERSON] and [ANIMATE] for caki), when retrieving an antecedent from memory. This will also serve as evidence to support the DCR model.

For the present experiments (Experiments 6 and 7), simple ditransitives such as (74) above (repeated below as (80)) were employed as the target construction containing the reflexive caki. They were structurally identical to those used in the offline acceptability judgment experiments in Chapter 3.

(80) 어제 존이 톰에게 방에서 자기의 사진을 갑자기 보여주었다.
    ecey John-i Tomj-eykey pang-eyse cakiuy-uy sacin-ul kapcaki
    yesterday J.-NOM T.-DAT room-at self-GEN photo-ACC suddenly
    보여주었다.
    Poyecwu-ess-ta.
    Show-PST-DC
    ‘Yesterday, John suddenly showed Tom a picture of himself in the room.’

Note that, in (80), two NPs (John and Tom) linearly precede the reflexive. Crucially, both of them can serve as grammatical antecedents of caki because not only are they both 3rd person and
animate but also they asymmetrically c-command and are co-indexed with the reflexive (although the subject is expected to be preferred over the indirect object as the antecedent, given the findings from Experiment 1 in Chapter 3). Therefore, the reflexive caki in (80) is referentially ambiguous (cf. Figure 4.4 for hierarchical representation of (80))32.

![Figure 4.4 Tree diagram of (80) (with adjunct phrases excluded)](image)

4.2.1 Common experimental characteristics of Experiment 6 and 7

Online experiments reported in this chapter used identical experimental techniques and procedures. In this section I first illustrate common experimental characteristics of Experiment 6

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32 The target construction of this type is useful in exploring the role of retrieval cues available at the reflexive. For example, unlike sentences in (79) (where the binding constraint plays a key role in determining caki’s antecedent), the same syntactic constraint cannot play a decisive role in (80) although this information may still be accessed and used in the initial process of RD formation. Thus, the parser would possibly secure non-syntactic cues and/or other external factors and rely on them in resolving caki’s reference in (80).
and 7. Other specific details (regarding stimuli and results) will be provided when relevant parts of experiments are discussed.

4.2.1.1 Participants

Forty Korean native speakers were recruited who resided in Seoul, South Korea (see Table 4.2). All participants signed an informed consent. They were remunerated for their participation. The study was approved by the IRB of the Graduate Center of the City University of New York.

<table>
<thead>
<tr>
<th>Number of</th>
<th>Experiment 6</th>
<th>Experiment 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participants</td>
<td>20</td>
<td>20</td>
</tr>
</tbody>
</table>

4.2.1.2 Procedures

The experimental paradigm adopted for this study (Experiment 6 and 7) was the *noncumulative word-by-word self-paced reading paradigm*, which required participants to read sentences like (80) word-by-word for comprehension, as seen in Figure 4.5. DMDX experimental software package (Forster & Forster, 2003) was used for stimuli presentation and response recordings.
Participants were tested individually in a soundproof room. Each participant was seated in front of the computer screen and was asked to complete tasks (i.e., reading sentences word-by-word and answering comprehension questions) on each trial, as instructed.

Every trial began with a screen that presented a sentence where all component words were masked by underscore characters (‘_’). Spaces and punctuation remained intact. Each subsequent word (or region) of the sentence was prompted by pressing the space bar button on the keyboard. As each word was presented, all preceding and following regions were masked. Reading time between each button press was recorded in milliseconds. A Yes/No comprehension question followed every trial (including fillers). Participants were instructed to answer as quickly and accurately as possible by pressing a designated ‘Yes’ or ‘No’ button on the keyboard. They received feedback only on incorrect answers. Two practice trials were displayed at the beginning.
of the experiment to familiarize participants with the experimental task. Experiments lasted approximately 30 minutes. Figure 4.6 provides a graphical overview of the procedure.

![Diagram](image)

**Figure 4.6 Graphical overview of experimental procedure**

4.2.2 Experiment 6: Gender

As demonstrated in the previous chapter, *caki* exhibits no sensitivity to the semantic gender feature of the antecedent that it co-refers with. In this experiment, I investigated whether different gender identities of PAs influence the online dependency formation between *caki* and its antecedent in the referentially ambiguous context like (80). For this, the semantic gender (Masculine vs. Feminine) of two PAs in the experimental sentence was manipulated, leading to four experimental conditions, as illustrated in (81).

(81) a. **Gender Match: Masculine-Masculine**
Yesterday, the uncle furtively showed the youngest elder brother a hundredth-day photo of himself in the attic.

b. Gender Match: Feminine-Feminine

Yesterday, the aunt furtively showed the eldest sister a hundredth-day photo of herself in the attic.

c. Gender Mismatch: Masculine-Feminine

Yesterday, the uncle showed the eldest sister a hundredth-day photo of herself in the attic.
‘Yesterday, the uncle furtively showed the eldest sister a hundredth-day photo of him-/her-self in the attic.’

d. Gender Mismatch: *Feminine-Masculine*

어제 숙모가 작은형에게 다락방에서 자기의
ecey swukmo,-ka cakunhyeng,-eykey talakpang-eyse caki$_{ij}$-uy
yesterday aunt-NOM youngest elder brother-DAT attic-LOC self-GEN

……

‘Yesterday, the aunt furtively showed the youngest elder brother a hundredth-day photo of him-/her-self in the attic.’

Experiment 1 in Chapter 3 showed that *caki*, appearing in the context like (81), has a strong subject antecedent preference and such subject bias of the reflexive is not modulated by gender property of PAs, suggesting no role of the gender cue in *caki*’s reference resolution. Therefore, one can reasonably posit that the parser should not attempt to access and use the gender cue at all levels of processing involved in the reflexive dependency formation. If so, all else being equal, no difference would be expected in reading times (RTs) at the reflexive across conditions. This is so because all possible combinations of PA gender would no longer be meaningful to the parser when it engages in the memory retrieval processes.

4.2.2.1 Stimuli
Sixteen sets of experimental stimuli were constructed in the format illustrated in (81) above. Each set, schematically represented in (82), consisted of four simple ditransitive sentences in different experimental conditions generated by fully crossing the possible gender types (masculine vs. feminine) of each PA (NP1 and NP2).

![Diagram](image)

All experimental sentences began with a temporal phrase (such as ecey ‘yesterday’ or onul ‘today’) to avoid the topicalization of the subject NP1. The nominative-marked subject (NP1) and the dative-marked indirect object (NP2), serving as PAs for caki, appeared in a row after the temporal phrase. They were all common nouns to manifest clear gender identity (e.g., sonyen ‘boy’/sonyeo ‘girl’, samchon ‘uncle’/swukmo ‘aunt’, etc.). The genitive-marked reflexive caki appeared as a possessor NP, along with the accusative-marked possessed NP, in the direct object position (i.e., caki-GEN NP-ACC). A locative expression, such as talakpang-eyse ‘attic-at’ in (81), was inserted between NP2 and the reflexive to control the possibility that caki selects NP2 as antecedent simply due to its proximity to NP2. Sentence-final verbs were all ditransitive (e.g.,
poyecwuta ‘to show’ or ponaycwuta ‘to send’)\textsuperscript{33}. Finally, an adverb phrase (e.g., sulccek ‘furtively, secretly’) was added between the accusative NP3 and the verb to capture delayed spillover effect from the critical region (containing caki).

Experimental sentences were divided into eight regions of interest (ROI) (except one sentence: 9 regions), as presented in (83).

(83) ROIs of (81a)

<table>
<thead>
<tr>
<th>ROI</th>
<th>Region 1</th>
<th>Region 2 (PA1)</th>
<th>Region 3 (PA2)</th>
<th>Region 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word</td>
<td>ecey</td>
<td>samchon-i</td>
<td>cakunhyeng-eykey</td>
<td>talakpang-eyse</td>
</tr>
<tr>
<td>Gloss</td>
<td>yesterday</td>
<td>uncle-NOM</td>
<td>youngest elder brother-DAT</td>
<td>attic-LOC</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ROI</th>
<th>Region 5</th>
<th>Region 6 (SP1)</th>
<th>Region 7 (SP2)</th>
<th>Region 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word</td>
<td>caki-uy</td>
<td>paykilsacin-ul</td>
<td>sulccek</td>
<td>poyecwu-ess-ta</td>
</tr>
<tr>
<td>Gloss</td>
<td>self-GEN</td>
<td>100-day photo-ACC</td>
<td>furtively</td>
<td>show-PST-DC</td>
</tr>
</tbody>
</table>

PAs and the reflexive appeared in the same regions across sentences: PA1 in Region 2, PA2 in Region 3, and caki in Region 5 (critical region). Regions 6 and 7 were treated as spillover (SP) regions.\textsuperscript{34}

Sixteen experimental sentences were distributed across four counterbalanced presentation lists, using the Latin Square design, so that each list contained one version of each target sentence and had equal numbers of items per condition. Each list was combined with 48 fillers of

\textsuperscript{33} In total, eight different verbs were chosen for this experiment. They were all ditransitive in that (i) they require three arguments (i.e., a subject, an indirect object, and a direct object) and (ii) they all can occupy the verb position of the sentential frame [ NP-NOM  NP-DAT  NP-ACC  V].

\textsuperscript{34} Region 8 (sentence-final verb region) was not considered as the spillover region due to the possible presence of the (end-of-sentence) wrap-up effect. Furthermore, by the same token, RT data from this region were not analyzed.
a wide variety of sentence types that did not embed the reflexive under investigation. The presentation order of experimental sentences and fillers was pseudo-randomized to ensure that experimental sentences were never presented successively.

4.2.2.2 Results and discussion

The mean accuracy of comprehension questions was 87%. RT data from two participants were removed due to the low accuracy (below 80% correct, combining scores for both fillers and experimental trials). All RT data analyses were conducted on residual RTs (Ferreira & Clifton, 1986; Sturt, Pickering, Scheepers, & Crocker, 2001; Sturt, Scheepers, & Pickering, 2002) in order to remove irrelevant variance induced by differences in word length and participant-specific reading pace. Residual RTs were calculated by conducting a simple linear regression analysis that predicts RT from the length of word in each region. In this experiment, the word length was measured by counting the number of syllables in each word. See (84) for example.

(84) Word length (WL) in terms of the number of syllables (a dot indicates syllable boundary)

<table>
<thead>
<tr>
<th>ROI</th>
<th>Region 1</th>
<th>Region 2 (PA1)</th>
<th>Region 3 (PA2)</th>
<th>Region 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word</td>
<td>e. cey</td>
<td>sam.chon.-i</td>
<td>cak.un.hyeng.-ey.key</td>
<td>ta.lak.pang.-eyse</td>
</tr>
<tr>
<td>Gloss</td>
<td>yesterday</td>
<td>uncle-NOM</td>
<td>youngest elder brother-DAT</td>
<td>attic-LOC</td>
</tr>
<tr>
<td>(WL)</td>
<td>(2)</td>
<td>(3)</td>
<td>(5)</td>
<td>(4)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ROI</th>
<th>Region 5</th>
<th>Region 6 (SP1)</th>
<th>Region 7 (SP2)</th>
<th>Region 8</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word</td>
<td>ca.ki.-uy</td>
<td>payk.il.sa.cin.-ul</td>
<td>sul.ccek</td>
<td>po.ye.cwu.-ess.-ta</td>
</tr>
<tr>
<td>Gloss</td>
<td>self-GEN</td>
<td>100-day photo-ACC</td>
<td>furtively</td>
<td>show-PST-DC</td>
</tr>
<tr>
<td>(WL)</td>
<td>(3)</td>
<td>(5)</td>
<td>(2)</td>
<td>(5)</td>
</tr>
</tbody>
</table>
A regression equation was calculated for each participant, using the RT data from all fillers and experimental trials where comprehension error did not occur. To enhance the accuracy of the equation, extreme values that included RTs longer than 2000ms or RTs shorter than 150ms were removed from the data before the regression analysis was conducted. Furthermore, RTs from the initial, final, and critical (containing caki) regions were also excluded in the data set because those regions may possibly reduce the accuracy of the length correction due to their relatively large amount of variance (Sturt et al., 2001, 2002). The residual RT (either positive or negative) for each region corresponded to the difference between the predicted RT (obtained from the regression analysis) and the actual RT. A positive (+) value represents a RT which is longer than what would be predicted by the region length, and a negative (−) value represents a RT which is shorter than what would be predicted as a function of the length.

