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# Caki-Binding in Optimality Theory[1]

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## 1. Introduction

In this study, I explore the reflexive anaphor *caki* in Korean which is not lexicalized with respect to binding domain and thus show both short-distance and long-distance binding with no additional morpheme. I attempt to demonstrate that Optimality Theory can account for the complicated binding phenomena of the long-distance anaphor *caki*.

There have been a large number of divergent proposals to achieve explanatory goal in the field of anaphoric binding. Some linguists such as Chomsky (1981, 1986, 1992, 1994) have consistently argued that the distribution and antecedency conditions of reflexives, reciprocals and pronominals are almost invariant across languages with some parametric variations. Under his theory, long-distance behavior of reflexives has been cross-linguistically handled with either one of three mechanisms; parameterized binding domain, cyclic head-movement in LF, or relativized SUBJECT. Linguists such as Darymple (1993) and Iida (1992) among many others have argued that these properties belong to the lexical properties of pronominal elements in particular languages. Darymple thus argues that reflexive anaphors in natural languages allow a total of thirty-four logically possible combinations of negative and positive constraints, leaving a possibility that other universally available requirements can reduce the total number. On the other hand, linguists like Yan Huang (1994) argues that pragmatic approach is required to determine anaphoric binding relation, questioning the basis of the structural approaches. He claims that a pragmatic theory of anaphora within the neo-Gricean framework is more efficient way to account for anaphoric binding in languages like Chinese, Japanese and Korean in which pragmatics seems to play a central role that is alleged to be played by grammar in familiar European languages.

Through the history of research on anaphoric binding, almost all linguists have agreed with the fact that anaphoric binding is closely related with extragrammatical factors. However, it is important to note that despite of interelation with multiple factors, one can still find a structural characteristics that governs anaphoric binding.

In the case of languages like English which has only one reflexive, it might seem adquate to characterize its anaphoric pattern as a comparatively simple property of

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structural condition. However, in languages like Korean among others which allow two or more reflexives in their lexical inventory, the distributional pattern of their reflexives are not easily handled within purely syntactic mechanism which heavily relies on the structural conditions. Consequently it might seem adquate to attribute a part of their diversities to the lexical information of each reflexive element. It is often argued that some reflexive anaphors are more lexically specified with regard to its binding domain, whereas others are less or not at all. For example, English *himself*-type reflexive is specified with regard to its binding domain, but Korean *caki*-type reflexive is not or partially specified with regard to its binding domain, thus making the choice of correct antecedent ambiguous.

Anaphor seems at first to be a very simple and straightforward, rooted in the avoidance of redundancy or repetition by the use of a semantically null or dependent expression in place of a full and relatively independent, lexical expression. By virtue of its pairing with an antecedent, an anaphor repeats its reference. By definition, an anaphor without an antecedent can have no intrinsic referential or semantic properties of its own. The essential work of establishing cross-linguistic universals of anaphoric binding is to determine the universally applicable set of possible binding constraints to which every anaphors are subject. In this study I speculate Korean reflexive anaphor *caki* in connection with some particular constructions to uncover the constraints which are universally applicable to similar type of reflexives across languages.

Yang (1983), under the markedness theory, classifies reflexives in the world into two types; unmarked reflexive and marked one. He asserts that the reflexives across languages that obey the structural principles are classified as unmarked reflexives and the ones that does not obey the structural principles are classified as marked reflexives. In a similar vein, Y-S Kim (1992) claims that the Korean reflexive *caki* should be classified as free anaphor and that the free anaphors, as the word 'free' indicates' do not have c-commanding relation with their antecedents. Thus he formulates a constraint for free anaphor, rougly stating that it must be bound in a sentence where it occurs. However, these claims have encountered many occurrences of anaphoric binding which show that the antecedents of anaphors are not free, but they are determined optimally among possible antecedent candidates. Besides, patterns of anaphoric binding in languages reveal that constraints on anaphoric binding are associated with all grammatical representations such as syntactic, semantic, discourse and the pragmatics.