After calculating residual RTs through the regression analysis, I trimmed residual RTs, for each condition, by replacing outliers with relevant cutoff values set up for each region of interest. Outliers were defined as any RTs above or below the cutoff value. The cutoff values were set at 1.5 × the interquartile range above the upper quartile (75%) and 1.5 × the interquartile range below the lower quartile (25%) (Sturt et al., 2001, 2002). This trimming procedure affected 2.7% of the data.

The trimmed data for each region (except the region 8) were submitted to one-way repeated measure ANOVA, treating the gender of PAs (with four levels: Male-Male, Female-

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35 RTs from the first region of a sentence tend to be longer than those from other regions. The similar lengthening effect is also frequently found in the RTs from the last region of a sentence due to the wrap-up effect.
Female, Male-Female, Female-Male) as within-participants and within-items factor.\textsuperscript{36} Analyses were performed on aggregated data for both participants ($F_1$) and items ($F_2$). Figure 4.7 provides mean residual RTs of the critical region (region 5) and subsequent spillover regions (region 6 and 7).

![Figure 4.7 Mean residual reading times (in ms) for the PA gender condition](image)

(error bars indicate standard errors)

The statistical results revealed no significant main effect of PA gender on RTs in the reflexive and subsequent spillover regions (all $F$’s $<$1), which suggests that the gender information of PAs plays no role in the “real-time” processing of the reflexive dependency formation. This, taken together with the previous finding that the PA gender does not affect the “final” interpretation of

\textsuperscript{36} Region 8 (containing a sentence-final verb) was not analyzed due to the potential (end-of-sentence) wrap-up effect (Just & Carpenter, 1980).
caki, leads us to conclude that the parser does not regard the gender feature as a reliable retrieval cue to resolve caki’s reference at all levels of the processing.

4.2.3 Experiment 7: Person

As noted in Chapter 2, caki refers only to the third-person antecedent, which has been explained in the theoretical literature (e.g., Han et al., 2011; Sohng, 2004) as taking place because it bears an inherent φ-feature [3RD PERSON]. See (85) for example.

(85)  a. 3-person Subject (Person match between the subject and caki):

그 남자는 자기를 싫어했다.
ku namca-q-nun caki-t-lul sileha-ss-ta.
the man-TOP self-ACC hate-PST-DC

‘The man hated himself.’

b. 1-person Subject (Person mismatch between the subject and caki):

나는 자기를 싫어했다.
na-q-nun caki-r-lul sileha-ss-ta.
I-TOP self-ACC hate-PST-DC

‘I hated myself.’

Not surprisingly, the same reflexive-antecedent person mismatch effect also emerges in more complex sentence structures, like (86), where two NPs in the subject and indirect object position c-command caki. In (86a), both the subject and the indirect object are in the third person. In this
case, the reflexive can take either the subject or the indirect object as its antecedent although the subject antecedent is preferred to the object antecedent (cf. Chapter 3). On the other hand, when one of the NPs is not in the third person, as in (86b) and (86c), the reflexive co-refers only with the NP in the third person, regardless of its syntactic position in the sentence, indicating that the person $\varphi$-feature of antecedent serves as a key determinant of caki’s antecedent selection.

(86)  

a. 3rd-person subject/3rd-person indirect object:

변호사가 의뢰인에게 자기의 전화기를 주었다.

pyenhosa-ka uyloyin-eykey caki$_{ij}$-uy cenhwaki-lul cwu-ess-ta.

lawyer-NOM client-DAT self-GEN phone-ACC give-PST-DC

‘The lawyer gave the client his phone.’

b. 1st-person subject/3rd-person indirect object:

내가 의뢰인에게 자기의 전화기를 주었다.

nay$_{i}$-ka uyloyin-eykey caki$_{ij}$-uy cenhwaki-lul cwuessta.

I-NOM client-DAT self-GEN phone-ACC give-PST-DC

‘I gave the client his phone.’

c. 3rd-person subject/1st-person indirect object:

변호사가 나에게 자기의 전화기를 주었다.

pyenhosa-ka na$_{i}$-eykey caki$_{ij}$-uy cenhwaki-lul cwuessta.

lawyer-NOM I-DAT self-GEN phone-ACC give-PST-DC

‘The lawyer gave me his phone.’
However, although the observations made in (86) reveal that the person cue plays a vital role in caki’s final antecedent selection, this does not directly demonstrate when the parser employs that information, i.e., more specifically, whether or not the parser can access it in the early stage of processing. This section tackles this issue, based on the RT data obtained from an experiment that explored how the parser handles the reflexive in different person match conditions (match vs. mismatch between caki and PAs) in real time.

Concerning the timing of access to the person cue, two scenarios can be generated based on relevant (still-ongoing) debates in the psycholinguistics literature: structure-guided serial search (SS model; Nicol & Swinney, 1989; Sturt, 2003) vs. Direct-access content-addressable retrieval (DCR model; Badecker & Straub, 2002; Patil et al., 2016). In the first scenario (or model), syntax is prioritized over other non-syntactic modules of grammar (e.g., morphology, semantics, or discourse/pragmatics). More crucially, this SS model assumes that syntax is the only available information (or cue) that the parser can access/use early in the processing (e.g., binding constraints for the reflexive reference resolution). Non-syntactic cues such as person are available only in the later stages of processing. Adopting this view makes an immediate prediction regarding the RT patterns at the reflexive: the person manipulation of PAs would not lead to notable differences in RT between the person conditions. This is so because the parser would initially search for the antecedent only on the basis of structural cues (e.g., binding constraints), ignoring non-syntactic features of PAs. In (86), all three sentences are structurally identical, as illustrated in Figure 4.8. Moreover, although PAs vary in the type of person feature, they are placed in the same syntactic positions (i.e., subject and indirect object) in which they c-command the reflexive. Thus, under this SS model, it is expected that the same number of PAs may be initially considered at the reflexive by the parser in all cases in (86). Therefore, no
processing differences between conditions (hence, no differences in the RT measure) would be found at the reflexive.\footnote{However, note that the antecedent may be finally selected in the later stage of processing, based on non-syntactic sources of information, including the person information. Thus, in the Syntax-first (two-staged) model, the person-mediated processing effect is expected to occur later in the course of processing (Nicol & Swinney, 1989, 2003; Sturt, 2003).}

\begin{figure}
\centering
\includegraphics[width=\textwidth]{tree_diagram.png}
\caption{Figure 4.8 Tree diagram of (86)}
\end{figure}

On the other hand, the second scenario (\textit{DCR} model) assumes that the parser can access all available sources of information, such as binding constraints and person, in the first pass of processing. Consequently, a different number of PAs is predicted to be initially considered as a function of the person type of PAs. For example, in the case like (86a), where both c-commanding PAs are in the third person, the number of PAs considered in the initial processing would be two. However, in (86b) and (86c), where only one PA is in the third-person, the
number of PAs considered would drop to one. Given that selecting one (antecedent) out of multiple options imposes more processing burden on the parser than selecting one from just a single choice option (Badecker & Straub, 2002), it is expected that RTs at the reflexive in (86a) (3rd-person subject /3rd-person indirect object: 3S3O) would be longer than those in (86b) (1st-person subject/3rd-person indirect object: 1S3O) and (86c) (3rd-person subject/1st-person indirect object: 3S1O). In addition, because there is no difference in the number of PAs retrieved between (86b) and (86c), the parser would initially experience the same amount of processing load at the reflexive. Hence, there would be no RT differences between the two. See Table 4.3 for the summary of predictions.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Number of PAs considered in the initial parsing</th>
</tr>
</thead>
<tbody>
<tr>
<td>SS</td>
<td>DCR</td>
</tr>
<tr>
<td>3S3O</td>
<td>2</td>
</tr>
<tr>
<td>3S1O</td>
<td>2</td>
</tr>
<tr>
<td>1S3O</td>
<td>2</td>
</tr>
</tbody>
</table>

Processing load: 3S3O = 3S1O = 1S3O  3S3O > 3S1O = 1S3O

To test these predictions, a self-paced reading experiment was conducted, parallel to the offline Experiment 6. A sample stimulus is provided in (87), showing the four experimental conditions. A detailed explanation of experimental stimuli will be given below.
(87)  a. 3rd-person Subject/3rd-person Indirect object [Multiple Match; 2 licit PAs]

ecey ecey

\[ \text{panjang}_{\text{PA1}} \] \[ \text{chinkwu}_{\text{PA2}} \] eykey

\begin{align*}
\text{yesterday} & \quad \text{class president-NOM} & \quad \text{friend-DAT} & \quad \text{blackboard beside-LOC} \\
\text{caki}_{\text{I}}-uy & \quad \text{hakkuptungwu-lul} & \quad \text{sulccek} & \quad \text{poyechwu-ess-ta} \\
\text{self-GEN} & \quad \text{class rank-ACC} & \quad \text{secretly} & \quad \text{show-PST-DC}
\end{align*}

‘Yesterday, the class president secretly showed (his/her) friend self’s class rank beside the blackboard.’

b. 3rd-person Subject/1st-person Indirect object [Single Match (Subject); 1 licit PA]

ecey ecey

\begin{align*}
\text{panjang}_{\text{I}} & \quad \text{na}_{\text{I}}-eykey & \quad \text{chilphan yeph-eyse} & \quad \text{……} \\
\text{yesterday} & \quad \text{class president-NOM} & \quad \text{I-DAT} & \quad \text{blackboard beside-LOC}
\end{align*}

‘Yesterday, the class president secretly showed me self’s class rank beside the blackboard.’

c. 1st-person Subject/3rd-person Indirect object [Single Match (Indirect object); 1 licit PA]

ecey ecey

\begin{align*}
\text{nayi-ka} & \quad \text{chinkwu}_{\text{I}}-eykey & \quad \text{chilphan yeph-eyse} & \quad \text{……} \\
\text{yesterday} & \quad \text{I-NOM} & \quad \text{friend-DAT} & \quad \text{blackboard beside-LOC}
\end{align*}

‘Yesterday, I secretly showed (my) friend self’s class rank beside the blackboard.’

d. 1st-person Subject/2nd-person Indirect object [Zero Match; 0 licit PA]

ecey ecey

\begin{align*}
\text{nayi-ka} & \quad \text{ne}_{\text{I}}-eykey & \quad \text{chilphan yeph-eyse} & \quad \text{……} \\
\text{yesterday} & \quad \text{I-NOM} & \quad \text{you-DAT} & \quad \text{blackboard beside-LOC}
\end{align*}

‘Yesterday, I secretly showed you self’s class rank beside the blackboard.’
4.2.3.1 Stimuli

Sixteen sets of experimental stimuli were constructed in the form shown in (87) above. Each set consisted of four Korean simple ditransitive sentences whose subject (NP1) and indirect object (NP2) serve as PAs for the possessive reflexive caki in the direct object position (NP3). Those four experimental sentences in each set were generated by manipulating the person feature of PAs, which resulted in four-person conditions (3S3O, 3S1O, 1S3O, and *1S2O) (see (88) for summary). Note that the sentence in the *1S2O person condition is not grammatical because the reflexive has no linearly preceding antecedent(s) in the third person to co-refer with.

(88) [ ADV NP1-NOM NP2-DAT Locative caki_{ij}-GEN NP3-ACC ADV V ]

a. 3S3O: 3P 3P \{ Multiple Match (2 PAs) \}

b. 3S1O: 3P 1P \{ Single Match (1 PA) \}

c. 1S3O: 1P 3P \{ Zero Match (0 PA) \}

d. 1S2O: 1P 2P \{ Ungrammatical \}

As schematically illustrated in (88) above, all experimental sentences began with a temporal phrase (such as ecey ‘yesterday’ or onul ‘today’) to avoid the topicalization of the subject NP1. The subject NP1 (PA1) and the indirect object NP2 (PA2) appeared in a row after the sentence-initial temporal phrase. The genitive-marked reflexive caki appeared as a possessor NP in the direct object position. A locative expression was inserted between the indirect object NP2 and
the reflexive to eliminate the possibility that *caki* co-refers with the indirect object because it is the linearly closest c-commanding antecedent. Finally, an adverb phrase (e.g., *sulccek* ‘secretly’) was added between the direct object NP3 and the verb to capture delayed spillover effects from the critical region (containing *caki*).

4.2.3.2 Results and discussion

Before conducting statistical analyses, mean accuracy of comprehension questions was computed. All participants scored above 80% correct (mean score was 90%). Therefore, RT data from all participants were used for statistical analysis.

All statistical analyses were conducted based on residual RTs from trials where the comprehension error did not occur. As in Experiment 6, before calculating residual RTs with the regression equation, extreme raw RTs were deleted (RTs>2000ms and RTs<150ms). Furthermore, raw RTs in the first, last, and fifth region of interest (ROI) were also excluded to enhance the accuracy of the regression equation (see the result section of Experiment 6 for details). (89) (= (87a)) illustrates the segmented ROIs.

(89) **ROIs of (87a)**

<table>
<thead>
<tr>
<th>ROI</th>
<th>Region 1</th>
<th><strong>Region 2 (PA1)</strong></th>
<th><strong>Region 3 (PA2)</strong></th>
<th>Region 4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word</td>
<td><em>e. cey</em></td>
<td><em>pan.cang. -i</em></td>
<td><em>chin.kwu. - ey.key</em></td>
<td><em>chil.phan. eyph. - ey.se</em></td>
</tr>
<tr>
<td>Gloss</td>
<td>yesterday</td>
<td>class captain-NOM</td>
<td>friend-DAT</td>
<td>blackboard beside-LOC</td>
</tr>
<tr>
<td>(WL)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
</tr>
</tbody>
</table>

---

38 All experimental sentences were segmented into 8 ROIs, except one sentence (9 ROIs). The number in the parenthesis represents the word length. The reflexive *caki* was always contained in Region 5. Regions 6 and 7 were spillover (SP) regions.
The residual RTs in each ROI were trimmed for each condition, using the same trimming
technique as in Experiment 6.

The resulting residual RTs for each region were entered into a one-way repeated measure
ANOVA, treating the PA person (3 levels: 3S3O, 3S1O, and 1S3O) as within-participants and
within-items factors\(^{39}\). Analyses were done on the aggregated data for both participants \((F_1)\) and
items \((F_2)\). I report statistical results from the critical region (Region 5 including \textit{caki}) and
spillover regions (Regions 6 and 7), presented in Table 4.4. The numerical results in Table 4.4
are plotted in Figure 4.9.

---

\(^{39}\) As shown in (87) above, the ungrammatical condition *1S2O was included in each set of
experimental stimuli for the completeness. In the current statistical analysis, RTs obtained in this
condition were excluded because it is not of interest for the present experiment how the reflexive
is processed when it cannot refer to preceding PAs. Only RTs from the grammatical conditions
(3S3O, 3S1O, and 1S3O) were considered for analysis, resulting in one independent variable
with three levels.
Figure 4.9 Trimmed residual RTs: Critical (Region 5) to Spillover regions (Region 6 and 7)

*Error bars represent standard errors

Table 4.4 Mean trimmed Residual RTs (and raw RTs) in milliseconds

<table>
<thead>
<tr>
<th>Condition</th>
<th>ROI</th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5</td>
<td>6</td>
<td>7</td>
<td></td>
</tr>
<tr>
<td></td>
<td><em>caki</em></td>
<td><em>SP1</em></td>
<td><em>SP2</em></td>
<td></td>
</tr>
<tr>
<td>3S3O</td>
<td>68.68 (526.55)</td>
<td>-33.44 (420.71)</td>
<td>-10.34 (422.05)</td>
<td></td>
</tr>
<tr>
<td>3S1O</td>
<td>-1.37 (455.62)</td>
<td>-26.45 (441.70)</td>
<td>-42.96 (401.03)</td>
<td></td>
</tr>
<tr>
<td>1S3O</td>
<td>32.07 (480.37)</td>
<td>-31.87 (423.63)</td>
<td>-19.69 (409.03)</td>
<td></td>
</tr>
</tbody>
</table>

The statistical results revealed a significant main effect of the PA person on the reading times at the critical region ($F_1(2, 38) = 3.450, p < 0.05$; $F_2(1.374, 20.615) = 4.525, p < 0.05$). To find out which pairs of person conditions significantly differ from one another, I conducted a post hoc test of simple effects using Bonferroni correction for multiple comparisons. As demonstrated in
Figure 4.10, the results showed that the only significant difference was between the 3S3O condition ($M = 66.68, SD = 110.28$) and the 3S1O condition ($M = -1.37, SD = 55.23; p < 0.05$). However, although the reflexive in the 3S3O condition, on average, was read numerically longer than that in the 1S3O condition ($M = 32.07, SD = 101.68$), the difference between the two conditions was not statistically significant. Finally, when the 3S1O condition was compared with the 1S3O condition (recall that both conditions contain only one grammatically licit antecedent for the reflexive), the mean difference was not significant.

![Figure 4.10 Mean residual reading times by the PA person in Region 5](image)

(Error bars indicate 95% Confidence Interval) *$p < 0.05$  

In the spillover regions (Region 6 and 7), no main effect of the PA person on reading times was found ($\text{Region 6: } F_1(2, 38) = 0.082, p = 0.921; F_2(2, 30) = 0.163, p = 0.850; \text{Region 7: } F’s <1$).

The current experiment explored whether the manipulation of the person feature of PAs has an impact on the online processing of caki. Results revealed a significant main effect of PA
person manipulation on RT at the reflexive. This suggests that the parser can indeed access and use the person cue early in the processing, which rejects the SS model as a viable approach to caki’s reference resolution. The present findings support the DCR model (cf. Table 4.3 above). In the following subsections, I further discuss the implications of the present findings and attempt to provide possible underlying mechanisms for the online dependency resolution between caki and its antecedent, based on the RT patterns observed in the critical region (Region 5).

3S3O vs. 3S1O:
As seen in Figure 4.9 and Figure 4.10, the 3S3O condition (Multiple match; cf. (88)) led to significantly longer mean RT at the reflexive than the 3S1O condition (Single match). This result can be interpreted as reflecting relatively increased processing load in the 3S3O condition, which was incurred by the simultaneous memory activation of multiple antecedents (in the current case, two) and the subsequent selection competition between those antecedents (possibly, before the final decision is reached at the later processing stages). This implies that all possible antecedents that satisfy relevant linguistic constraints (such as c-command, animacy, and person constraint) are rapidly retrieved from memory and considered by the parser for selection.

1S3O vs. 3S1O:
The 1S3O condition contains only one grammatically licit antecedent, as the 3S1O condition. Therefore, one can assume that RTs in the 1S3O condition would pattern like those in the 3S1O condition so that the 1S3O condition could result in significantly faster RTs at the reflexive than the 3S3O condition, as the 3S1O condition did (cf. (90) for summary and clarification).
<table>
<thead>
<tr>
<th>Pair</th>
<th>Prediction</th>
<th>Mean residual RT</th>
<th>Significant?</th>
</tr>
</thead>
<tbody>
<tr>
<td>a. 3S3O vs. 3S1O</td>
<td>3S3O &gt; 3S1O</td>
<td>3S3O &gt; 3S1O</td>
<td>YES</td>
</tr>
<tr>
<td>b. 3S3O vs. 1S3O</td>
<td>3S3O &gt; 1S3O</td>
<td>3S3O &gt; 1S3O</td>
<td>NO</td>
</tr>
<tr>
<td>c. 3S1O vs. 1S3O</td>
<td>3S1O = 1S3O</td>
<td>3S1O &lt; 1S3O</td>
<td>NO</td>
</tr>
</tbody>
</table>

However, surprisingly, results of the post-hoc analysis did not support this prediction. That is, unlike the 3S1O condition ($M = -1.37$, $SD = 55.23$), the 1S3O condition ($M = 32.07$, $SD = 101.68$) did not differ significantly in RT from the 3S3O condition ($M = 66.68$, $SD = 110.28$) due to the relatively large participant variance (and, possibly, small sample size). Although mean difference between 1S3O and 3S1O was not statistically significant, more than half of participants (65% of them) read the reflexive relatively more slowly in the 1S3O condition than in the 3S1O condition.\(^{40}\) I argue that this happens because *caki*’s co-reference with a subject PA (3S1O) was easier to process (hence, faster to read) than its reference to a non-subject PA (1S3O). Given the fact that experimental sentences in both conditions were identical in every aspect except for the position of the grammatically legitimate antecedent (i.e., subject in 3S1O and indirect object in 1S3O) and the subject antecedent advantage at the reflexive (RT: 3S1O < 

---

\(^{40}\) One could argue that this is just a sampling error. That is, the two conditions are from the same group of population. If the online processing of *caki* in both conditions is really similar in nature (to put differently, the two conditions impose similar processing pressures on the parser at the reflexive), RT patterns (and participant variances) found at the reflexive should be similar between the 1S3O and 3S1O condition. However, the 1S3O condition ($SD = 101.68$) resulted in much larger RT variance than the 3S1O condition ($SD = 55.23$). Also, as stated above, the reflexive in the 1S3O condition was consistently read more slowly by 65% of participants than the reflexive in the 3S1O condition. These differences between the conditions should not be treated just as an error. I believe that they indeed reflect certain qualitative differences (in processing) between the two conditions and this definitely requires an explanation.
1S3O), it seems fairly reasonable to assume the presence of certain subject-related factor(s) that can independently enhance the availability (or the memory activation level) of a PA in the subject position (probably, regardless of its inherent lexical profile)\(^{41}\).

If this is the case, we can explain why the 1S3O condition resulted in relatively longer RT (or higher processing load) than the 3S1O condition by arguing that, in the 1S3O condition, a subject factor increases the availability of the incorrect subject PA in memory. As a result, it is falsely considered by the parser as a candidate antecedent, along with the correct PA in the non-subject position. Consequently, the presence of incorrect PA may impede the parser’s immediate and direct access to correct PA during retrieval. The parser is unintendedly forced to navigate and retrieve a target (antecedent) from a pool of candidate PAs that compete with each other for selection. This whole process may require more efforts than the processes without an interference effect or selection competition between choice options (cf. Figure 4.11A). On the other hand, such interference effect by the incorrect PA may be minimal or even null in the 3S1O condition (cf. Figure 4.11B). This is so because the correct PA already occupies the subject position (SpecTP). Also, it may receive further positive support from the subject factor(s) in that position so that it becomes even more accessible during the online antecedent retrieval (hence, easier to retrieve /process).

\(^{41}\) The subject-related factors may include the following:

(i)  
  a. Structural position of antecedent (purely syntactic): specifier of TP  
  b. Morphological case: nominative  
  c. Semantic agentivity/grammatical role  
  d. Discourse/pragmatic prominence  
  e. Order of mention: 1st-mentioned vs. 2nd-mentioned
Figure 4.11 Tree diagrams of sample target sentences in 1S3O and 3S1O:

In each panel, numbers beside dotted lines indicate the number of features that match between PAs and reflexive. The effect of subject factors is quantified by adding a (constant) weighting value (W) to the number of matching features between the subject PA and caki. This weighted value can be understood as indirectly representing the retrieval probability (RP) of the PA. In 1S3O, W may make the RP difference between the subject and object PA smaller (hence, interference may arise) whereas the same W may make it larger in 3S1O (only the subject PA is promoted. Hence, no interference).

Another alternative (and I believe more promising) account for the current results could argue that the reflexive itself may include an additional feature linked directly to specific
linguistic properties of the subject position, besides the person [3rd-Person] and animacy [Animate]. This feature (which I call subject feature [+SUBJECT]) is assumed to serve as a retrieval cue available at the reflexive, along with other cues. Importantly, the subject cue is assumed to guide the parser to blindly access and retrieve an NP in the subject position. This approach explains that the relatively slower RT in the 1S3O condition, in comparison to the 3S1O condition, is attributable to the fact that the retrieval probability of each PA is identical in the 1S3O condition. Thus, the parser would experience a relatively higher processing load because it should initially select one from two candidate PAs with equal retrieval probability (Figure 4.12A). On the other hand, in the 3S1O condition, the number of matching features between the subject PA and the reflexive is greater than that between the object PA and the reflexive (Subject PA–caki = 3, Object PA–caki = 1). That is, the retrieval probability of the subject PA is higher than that of the object PA. Therefore, the parser would experience little or no processing difficulty at the reflexive so that it could rapidly retrieve and select an antecedent from memory (Figure 4.12B).

42 The likelihood that a specific PA is retrieved from memory can be indirectly predicted by estimating the number of matching features between the PA and the reflexive because the retrieval probability (RP) is positively correlated with the number of matching features between the two items. That is, the higher the number of matching features between PA and reflexive, the more probable is that PA to be retrieved and finally selected as the antecedent of the reflexive (i). For example, in Figure 4.12B, the number of matching features between subject PA and caki is 3. But, the number of matching features between object PA and caki is 1. In this case, all else being equal, the subject PA would more likely be retrieved as antecedent because the matching features of the subject PA outnumbers those of the object PA.

(i)  # of matching features between items ↑ ⇒ RP ↑
Figure 4.12 Tree diagrams of sample target sentences in 1S3O and 3S1O:

Numbers in parentheses indicate the number of matching features between PA and caki. In 1S3O, the number of matching features between subject PA and caki [2] is identical to that between object PA and reflexive [2]. But, in 3S1O, the former [3] is greater than the latter [1].

The two accounts provided above are speculative at present. Furthermore, the exact (psycho)linguistic nature of (what I call) subject feature still remains unclear. Nevertheless, at least, the present results clearly show:

(a) The person cue is available early in the processing, supporting the DCR model, and plays a crucial role as a retrieval cue in the real-time processing of caki.
(b) The presence of multiple legitimate antecedents often causes the processing delay (a type of interference effect), indicating that the grammatically legitimate PAs are available at the time of retrieval, competing with each other for selection (cf. 3S3O vs. 3S1O/1S3O).

(c) A PA in the subject position has a processing advantage over a PA in the non-subject position. Assuming the presence of an additional factor (or feature) related to the subject position better explains the results of the current experiment although further in-depth research is required to figure out what it is and how it works.

4.3 General Discussion and Conclusion

In this chapter, I explored whether (and if so, how) manipulating the gender and person φ-feature of PAs appearing in the referentially ambiguous mono-clauses influences the real-time reference resolution of caki.

The results of two self-paced reading experiments (Experiment 6 and 7) showed that the gender manipulation did not affect the reading of the reflexive, indicating that the parser is gender-blind, at least, in resolving caki’s reference. On the contrary, the person manipulation induced a notable lengthening in RT at the reflexive region when two third-person PAs serve as grammatical PAs for the reflexive.

All together, it can be concluded that the gender is not a cue that the parser relies on during retrieval while the person is indeed a crucial retrieval cue available at the early stage of caki’s reference resolution. Furthermore, the early availability of the person cue suggests that the parser can access and use non-syntactic sources of information in the initial pass of processing,
rejecting an approach to the reflexive dependency formation that prioritizes the syntactic cue over other non-syntactic cues in the early stage of processing.

Although varying RT patterns found at the reflexive in Experiment 7 provided us with an important opportunity to understand how our mind (or the parser) operates in resolving the reference of caki, there are still many unresolved issues and challenges that require further in-depth and rigorous investigation efforts. In the next chapter, I further investigate the early availability of the animacy feature during the reflexive dependency formation. Recall that, along with the person feature, the animacy feature [ANIMATE] is in the set of core retrieval cues available at the reflexive. If it turns out that the manipulation of PA’s animacy can initially affect the processing of caki, as the person manipulation did, this will serve as another piece of supporting evidence for the DCR model.

Furthermore, to make a stronger case, I also examine whether the animacy manipulation of a non-c-commanding PA (that violates the binding constraints) can have an effect on the online processing of the reflexive. If results are positive, this will form even stronger evidence for the early availability of non-syntactic cues. This is so because, if the binding constraint is the only available cue that the parser can initially rely on during retrieval, the animacy manipulation of a syntactically illicit PA will no longer have an effect on the reading of caki. The psycholinguistic mechanisms involved in caki’s reference resolution are further discussed in the following chapters.
5 Online interpretation of caki: Animacy and Interference

5.1 Introduction

In Experiment 7, we found that a non-syntactic cue such as person can be initially accessed and employed in caki’s reference resolution (contra the prediction of the Serial Search (SS) model), especially in the referentially ambiguous context in which all PAs were grammatical antecedents of the reflexive. Based on this finding, I argued that caki’s referential dependency is established by the mechanism in which a target antecedent is directly accessed based on the cues available at the retrieval site, as suggested by the Direct-access Content-addressable Retrieval (DCR) model. In this chapter, I present additional empirical evidence to support this claim.

5.1.1 Role of ungrammatical PA in RD formation

As discussed in Chapter 1, SS and DCR models make different predictions about the type of information (or cue) available in the initial pass of reflexive-antecedent dependency formation. That is, the SS model only allows access to syntactic information whereas the DCR model permits initial access to non-syntactic (as well as syntactic) cues such as person and animacy. As a result, the antecedent retrieval conducted under the SS model always outputs grammatically correct results: memory retrieval of a correct antecedent (A) that satisfies syntactic requirements (such as binding constraints) in regard to the reflexive, as illustrated in Figure 5.1.
Figure 5.1 Retrieval of correct antecedent under the SS model

The incorrect antecedent (B) will never be retrieved because it is ruled out by the grammatical restriction that prohibits access to an item in the island for dependency resolution (Ross, 1967).

On the other hand, the memory retrieval process operated by the DCR mechanism often undergoes interference from irrelevant distractors (e.g., an incorrect antecedent (B) in Figure 5.2) if they fully or partially match the retrieval trigger in features. Crucially, such interference, either inhibitory or facilitatory, affects antecedent selection and relevant reference processing (cf. §1.2 for detailed discussion).
The theoretical difference between SS and DCR in the prediction of the initially available (or accessible) antecedent provides a good diagnostic tool to determine which model (SS vs. DCR) best fits the observed behaviors of the reflexive under investigation. That is, if an antecedent is searched and retrieved as the SS model assumes, the incorrect PA in the syntactic island will never be taken as the antecedent for the reflexive. On the other hand, the DCR model predicts that both the correct PA and the incorrect PA (sitting inside the island), as in Figure 5.2, would be initially considered as possible antecedents, hence causing an interference effect, because the two fully match the reflexive in features (although, in this case, the incorrect PA would be ruled out later in processing due to the violation of the island restriction).

The present study used this diagnostic and explored whether the systematic manipulation of feature content (e.g., animacy) of a grammatically inaccessible PA (hereafter, “incorrect PA”; e.g., NP3 in the adjunct clause in (91)) can influence the online processing of the reflexive caki.
5.1.2 Role of animacy in caki’s reference resolution

One of target linguistic features manipulated in this study was the animacy of an incorrect PA, whose role in RD formation has not been empirically explored in previous studies on caki. As noted in §2.2, caki only co-refers with an antecedent that is animate (cf. (32) above, repeated below as (92)), suggesting that animacy, like person, can serve as a retrieval cue in forming a referential dependency between caki and its antecedent.

(92) a. 한 시위자가 법원 앞에서 자기의 입장을 발표했다.
han siwica-ka pepwen aph-eyse caki-uy ipcang-ul palphyoha-ss-ta.
a protest-NOM court front-at self-GEN stance-ACC announce-PST-DC
‘A protester announced self’s stance in front of a court of law.’

\[ siwica ‘protester’ [3 person, singular, animate] = caki \]

b. *한 시위가 법원 앞에서 자기의 입장을 발표했다.
han siwi-ka pepwen aph-eyse caki-uy ipcang-ul palphyoha-ss-ta.
a protest-NOM court front-at self-GEN stance-ACC announce-PST-DC

\[ siwi ‘protest’ [3 person, singular, inanimate] ≠ caki \]
Previous studies showed that animacy information plays a significant role in encoding and accessing items in memory (Nairne, VanArsdall, Pandeirada, Cogdill, & LeBreton, 2013; Parker et al., 2017; VanArsdall, Nairne, Pandeirada, & Blunt, 2013). If this also applies to caki’s online reference resolution, one can predict that, under the DCR model, animacy would play an important role in the initial pass of caki’s reference resolution. More specifically, if an incorrect PA (e.g., NP3 in (91)) matches the reflexive in features (including animacy), the cue-based parser would consider it as a retrievable PA of caki. This could, in turn, result in interference during antecedent retrieval, especially when the parser attempts to form a dependency with a grammatically correct PA. For example, in a context like (93), an interference effect is expected to occur in both (93a) and (93b).

(93) a. Nonlocal *animate* correct PA (NP1) /local *inanimate* correct PA (NP2)

![Diagram showing the structure of sentence (93a) with DCR: ✓ and SS: ✗]

In (93a), the matrix subject NP1 is *animate* whereas the embedded subject NP2 is *inanimate*. Thus, only the nonlocal subject NP1 can serve as the correct PA for caki. Note that the subject
NP3 of the adjunct adverbial clause is also animate. Hence, NP3 may also possibly be considered by the parser as a PA for *caki*. Consequently, interference occurs. The same happens in (93b) although, in this case, the correct PA for *caki* is NP2, not NP1. On the other hand, the SS model makes qualitatively different predictions from the DCR model: the manipulation of the animacy of an incorrect PA would not affect *caki*’s antecedent selection because the grammar (e.g., binding constraints) would initially rule out the possibility that the incorrect PA is considered as *caki*’s antecedent in both (93a) and (93b). Thus, no interference effect is expected to appear and only the c-commanding correct PA (which is animate) would be chosen and retrieved as the antecedent. The summary of predictions is provided in (94).

(94)  **Predictions:**

<table>
<thead>
<tr>
<th>Model</th>
<th>Initial availability of animacy cue</th>
<th>Interference by incorrect PA</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>SS</strong></td>
<td>NO</td>
<td>NO</td>
</tr>
<tr>
<td><strong>DCR</strong></td>
<td>YES</td>
<td>YES</td>
</tr>
</tbody>
</table>

5.1.3 Locality of correct PA

Regardless of whether the incorrect PA (e.g., NP3 in (91)) can be initially accessed or not, (91) (repeated below as (95)) is in principle referentially ambiguous if both NP1 and NP2 – which are all grammatical binders of the reflexive – are 3rd person animate.

(95)  [ NP1-TOP [ NP2-NOM [ NP3-NOM … V-WHEN] *caki*-GEN NP3-DAT … V ] V ]
Here note that NP1 and NP2 in (95) are functionally identical in that both function as grammatical subjects (in Spec, TP). However, they differ in locality: NP1 is a *nonlocal* antecedent whereas NP2 is a *local* antecedent for *caki* (Han & Storoshenko, 2013; Kim et al., 2009; Sohng, 2004; cf. Chapter 2 for a more detailed discussion). Here, a question arises that has yet to be empirically explored in the literature on *caki: Do differences in locality of correct PAs (local vs. nonlocal reference) cause differences in processing load at the reflexive?*

Regarding this issue, previous studies have consistently reported that the local dependency is easier to process than the nonlocal dependency due to (i) the time-based decay or deactivation of nonlocal dependencies in memory and/or (ii) the enhanced effect of (similarity-based) interference (Bartek, Lewis, Vasishth, & Smith, 2011; Dillon et al., 2014; Lewis et al., 2006; Van Dyke & Johns, 2012).

43 Based on the findings from these studies, one can predict that *caki*’s reference to a local antecedent (*local condition;* e.g., (96a)) would be easier to process than its reference to a nonlocal antecedent (*nonlocal condition;* e.g., (96b)). If reading time is measured, one would find faster RT at the reflexive in the local condition than in the nonlocal condition.

44 The *decay* account explains that the reduced availability of nonlocal linguistic items is caused by their relatively lower activation level in memory than (more recently accessed and activated) local items. However, the *interference* account explains the locality effect from different perspectives. That is, when the dependency is longer, more items are likely to intervene between dependent items. When there are more items in memory, the degree of similarity-based interference is likely to be greater, leading to increased processing load.

44 In the local condition (96a), NP1 (in the matrix subject position) is *inanimate* whereas NP2 (in the subject position of complement clause) is *animate*. Thus, in (96a), *caki* can only refer to NP2, not NP1 (i.e., local reference resolution). On the other hand, in the nonlocal condition (96b), the reverse is true. That is, *caki* can only refer to NP1 because it is the only animate PA (i.e., nonlocal reference resolution).
Importantly, this locality-based prediction of processing difficulty at the reflexive can be used as an additional diagnostic criterion to determine by which mechanism (SS vs. DCR) the antecedent is retrieved from memory. This is so because the SS and DCR models make different predictions about retrieval latencies (measurable at the retrieval site) as a function of locality of correct PA.

As discussed in detail in §1.2, the SS model posits that the speed of memory retrieval slows down as the structural distance between the retrieval target and the trigger grows. As illustrated in Figure 5.3, the target-trigger linear (or hierarchical) distance between the antecedent and the reflexive is larger in the nonlocal condition (96b) than in the local condition (96a). Thus, the model predicts longer latency (RT) at the reflexive in the nonlocal condition than in the local condition.
On the other hand, the DCR model assumes that memory access is direct and content-addressable, which ensures rapid and \textit{constant-time} implementation of memory retrieval (i.e., retrieval speed is constant). Therefore, the DCR model predicts no difference in retrieval latency by locality at the reflexive. In other words, locality does not affect the memory retrieval process.

5.2 Experiment 8: Animacy and Locality

In the present experiment, I explored (i) whether the animacy manipulation of an incorrect PA (in an embedded adjunct clause) can affect the online processing of the reflexive \textit{caki} and (ii) whether the locality of correct PAs influences retrieval speed, using the same experimental paradigm as was used in Experiments 6 and 7, i.e., non-cumulative self-paced reading paradigm (see §4.2.1 for a detailed description of the experimental procedure). The following predictions were made:
Predictions

a. In contexts like (96), if the retrieval occurs as the DCR model assumes
   (i) Animacy manipulation of incorrect PA would affect the online processing of the reflexive, i.e., interference effect. The reflexive would be read longer when the incorrect PA is animate (hence, both correct and incorrect PAs are animate) than when it is inanimate.
   (ii) No locality effect should occur. No significant differences in RT would be observed at the reflexive region between local and nonlocal conditions.

b. If the retrieval occurs as the SS model assumes
   (i) Animacy manipulation of incorrect PA would not have an impact on the online processing of the reflexive, i.e., no interference effect.
   (ii) Locality effects should be induced: The reflexive would be read faster in the local condition than in the nonlocal condition.

5.2.1 Participants

Twenty-four Korean native speakers who lived in the New York metropolitan area or adjacent counties at the time of experiment were recruited. All participants signed an informed consent. They were remunerated for their participation. The study was approved by the IRB of the Graduate Center of the City University of New York.
24 sets of complex sentences were constructed for this experiment. Each set was comprised of six Korean complex sentences: Four of them were main experimental sentences where the subordinate complement clause included an additional adjunct clause in the format shown in (98a-d). They were created by crossing two levels of *locality of correct PA* (local vs. nonlocal correct PA) with two levels of *animacy of incorrect PA* (animate vs. inanimate incorrect PA) (cf. Chen et al., 2012; Dillon et al., 2014).

(98) a. Local correct PA / Animate incorrect PA

\[
\begin{align*}
\text{MATRİX CLAUSE} & \quad \begin{array}{c}
\text{COMPLEMENT CLAUSE} \\
\text{ADJUNCT CLAUSE}
\end{array} \\
[\text{NP1-}\text{-TOP} & \quad [\text{NP2-}\text{-NOM} [\text{NP3-}\text{-NOM} \ldots \text{V-WHEN}] \text{caki}^{i/j/k}\text{-GEN NP3-DAT} \ldots \text{V-COMP}] \text{V} ]
\end{align*}
\]

b. Local correct PA / Inanimate incorrect PA

\[
\begin{align*}
[\text{NP1-}\text{-TOP} & \quad [\text{NP2-}\text{-NOM} [\text{NP3-}\text{-NOM} \ldots \text{V-WHEN}] \text{caki}^{i/j/k}\text{-GEN NP3-DAT} \ldots \text{V-COMP}] \text{V} ]
\end{align*}
\]

c. Nonlocal correct PA / Animate incorrect PA

\[
\begin{align*}
[\text{NP1-}\text{-TOP} & \quad [\text{NP2-}\text{-NOM} [\text{NP3-}\text{-NOM} \ldots \text{V-WHEN}] \text{caki}^{i/j/k}\text{-GEN NP3-DAT} \ldots \text{V-COMP}] \text{V} ]
\end{align*}
\]

d. Nonlocal correct PA / Inanimate incorrect PA

\[
\begin{align*}
[\text{NP1-}\text{-TOP} & \quad [\text{NP2-}\text{-NOM} [\text{NP3-}\text{-NOM} \ldots \text{V-WHEN}] \text{caki}^{i/j/k}\text{-GEN NP3-DAT} \ldots \text{V-COMP}] \text{V} ]
\end{align*}
\]

The remaining two sentences were sentences in the form of (99), constructed by removing an adjunct clause (including NP3) from the main experimental sentence in each locality condition.

\[
\begin{align*}
\text{<ANIMATE>} & \quad \text{<INANIMATE>} & \quad \text{<INANIMATE>} \\
\text{<ANIMATE>} & \quad \text{<ANIMATE>} & \quad \text{<ANIMATE>} \\
\text{<ANIMATE>} & \quad \text{<INANIMATE>} & \quad \text{<INANIMATE>} \\
\text{<ANIMATE>} & \quad \text{<INANIMATE>} & \quad \text{<INANIMATE>} \\
\text{<ANIMATE>} & \quad \text{<ANIMATE>} & \quad \text{<ANIMATE>} \\
\text{<ANIMATE>} & \quad \text{<INANIMATE>} & \quad \text{<INANIMATE>} \\
\text{<ANIMATE>} & \quad \text{<INANIMATE>} & \quad \text{<INANIMATE>} \\
\text{<ANIMATE>} & \quad \text{<ANIMATE>} & \quad \text{<ANIMATE>}
\end{align*}
\]
These sentences were additionally added in order to check whether the locality effect can also emerge in a relatively simpler sentence context (i.e., bi-clausal sentences without additional adjunct clauses).

(99) a. Local correct PA (with no adjunct clause)

\[
\text{NP}_1\text{-TOP} \left[ \text{NP}_2\text{-NOM} \left[ \text{NP}_3\text{-NOM} \ldots \text{V}\text{-WHEN} \right] caki_{i/j}\text{-GEN} \text{NP}_3\text{-DAT} \ldots \text{V}\text{-COMP} \right] \text{V} \\
\text{<INANIMATE>} \quad \text{<ANIMATE>}
\]

b. Nonlocal correct PA (with no adjunct clause)

\[
\text{NP}_1\text{-TOP} \left[ \text{NP}_2\text{-NOM} \left[ \text{NP}_3\text{-NOM} \ldots \text{V}\text{-WHEN} \right] caki_{i/j}\text{-GEN} \text{NP}_3\text{-DAT} \ldots \text{V}\text{-COMP} \right] \text{V} \\
\text{<INANIMATE>} \quad \text{<INANIMATE>}
\]

A sample set of experimental sentences is provided in (100).

(100) a. Local correct PA / Animate incorrect PA (interference)

\[
\text{진술서는 변호사가 살해범이 밝혀질 무렵} \quad \text{자기의} \\
\text{의뢰인을 정서적으로 위축시켰다고 지적했다.} \\
\text{cinswulse}-nun \text{pyenhosa}-ka salhaypem-i \text{palkhyecil mwulyep} \quad \text{caki}_{i/j/k}\text{-uy} \\
\text{statement-TOP} \quad \text{lawyer-NOM} \quad \text{murderer-NOM} \quad \text{be revealed when} \quad \text{self-GEN} \\
\text{uyloyin-ul cengsecekulo wichwusikhyess-tako cicekhay-ss-ta} \\
\text{client-ACC emotionally shriveled-COMP pointed out-PST-DC}
\]
‘(Lit.) The statement pointed out that the lawyer made self’s client emotionally withdrawn when the murderer was revealed.’

b. Local correct PA / Inanimate incorrect PA (no interference)

리서는 변호사가 살해동기 가 밝혀질 무렵 자기의

변호사는 변호사가 살해동기 가 밝혀질 무렵 자기의

변호사는 변호사가 살해동기 가 밝혀질 무렵 자기의

‘(Lit.) The statement pointed out that the lawyer made self’s client emotionally withdrawn when the murderer was revealed.’

c. Nonlocal correct PA / Animate incorrect PA (interference)

변호사는 변호사가 살해동기 가 밝혀질 무렵 자기의

변호사는 변호사가 살해동기 가 밝혀질 무렵 자기의

변호사는 변호사가 살해동기 가 밝혀질 무렵 자기의

‘(Lit.) The lawyer pointed out that the statement made self’s client emotionally withdrawn when the murderer was revealed.’
d. Nonlocal correct PA / Inanimate incorrect PA (no interference)
변호사는 진술서가 살해동기가 밝혀질 무렵 자기의
pyenhosa-nun cinswulse-ca salhaytongka-pa palkhyecil mwulye caki
lawyer-TOP statement-NOM murder motive-NOM be revealed when self-GEN
의뢰인은 정서적으로 위축시켰다고 지적했다.
uyloyin-ul cengsecekulo wichwusikhyess-tako cicekhay-ss-ta
client-ACC emotionally shriveled-COMP pointed out-PST-DC
‘(Lit.) The lawyer pointed out that the statement made self’s client emotionally withdrawn when the murder motive was revealed.’

e. Local correct PA (with no adjunct clause)
진술서는 변호사가 자기의 의뢰인을 정서적으로
<INANIMATE> <ANIMATE> 자기의 의뢰인을 정서적으로
cinswulse-ca pyenhosa-ka caki uyloyin-ul cengsecekulo
statement-TOP lawyer-NOM self-GEN client-ACC emotionally
위축시켰다고 지적했다.
wichwusikhyess-tako cicekhay-ss-ta
shriveled-COMP pointed out-PST-DC
‘(Lit.) The statement pointed out that the lawyer made self’s client emotionally withdrawn.’

f. Nonlocal correct PA (with no adjunct clause)
변호사는 진술서가 자기의 의뢰인을 정서적으로
pyenhosa-nun cinswulse-ca caki uyloyin-ul cengsecekulo
As shown in (100), the factor animacy was manipulated by varying the animacy of the incorrect PA in the adjunct clause: animate (e.g., murderer in (100a) and (100c)) vs. inanimate incorrect PA (e.g., murder motive in (100b) and (100d)). Words used as incorrect PAs were semantically related: protest vs. protester; murder motive vs. murderer, and so forth. The factor locality was manipulated by varying the linear (and structural) distance between the correct PA and the reflexive. For example, in the nonlocal condition, caki formed a dependency only with the (nonlocal) matrix subject because it was the only grammatically correct antecedent that was animate. In this condition, the local embedded subject was always inanimate. Sentences in the local condition were made by simply switching the order of correct PAs in the nonlocal conditions (101a), which resulted in (101b).

(101) a. Nonlocal condition:  

\[
\text{[ NP1-TOP [ NP2-NOM [ NP3-NOM \ldots \text{caki} \ldots ]] ]}
\]

\[
\text{[ <INIMATE> <ANIMATE> ]}
\]

b. Local condition:  

\[
\text{[ NP2-TOP [ NP1-NOM [ NP3-NOM \ldots \text{caki} \ldots ]] ]}
\]

\[
\text{[ <INIMATE> <ANIMATE> ]}
\]
Although all PAs (NP1, NP2 and NP3) functioned as the subject (in Spec, TP), NP1 was morphologically marked by the topic particle (e.g., *-un or *-nun) while NP2 and NP3 were marked by the nominative case particle (*-i or *-ka).\(^{45}\) This was done to avoid imposing unnecessary processing load on the parser, based on the previous findings (Uehara, 1997; Uehara & Bradley, 1996) that sentences containing more than two consecutive NPs with the same nominative case particle (e.g., (102a)) were more difficult to process than their counterparts where different case particles attached to consecutive NPs (e.g., (102b)).

\[(102)\]  
\[\text{a. 철수가 민지가 영희가 운영하는 카페에서 친구를 만났다고 생각했다.} \]
\[\text{Chelswu-ka Minci-ka Yenghui-ka wunyengha-nun khaphe-eyse} \]
\[\text{C.-NOM M.-NOM Y.-NOM manage-REL café-at} \]
\[\text{친구를 만났다고 생각했다.} \]
\[\text{Chinkwu-lul manna-ss-tako sayngkakhay-ss-ta} \]
\[\text{Friend-ACC meet-PST-COMP think-PST-DC} \]

‘Chelswu thought that Minci met a friend in a café which Yenghui manages.’

\(^{45}\) The subject NP often appears with a topic particle in Korean. Note that the topic particle and the nominative case particle cannot appear together, as seen in (i). The grammatical function of a topic-marked NP is understood based on its structural relation to other parts of the sentence although there is a tendency that a clause-initial topic-marked NP is normally treated as the subject.

\[(i)\]  
\[\text{*철수가는 영희를 사랑한다.} \]
\[\text{Chelswu-ka-nun Yenghui-lul salanghanta.} \]
\[\text{C.-NOM-TOP Y.ACC love} \]

‘Chelswu loves Yenghui.’
Like in Experiments 6 and 7, the genitive-marked reflexive caki appeared as a possessor NP, along with the accusative-marked possessed NP (i.e., caki-GEN NP-ACC) in the direct object position of the complement clause.

Experimental sentences were divided into ten regions of interest (ROI), as shown in (103).

For main experimental sentences (e.g., (100a-d)), PAs and the reflexive appeared in the same regions across sentences: correct PA1 in Region 1, correct PA2 in Region 2, incorrect PA in Region 3, and caki in Region 6 (critical region). Regions 7 and 8 were treated as spillover (SP).
regions. For sentences with no adjunct clause (e.g., (100e-f)), stimuli were segmented into seven ROIs, as seen in (104): correct PA1 in Region 1 and correct PA2 in Region 2. Caki always appeared in Region 3. Regions 4 and 5 were treated as spillover regions.

(104) ROI of (100e)

<table>
<thead>
<tr>
<th>ROI</th>
<th>Region 1 (PA1)</th>
<th>Region 2 (PA2)</th>
<th>Region 3</th>
<th>Region 4 (SP1)</th>
<th>Region 5 (SP2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Word Gloss</td>
<td>cinswulse-nun statement- TOP</td>
<td>pyenhosa-ka lawyer-NOM</td>
<td>caki-uy self-GEN</td>
<td>uyloyin-ul client-ACC</td>
<td>cengsecekulo emotionally</td>
</tr>
<tr>
<td>ROI</td>
<td>Region 6</td>
<td>Region 7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Word Gloss</td>
<td>wichwuxsikhyess-tako shriveled-COMP</td>
<td>cicekhay-ss-ta pointed out</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The 24 item sets were distributed across 6 presentation lists in a Latin Square design so that each list contained one version of each target sentence and had equal numbers of items per condition. Each list was combined with 120 fillers of a wide variety of sentence types, for a total of 144 sentences per list. Each sentence was followed by a Yes/No comprehension question, which was designed to assess participants’ understanding of (various parts of) sentences. Note that, in the target experimental trials, comprehension questions did not directly ask participants which PA the reflexive co-referred with to prevent them from developing certain superficial (or shallow) reading strategies that would permit them to respond to questions without reading the whole sentence. The presentation order of experimental sentences and fillers was randomized.

46 Like in Experiments 6 and 7, clause-final verb regions (Regions 9 and 10) were not considered as the spillover regions due to the possible presence of the (end-of-sentence) wrap-up effect (Just & Carpenter 1980). Furthermore, by the same token, RT data from these regions were excluded from the statistical analysis.
Sentences were presented on a laptop PC and participants’ word-by-word reading times were measured using the Linger software package (Rohde, 2003).

5.2.3 Results and discussion

The mean accuracy of comprehension questions was 82%. RT data from one participant were removed due to low accuracy (below 70% correct, combining scores for both fillers and experimental trials). As was done in Experiments 6 and 7, all RT data analyses were carried out on residual RTs which were obtained by implementing a simple linear regression (Ferreira & Clifton, 1986; Sturt et al., 2001, 2002). See §4.2.2.2 for detailed explanation.

The obtained residual RTs were then trimmed for each region of interest in the respective conditions by replacing outliers with relevant cutoff values. These values were designated at 2.5×standard deviation (SD) above and below the region mean. This trimming procedure affected 3% of the data.

The trimmed data for each region (except Regions 9 and 10) were submitted to 2×2 repeated measure ANOVA, treating the locality of correct PAs (with two levels: local vs. nonlocal PAs) and the animacy of incorrect PAs (with two levels: animate vs. inanimate PAs) as within-participants and within-items factor. Analyses were performed on aggregated data for both participants ($F_1$) and items ($F_2$). Table 5.1 provides residual RTs for the critical (Region 6) and spillover regions (Regions 7 and 8). Figure 5.4 provides graphical representations of residual RTs from Region 1 to Region 8.
Table 5.1 Trimmed residual (and raw) RTs (ms) for the critical and spillover regions

<table>
<thead>
<tr>
<th>Condition</th>
<th>Region 6 <em>caki</em></th>
<th>Region 7 Spillover 1</th>
<th>Region 8 Spillover 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local/Animate</td>
<td>22.68 (532.29)</td>
<td>-53.60 (501.07)</td>
<td>-87.74 (480.61)</td>
</tr>
<tr>
<td>Local/Inanimate</td>
<td>-35.46 (481.09)</td>
<td>-96.51 (466.96)</td>
<td>-92.41 (465.32)</td>
</tr>
<tr>
<td>Nonlocal/Animate</td>
<td>37.83 (553.75)</td>
<td>-41.05 (502.32)</td>
<td>-85.69 (494.67)</td>
</tr>
<tr>
<td>Nonlocal/Inanimate</td>
<td>-30.98 (485.90)</td>
<td>-65.46 (489.60)</td>
<td>-108.74 (467.23)</td>
</tr>
</tbody>
</table>

Figure 5.4 Trimmed residual RTs from Region 1 to Region 8

(Error bar indicates the standard error.)

Pre-critical regions (Region 1 through Region 5):

In the pre-critical regions, no significant effects were detected (all p’s > .05).
**Critical region (Region 6):**

In the critical region containing *caki* (Region 6), the reflexive was read more slowly when the incorrect PA matched the reflexive in animacy (i.e., animate) than when it did not. The difference in latency was statistically significant in the subject analysis but not in the item analysis ($F_1(1, 21) = 4.517, p < .05; F_2(1, 20) = 2.782, p = .11$). There was no effect of locality or interaction between animacy and locality ($F’$'s < 1).

**Spillover regions (Region 7 and 8):**

An identical reading time pattern occurred in the first spillover region (Region 7): a significant main effect was found for the animacy of incorrect PA in both the subject and the item analysis ($F_1(1, 21) = 6.471, p < .05; F_2(1, 20) = 4.946, p < .05$), but not for the locality of correct PA and the interaction between the two factors ($F’$’s< 1). Finally, in the second spillover region (Region 8), no effects reached significance (all $p$’s > .1).

A separate statistical analysis was conducted on residual RTs for sentences without adjunct clauses (cf. (100e) and (100f) above). Table 5.2 presents mean residual RTs for the critical region with *caki* (Region 3) and spillover regions (Regions 4 and 5). Figure 5.5 reveals this information graphically from Region 1 to Region 5.
Table 5.2 Trimmed residual (and raw) RTs (ms) for the critical and spillover regions

<table>
<thead>
<tr>
<th>Region</th>
<th>Region 3</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Region 4</td>
</tr>
<tr>
<td></td>
<td>Region 5</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Local</td>
<td>caki</td>
</tr>
<tr>
<td>Local</td>
<td>77.48 (600.81)</td>
</tr>
<tr>
<td>Nonlocal</td>
<td>29.16 (537.71)</td>
</tr>
</tbody>
</table>

Figure 5.5 Trimmed residual RTs from Region 1 to Region 5

(Error bar indicates the standard error.)

One-way repeated measure ANOVA, treating the locality of correct PA as within-participant and within-item factor, revealed no significant effect of locality in all regions examined (all $p$’s $>$ .1).

To summarize, a significant main effect of animacy of incorrect PA was found only at the critical region (with reflexive) and the immediately following spillover region. That is, RTs were slower when the incorrect PA matched the reflexive in animacy (as animate) than when it did not: a case of inhibitory interference. On the other hand, no significant effect was found for the locality of correct PA at the critical and spillover regions. These results clearly indicate that the
linguistic feature (e.g., animacy) of the grammatically inaccessible antecedent is indeed accessible in the early stage of processing. Moreover, the lack of locality effect (i.e., no significant RT latencies as a function of locality) reveals that the linear distance (or hierarchical depth) between dependent constituents does not influence memory retrieval, at least, for the reflexive *caki*. One possible interpretation of this latter finding is that an item in memory is searched via the *direct-access* mechanism, but not via the structure-guided (or hierarchy-based) search. Simply put, a memory item is *directly* accessed and retrieved (based on the cues available at the retrieval site), as illustrated in Figure 5.6. Here, it should be noted that the functional (or positional) characteristics of memory items (e.g., subjecthood) may serve as a cue to memory retrieval. However, this functional cue is *not* the only available cue at the retrieval site. It is just one of many different sources of information (or cue) available when the memory search is initiated for retrieval.

![Figure 5.6 Direct access vs. Structure-guided search](image)

Figure 5.6 Direct access vs. Structure-guided search
caki’s antecedent is directly accessed and retrieved based on the cues available at the retrieval site (retrieval trigger).

Taken together, the findings of the current study point to the conclusion that caki’s antecedent retrieval is executed by the direct-access, content-addressable retrieval (DCR) mechanism, not by the serial search (SS) mechanism. In other words, when caki is encountered, the parser searches the memory to directly access and retrieve an antecedent, using all the cues available at the reflexive, so that a referential dependency between the reflexive and the retrieved antecedent can be established.
6 Overview and Conclusion

6.1 Overview of the dissertation

In this dissertation research, I have conducted a series of psycholinguistic experiments to examine:

(i) [in Experiments 1 through 5] how the Korean reflexive caki (also known as the long-distance anaphor) is interpreted in the referentially ambiguous contexts where various linguistic aspects (e.g., gender, person, word order, etc.) of potential antecedents were manipulated, and

(ii) [in Experiments 6 through 8] how caki searches and retrieves its antecedent from the memory and what cognitive computational mechanism underlies such memory search and retrieval processes.

Major findings of the experiments are as follows:

(i) The reflexive caki has a robust subject antecedent preference. However, the online and offline comprehension of caki can be modulated such that some non-syntactic factors – such as person or source of information – weaken caki’s subject preference although they do not completely cancel the bias.
(ii) The animacy feature match between caki and a grammatically incorrect (non-c-commanding) antecedent led to processing difficulties (i.e., interference effect). Furthermore, no significant difference in RT was detected between two locality conditions (i.e., co-reference with a local antecedent vs. with a nonlocal antecedent).

These results suggest that

(i) The subjecthood of the antecedent (more precisely, an NP being in SpecTP) plays an important role in caki’s reference resolution. However, given that the subject bias can be weakened by some non-syntactic factors (e.g., person), the structural or positional information like subjecthood may not be the only available source of information that determines caki’s interpretation. Instead, for the successful (final) interpretation of caki, comprehenders should take into account various different sources of information or cues that are either syntactic or non-syntactic.

(ii) The animacy feature of a grammatically incorrect antecedent is available and accessible immediately during memory retrieval. This further indicates that the parser retrieves caki’s antecedent based on the cues (linguistic features) available at the retrieval site (i.e., reflexive), without considering whether the potential antecedent is placed in the grammatically appropriate position or not. Taken together, all these results are in support of (cue-based) direct-access content-addressable memory retrieval model.

However, more fundamental questions still remain unanswered:
(i) What makes the subject antecedent more favorable than the non-subject antecedent in the referentially ambiguous contexts? More specifically, does the bias come from the reflexive itself (i.e., lexically-driven) or from certain other external factors?

(ii) The strong subject antecedent bias is a key feature that characterizes the reflexive *caki*. Theoretically, this means that the relevant cognitive model must be able to successfully explain and predict *caki*’s referential bias. Then, how do we integrate such (heuristic) bias into the parsing model?

This chapter concludes the present study on *caki* by discussing possible answers to these questions.

6.2 Sources of *caki*’s subject bias

A series of judgment experiments reported in Chapter 3 consistently found that *caki* strongly preferred the subject antecedent (NP1) over the object antecedent (NP2) in the referentially ambiguous context like (105).

(105) [NP1-NOM ... NP2-DAT ... *caki*-GEN NP3-ACC ... Vditran]  
[3rd PERSON, ANIMATE] [3rd PERSON, ANIMATE]
Then why does *caki* preferentially select the subject NP (i.e., an NP in SpecTP) as its antecedent in (105) (where all potential antecedents (NP1 and NP2) are identical in the feature composition and can grammatically bind the reflexive)? More generally, what drives the subject preference?

The first possible source of this bias can be found in the position-related (non)linguistic properties of the subject. Several previous studies have shown that a pronoun in the sentence is likely to refer to the grammatical subject because the subject tends to be perceived as more prominent or accessible than other arguments of a clause (Arnold, Eisenband, Brown-Schmidt, & Trueswell, 2000; Brennan, 1995; Brennan, Friedman, & Pollard, 1987). Furthermore, it has been argued that the first-mentioned argument NP in the sentence (which is normally the grammatical subject) is more accessible (hence, more retrievable from memory) than the second-mentioned argument NP (e.g., direct object) (primacy effect; cf. Carreiras, Gernsbacher, & Villa, 1995; Gernsbacher & Hargreaves, 1988; Järvikivi, van Gompel, Hyönä, & Bertram, 2005). If these phenomena are manifested in Korean as well, one would be able to build a prediction that the reflexive pronoun *caki* in (105) would select the subject NP1 as its antecedent more often than the indirect object NP2. Also, note that NP1 is the first-mentioned argument in (105).

Therefore, it is expected that NP1 has privileged status in memory and hence is more likely to be retrieved, in contrast to the second-mentioned indirect object NP2. Given that both order of mention and grammatical subjecthood independently affect the processing of the pronoun (Järvikivi et al., 2005; Kaiser & Trueswell, 2008)\(^\text{47}\), the grammatical subject seems to be the best antecedent for *caki* in (105). To put it differently, the syntactic prominence and the advantage of

\(^{47}\) Note that the first-mention advantage has been argued to be attributed to language-independent general cognitive processes (Gernsbacher & Hargreaves, 1988). However, the grammatical role information such as the subjecthood is a linguistic factor.
first mention together can make the grammatical subject a more easily retrievable antecedent for caki, which surfaces as the preference for the subject.

However, in Experiment 3 (cf. Chapter 3), it was found that the manipulation of order-of-mention of potential antecedents (canonical vs. scrambled word order) did not affect the interpretation of the reflexive. That is, even in the context, like (106b), where the grammatical subject NP1 comes linearly after the indirect object NP2, caki still preferred the (second-mentioned) subject antecedent NP1 over the (first-mentioned) object antecedent NP2, i.e., no advantage of first mention.

(106) a. canonical: [ NP1-NOM ... NP2-DAT ... caki_i> j ...]
b. scrambled: [ NP2-DAT ... NP1-NOM ... caki_i> j ...]

Here note that the lack of primacy effect in (106b) does not mean that it never exists at all. Given that (i) the primacy effect appears by language-independent, domain-general cognitive processes (Gernsbacher & Hargreaves, 1988) and that (ii) previous studies showed that the primacy effect can be detected in the Korean sentence comprehension (Kim et al., 2004), there is no a priori reason to believe that the primacy effect never occurs in caki’s reference resolution (although more in-depth research is needed to empirically test this idea). Thus, a theoretically more appealing approach to caki’s subject preference would be to embrace the possibility of there being the primacy effect and, at the same time, to assume the presence of a counterfactor that competes against it. Bearing this in mind, I interpret the absence of primacy effect in (106b) as resulting from the difference in strength between the first-mention advantage and the syntactic prominence (of the subject). That is, caki preferentially co-refers with the subject in (106b)
because the syntactic prominence of the grammatical subject is greater in strength than the first-mention advantage so that the former cancels or masks the effect of the latter. Dissociating those two effects, as separate independent factors, and assigning them with different factor strength seem appropriate in that this nicely explains why caki shows the strong subject antecedent preference. Furthermore, there are previous psycholinguistic studies that showed independent (non-interactive) effects of the first mention and the syntactic prominence (i.e., subjecthood) on the pronominal reference resolution (Järvikivi et al., 2005; Kaiser & Trueswell, 2008).

Thus far, I have discussed two possible (external) sources of caki’s strong subject preference and argued that the syntactic prominence (i.e., subjecthood) has a greater responsibility for the preference than the first-mention advantage (see (107) for summary).

(107) Sources of caki’s subject antecedent preference

(a) First-mention advantage

(b) Syntactic prominence of grammatical subject

* Factor strength: (a) < (b)

These sources are rather external in the sense that they are factors operating outside the trigger (e.g., reflexive, etc.) of dependency formation. In other words, they do not stem directly from the pronominal item itself.

However, previous empirical studies on caki consistently reported results that suggest caki’s early reference to the subject antecedent in the referentially ambiguous context (Han et al., 2015, 2011). For example, Han et al. (2011) provided evidence to show that caki is subject-oriented. In their visual-world eye tracking experiment, where Korean native speakers were
asked to look at some images on the screen while listening to mini-stories (containing target sentences like (108) with either a personal pronoun (e.g., *ku* ‘he’ or *kunye* ‘she’ or *caki*), the discourse prominence of subject referent (*Jongwu*) and object referent (*Yuli*) was manipulated.

(108) 종우가 유리에게 칠판 옆에서 자기/그/그녀가

<table>
<thead>
<tr>
<th>Jongwu-ka</th>
<th>Yuli-eykey</th>
<th>chilphan</th>
<th>yeph-eyse</th>
<th>caki/ku/kunye-ka</th>
</tr>
</thead>
<tbody>
<tr>
<td>J.-NOM</td>
<td>Y.-DAT</td>
<td>blackboard</td>
<td>beside-at</td>
<td>self/he/she-NOM</td>
</tr>
</tbody>
</table>

시험을 잘 치렀다고 말한다.

sihem-ul cal chi-less-tako malha-n-ta

test-ACC well take-PST-COMP say-PRES-DC

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

The analysis of eye fixation data revealed that, regardless of the discourse prominence of referents, native speakers initially saw the images of subject referent more often than those of object referent as soon as they heard a pronoun or *caki*. This suggests that there is a default setting to choose the grammatical subject as antecedent, upon first hearing a pronominal item (including the reflexive). Furthermore, it has also been shown experimentally in the literature that, unlike

\[caki = \text{Chelswu} > \text{Yengui}\]

---

\[48\] Note that the pronominal items in (108) appear before verbs (which play a crucial role in determining *caki*’s interpretation; consider sentences in (ia) and (ib) below; the replacement of the verb (give vs. return) influences the interpretation of the reflexive.).

(i)

<table>
<thead>
<tr>
<th>a.</th>
<th>철수가 영희에게 자기의 가방을 주었다.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chelswu-ka</td>
<td>Yenghui-eykey</td>
</tr>
<tr>
<td>C.-NOM</td>
<td>Y.-DAT</td>
</tr>
</tbody>
</table>

‘Chelsw gave Yenghu self’s bag.’

<table>
<thead>
<tr>
<th>b.</th>
<th>철수가 영희에게 자기의 가방을 돌려주었다.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chelswu-ka</td>
<td>Yenghui-eykey</td>
</tr>
<tr>
<td>C.-NOM</td>
<td>Y.-DAT</td>
</tr>
</tbody>
</table>
typical personal pronouns in Korean (e.g., *ku* ‘he’, *kunye* ‘she’)
49, *caki*’s demand for the subject antecedent tends to remain strong (from beginning to end), even despite various experimental manipulations of factors such as word order, the verb’s semantic bias, or discourse prominence of potential antecedents (Han et al., 2011; also see Chapter 3 and 4).

These facts suggest (i) the *early sensitivity* of *caki* to the subjecthood of antecedent and (ii) the presence of a strong and stable internal motivation to sustain a computational strategy (i.e., co-reference with a grammatical subject) throughout the process of dependency formation. So, it seems reasonable and correct to claim that *caki per se* has an *internal* drive to co-refer with a subject antecedent, which can serve as a factor that initially guides the antecedent selection.50

Here, I propose that, as well as the external factors mentioned above (such as syntactic prominence and first-mention advantage), the subject preference can also be triggered internally by the reflexive. However, note that I do not argue that the bias originates lexically. One could say that the bias occurs possibly because *caki* has an inherent feature like [+SUBJECT], as well as

| ‘Chelsw returned Yenghu self’s bag.’ | [*caki* = #Chelswu, ✓Yengui] |

Therefore, eye movements triggered on hearing the reflexive do not result from the verb. Instead, they represent referent selection as a function of the reflexive itself.

49 Personal pronouns in Korean (e.g., *ku*, *kunye*) are also known to initially show the subject antecedent bias. However, various studies showed that the initial subject preference of personal pronouns can be easily modulated, unlike the reflexive *caki* (Han, Storoshenko, & Walshe, 2011; also see references therein). This suggests that personal pronouns are different in nature from the reflexive *caki* even though they both must construct a dependency with an antecedent for interpretation.

50 Here it should be noted that the fact that *caki* is subject-oriented does not mean that it co-refers only with the subject antecedent. Indeed, as shown in Chapter 2 and 3, it can also refer to a non-subject antecedent. Thus, *caki*’s subject-orientation should be taken to refer to *caki*’s sensitivity to the subjecthood. It is not a compulsion from the grammar but simply a (though, strong) propensity of the reflexive.
lexical (category and morpho-semantic) features such as \([\text{N(oun)}], [\text{3RD PERSON}], \text{and} [\text{+ANIMATE}]\), as illustrated in (109).

\[
\begin{bmatrix}
\text{N} \\
\text{3RD PERSON} \\
\text{+ANIMATE} \\
\text{+SUBJECT}
\end{bmatrix}
\]

But it is doubtful whether it is appropriate to enumerate the feature \([\text{+SUBJECT}]\) with other lexical features in the same feature inventory since \([\text{+SUBJECT}]\) differs from other features listed in (109) in its linguistic nature. That is, \([\text{+SUBJECT}]\) is a structural or syntactic feature that defines the grammatical function or role of a constituent and is more like a composite feature that can be decomposed into more elementary features (e.g., \(\text{N(oun)}\), \(\text{+NOMINATIVE}\), \(\text{+AGENT}\), etc.). On the other hand, other remaining features are non-syntactic and lexical in nature. In addition, they are primitive features (of a lexical item, but not of a syntactic position) in the sense that they cannot be further decomposed. Thus, it seems implausible to put them all together in the same lexical feature inventory.

Then, what would be the internal source of \(\text{caki}\)’s subject bias? As a response to this question, I argue that, from the psycholinguistic perspective, the preference may originate from the \textit{frequency-based prediction} generated at the moment of processing \(\text{caki}\). As already shown in the previous chapters, the referentially ambiguous \(\text{caki}\) strongly prefers the subject antecedent. From a slightly different perspective, this means that the antecedent of \(\text{caki}\) is \textit{frequently} a grammatical subject. Given that a number of previous studies reported an early effect of frequency on sentence parsing (Ferreira, Henderson, Anes, Weeks, Jr., & McFarlane, 1996;
Garnsey, Pearlmutter, Myers, & Lotocky, 1997; Reali & Christiansen, 2007; Trueswell, 1996), it seems reasonable to postulate that when *caki* is processed, the parser can access the frequency-of-occurrence information (i.e., contextual knowledge the parser has: *caki* refers to a subject NP in most instances), through which concomitantly creates a prediction about “a dependency relation between *caki* and an NP (or DP) in SpecTP”. The parser can employ this derived information in the process of forming an antecedent-reflexive dependency. Here note that *caki* does not predict a specific word. What it predicts is its *relationship* with a potential NP occupying the subject position, which is structurally identifiable in the realm of TP.

(110) Frequency-based prediction of *caki*

\[ caki \rightarrow \text{< NP in SpecTP>} \]

*Frequency-of-occurrence of relation between caki and subject*

I will continue the discussion in the next section where I will try to show how it is realized in the cue-based retrieval parsing system.

Thus far, I have attempted to explain why the referentially ambiguous *caki* preferentially forms a dependency with a grammatical subject. I proposed that *caki’s* subject bias can occur from various sources, as summarized in (111).

(111) Sources of *caki’s* subject antecedent preference
External factors:

(a) First-mention advantage

(b) Syntactic prominence of grammatical subject

* Factor strength: (b) > (a)

Internal factor:

(c) frequency-based prediction about caki-subject dependency relation

6.3 caki’s antecedent retrieval under the cue-based retrieval parsing

In the previous section, I proposed that caki’s subject bias can be attributed to the frequency-based prediction generated at the reflexive. Then, how is this frequency-based anticipation realized (psychologically) in the parsing system? The answer may vary, depending on which type of the parsing model is assumed. However, what is clear, at least, is that the parsing system must be equipped with tools for prediction and with a memory system that allows direct-access, content-addressable retrieval (DCR; cf. Experiment 8).

One promising candidate is cue-based retrieval parsing (Lewis & Vasishth, 2005; Lewis et al., 2006; McElree et al., 2003; Van Dyke & Lewis, 2003). Here I briefly explain how the model works and then I will illustrate the process by which caki (with the strong subject antecedent preference) forms a dependency with an antecedent under the cue-based retrieval parsing.

Cue-based retrieval (QR) parsing is a sentence processing model that actively integrates a memory retrieval mechanism (e.g., DCR) into an incremental, node-by-node, sentence processing system which employs both top-down and bottom-up parsing strategies (often called
the *left-corner parser*, cf. Abney & Johnson, 1991; Lewis & Vasishth, 2005). The QR parser runs in a serial/step-by-step manner, utilizing the grammatical knowledge (e.g., phrase structure rules or constraints). Crucially, this model allows rule/grammar-based *predictions* about likely upcoming constituent(s) based on the current lexical item and linguistic context in the fashion of a left-corner (LC) parser.

### 6.3.1 Cue-based retrieval parsing

#### 6.3.1.1 Left-corner parsing strategy

A core idea of the *LC parsing* is to integrate (predictive) top-down processing with bottom-up processing.\(^{51}\) It uses grammatical knowledge (e.g., phrase structure or rewrite rules) to predict what should come next, given what it has already found. The LC parsing proceeds as follows:

[STEP 1] Assume that there exists a (context-free) grammar $G$ with the following rewrite rules.

<table>
<thead>
<tr>
<th>$S$</th>
<th>$\rightarrow$</th>
<th>$NP$</th>
<th>$VP$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$NP$</td>
<td>$\rightarrow$</td>
<td>$(Det)$</td>
<td>$N$</td>
</tr>
<tr>
<td>$VP$</td>
<td>$\rightarrow$</td>
<td>$V$</td>
<td>$(NP)$</td>
</tr>
<tr>
<td>$Det$</td>
<td>$\rightarrow$</td>
<td>$a$, $the$</td>
<td></td>
</tr>
<tr>
<td>$N$</td>
<td>$\rightarrow$</td>
<td>$boy$</td>
<td></td>
</tr>
<tr>
<td>$V$</td>
<td>$\rightarrow$</td>
<td>$ran$</td>
<td></td>
</tr>
</tbody>
</table>

[STEP 2] In the (left-to-right) input string of a sentence *‘a boy ran’*, the parser would first identify the word *a*. By the rule $[Det \rightarrow a$, $the]$ in $G$, *a* is expanded to $Det$.

---

\(^{51}\) Here, the *left corner* is simply a term to refer to the first symbol on the right-hand side of a rewrite rule. For example, in a rewrite rule *‘$S \rightarrow NP$ $VP$’*, NP is called “the left corner” of the rule. Likewise, in a (lexical) rule like *‘$N \rightarrow boy$’*, *boy* can be said to be the left corner of the rule.
[STEP 3] Then, the LC parser looks for any rewrite rule in $G$ which contains $Det$ at its left corner.

$\Rightarrow [NP \rightarrow Det \ N]$. From this rule, the parser further builds a parse-tree.

The rule $[NP \rightarrow Det \ N]$ makes the parser predict that a category $N$ will follow $Det$. This prediction will be confirmed or disconfirmed by the subsequent input (i.e., bottom-up filtering). Here note that STEP 3 still proceeds. As a result of the bottom-up application of the rule $[NP \rightarrow Det \ N]$, the parse-tree has a new phrase marker $NP$ at the top. Thus, the parser searches $G$ again to check whether there is any other rule that contains, at this time, $NP$ at its left corner. Indeed, there is one: $[S \rightarrow NP \ VP]$.

[STEP 4] The LC parser further builds a parse-tree, based on the rule $[S \rightarrow NP \ VP]$. Because no further applications of the rule are possible (i.e., there are no rules of which $S$ is a left corner), the LC parser stops the tree building and waits for the next input.
[STEP 5] The new input \textit{boy} is identified. By the rule \([N \rightarrow \text{boy}]\), the input \textit{boy} is expanded to \text{N}.

Because the parser has already \textit{predicted} the presence of \text{N} (in STEP 3), it combines \text{N} with the parse-tree. The parser awaits the next input after this process (no rules to apply).

[STEP 6] The new input \textit{ran} is identified. By the rule \([V \rightarrow \text{ran}]\), the input \textit{ran} is expanded to \text{V}.

Because there is another rule that contains \text{V} at its left corner: \([VP \rightarrow \text{V}]\), the structure is further expanded.
Because the parser has already predicted the presence of VP (in STEP 4), it integrates the VP (and its descendants) into the existing parse-tree.

6.3.1.2 Role of memory retrieval in the parsing system

Let us return to the discussion of the QR parsing model. In this model, the concept of memory retrieval plays a central role. The model assumes that, whenever a new input (e.g., word) is introduced to an already-existing structure or representation, memory retrieval inevitably occurs due to the limited focus of attention (Cowan, 2010; McElree, 2006; also see Chapter 1), as illustrated in Figure 6.1. A new input in the focus of attention (FOA: size of one or two words) triggers memory retrieval of representation(s) of a previous item or structure (which resides outside the FOA).
Here, the retrieval is accomplished by associative, content-based access (i.e., via DCR): the target memory item is directly accessed and retrieved by the retrieval cues (which are a subset of the features of the target item). The basic operating principle of QR parsing is that, due to the very limited FOA, each brand-new input sets off retrievals (using DCR) to merge the input with the preceding representation or structure stored in the memory, as illustrated in Figure 6.2.
Figure 6.2 Schematic representation of the time course of memory retrieval

(This figure was made for demonstration purposes. As will be discussed below, each input is represented in the memory as feature bundles in the QR parsing.)

Here note that each input is encoded in memory as feature bundles (or chunks), as exemplified in Figure 6.3.

Figure 6.3 Lexical input as feature bundles or chunks
Importantly, certain input \textit{anticipatorily} generates an additional feature bundle (in the manner of LC parsing), based on the grammar. For example, when the first word (e.g., determiner \textit{a}) of the sentence \textit{a boy ran} is processed by the QR parser, the input \textit{a} creates a memory encoding of DP where D(eterminer) is a head of. At this moment, additional feature bundles are predicted for as-yet undetected categories: \textit{underspecified} memory representations of (i) an NP that is a complement of DP, (ii) a TP that DP is a subject of, and (iii) a VP that is a complement of the predicted TP (cf. Figure 6.4).

\textbf{Figure 6.4 Memory representations triggered by the determiner \textit{a}}

These predicted feature chunks are stored in memory until they are retrieved for further parsing. To illustrate, in the sentence \textit{a boy ran}, the verb \textit{ran} retrieves its subject representation stored in the memory. This retrieval is triggered by the retrieval cues from the verb (and relevant linguistic context and grammatical constraints), using DCR, as shown in Figure 6.5.
Figure 6.5 Retrieval of a predicted VP at the verb *ran*
(Retrieval cues are a subset of the features of the retrieval target.)

Finally, because items in memory are retrieved by matching a set of features (or cues) between retrieval target and trigger in this parsing model, *similarity-based interference* effects can occur, especially when the memory contains multiple items that are partially or fully matched in features with the retrieval trigger (Gordon, Hendrick, & Johnson, 2001; Lewis et al., 2006; Van Dyke & Johns, 2012; Van Dyke & McElree, 2011).

6.3.2 *caki*’s reference resolution under the QR parsing

Under QR parsing, each input and its parsing output are stored in memory as feature bundles.
As shown in Figure 6.6, *caki* generates two distinct types of feature chunks: (i) a lexical feature bundle on the reflexive and (ii) a derived feature bundle on TP whose subject (in Spec) is an NP. As proposed in §6.2, the derived feature bundle is created by the frequency-based anticipation (i.e., because *caki*’s antecedent is frequently a grammatical subject (NP in SpecTP), it is highly likely that the same reflexive being parsed now will behave in the same manner). Here note that the derived feature bundle defines the subject in terms of its structural position. Although subjecthood can be defined by other non-syntactic features such as [+NOMINATIVE], [+AGENT], and/or [+TOPIC] (cf. Experiment 4 in Chapter 3), these are not reliable in that the subject NP can appear with non-nominative and non-agent/topic features in Korean. The most reliable feature with respect to the grammatical subject is its structural position (SpecTP). Using such a structural feature would make the parsing more accurate and efficient.

Now let us turn our attention to how *caki* retrieves its antecedent from memory. Suppose that the QR parser processes the sentence in (112) below.
As illustrated in Figure 6.7, the QR parser would initially construct a (partially-represented) parse-tree of $TP$ as soon as the first NP ($Chelswu-ka$) is encountered. In this step, the parser assumes that “the NP Chelswu is a constituent NP that comprises a sentence $TP$ as a subject. Hence, a VP will follow”. This (underspecified) structure is encoded and stored in the memory as feature bundles. The structure building stops until the next input is encountered.

In the second round (Figure 6.8), $caki$, as an NP, is attached to the predicted VP. Since $caki$ is accusative-marked, the parser would expect that the verb in $VP_1$ is transitive.
Here, because *caki* must form a dependency with an antecedent for interpretation, the QR parser accesses and searches the memory using retrieval cues generated at the reflexive. The retrieval is accomplished via the DCR mechanism. Crucially, the parser also anticipatorily generates a feature bundle on TP, which also serves as the retrieval cue (cf. Figure 6.9).

**Figure 6.9 caki’s antecedent retrieval**
The predicted TP created at the reflexive is interpreted by the parser as follows: “caki is the complement of VP. This VP is contained in TP whose subject is NP. In this context, caki refers to the NP”. The graphical representation of this (computational) interpretation is provided in Figure 6.10.

Figure 6.10 Graphical representation of the predicted TP at the reflexive

In (112), the subject NP Chelswu is considered by the parser to be the best candidate antecedent for caki because this NP is located in the specifier of TP whose hierarchical structure is exactly matched with that of the predicted TP.

caki in the referentially ambiguous context:

If caki appears in a referentially ambiguous context like (113), the parsing mechanism discussed thus far easily predicts the presence of interference effect (i.e., hallmark phenomenon of DCR). Furthermore, the parser would preferentially consider the subject NP1 in (113) to be the antecedent of the reflexive because the predicted TP (generated at the reflexive) matches in structural details the TP where the reflexive co-refers with NP1 (in SpecTP). The non-subject NP2 in (113) is not supported by this predicted TP even though it fully matches the reflexive in
lexical features. Therefore, it is less preferred by the parser as the antecedent for \textit{caki} (cf. Figure 6.11).

(113) \[
\begin{array}{llllll}
\text{NP1-NOM} & \text{NP2-DAT} & \text{caki-GEN} & \text{NP3-ACC} & V
\end{array}
\]

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure6_11.png}
\caption{\textit{caki}’s antecedent retrieval in the referentially ambiguous context}
\end{figure}

6.4 Conclusion

In this dissertation, I explored how the Korean reflexive \textit{caki} is comprehended in the referentially ambiguous context. A series of empirical experiments revealed that \textit{caki} has a very strong referential preference, namely, the subject antecedent bias. However, it was also found that this bias can be weakened by non-syntactic factors (such as person, discourse status of potential antecedent, etc.). Consequently, for the successful interpretation of \textit{caki}, various distinct sources of (non)linguistic information should be consulted.
Furthermore, this dissertation provides empirical evidence that *caki*’s antecedent search and retrieval are governed by the direct-access, content-addressable memory retrieval mechanism. Although further research needs to be conducted using more powerful experimental tools with higher resolution, such as eye-tracking or ERP (given recent criticisms of the self-paced reading experimental paradigm), I believe, the cross-linguistic data reported in the present dissertation contribute to the growing literature on memory and sentence comprehension.

Finally, I showed that the cue-based retrieval parsing model can nicely explain how *caki* is processed in real time. Although the cognitive, computational, model on *caki*’s comprehension that I proposed in the present dissertation includes some speculative suggestions that must be empirically supported for validity, I believe that this deserves serious consideration as an advanced view (with high theoretical and empirical expandability) to the phenomenon.
7 References


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