It is well known that Korean *caki* allows multiple antecedent as the indices indicate in (1):

(1) John$_i$-i [Bill$_j$-i caki$_{i/j}$-lul piphanhayssta-ko] sayngkakhayssta.
John-nom Bill-nom self-acc criticize-comp thought
'John$_i$ thought that Bill$_j$ criticized self$_{i/j}$.'

Both *John* and *Bill* can be *caki*'s antecedents differently from English type reflexive which usually is bound within the embedded clause. If it is correct that there are consistently more than one potential antecedent for a *caki*-type reflexive in a sentence,

the question arises as to which to choose. The choice between them may be of syntactic nature if among two potential antecedents α and β, only α is consistently selected as the actual antecedent for *caki*, irrespective of lexical and contextual variation. Otherwise the choice is of non-syntactic nature (that is, semantic, discourse or pragmatic nature). It is clearly not syntactic matter if among two potential antecedents α and β, α is more likely to be selected as the actual antecedent than β, other things being equal. Consider an English example (2) which corresponds to (1):

(2) John says Bill likes himself.

English speakers will consistently choose the immediate subject, *Bill* in this particular case, as the binder for *himself*, regardless of lexical and contextual meaning. Hence a structural principle (Binding Principle A) relying on c-command condition is proposed to explain the fact. However, in the exactly identical environment, Korean reflexive may be able to choose not only *Bill* but also *John* with no additional morphological information. Consider another English example (3) which shows quantificational scope ambiguity:

(3) Five students read ten books.

It is well known that the subject is more likely to take wide scope than the object. Whether the latter can be interpreted as having scope over the former largely depends on the context. Generative grammarians generally assume that either of them can be selected as the wide scope quantifier, treating the asymmetric tendency as extragrammatical.

In the past two decades, linguistists involved in Korean reflexive anaphor *caki* have called attention to a number of interesting constraints with respect to the choice of antecedents, including subject-orientedness, thematic hierarchy, precedence relation, and c-command relation. If these constraints are consistently relevant to the choice of *caki*'s antecedent, it naturally suggests that *caki*'s antecedent may be optimally determined by all of these relevant constraints.

## 2. Constraints on LDA

In this section I examine a series of constraints which affect LDA-binding by thier mutual interaction with each other. I first propose the Thematic Hierarchy Constraint, which will explain how the thematic roles interplay in LDA-binding. I argue that the antecedent with an agent role always takes priority over ones with experiencer or other roles. Second, I propose the Large Domain Preference Constraint, which states that an antecedent in a larger domain takes priority over one in a smaller domain. Third, I propose the Subject-Orientedness Constraint, which states that LDA must be bound by a subject antecedent. I show that an antecedent in the subject position takes strong priority over those in other positions in LDA-binding. Fourth, I propose the C-Command

Constraint, which states that LDA must be c-commanded by an antecedent NP. I argue that c-command condition is not a sufficient, but necessary condition to account for LDA-binding facts. I finally propose the Discourse Binding Constraint, which states that LDA must be bound by a prominent discourse NP if there is no sentential antecedent available.

Notice that each of the constraints I propose does not exhaustively explain all of LDA-binding because the constraints are interaction in account for all aspects of LDA-binding facts. In fact they compete with each other to choose in the choice of *caki*'s antecedent.

### 2.1. The Thematic Hierarchy Constraint (THC)

It is well known that not only hierarchical relation between elements of phrases and sentences, but also the semantic relation between elements, plays an important role in the grammar. Consider the example (4):

(4) a. John loves Mary.
b. Mary was loved by John.

In (4a), the subject is *John*, while in (4b) it is the *Mary*. In (4a), *Mary* is the object, while there does not seem to be an object in (4b). However, both sentences describe the same event. In both sentences, *John* plays the role of *agent*, or doer of the action, and *Mary* plays the role of *patient*, or undergoer of the action. The roles of agent and patient, among others, are *thematic relations* that NP can have.

Thematic relations were first described in the generative framework by Gruber (1965). Jackendoff (1972) is an expansion and development of Gruber's pioneering work, and since then he tried to refine some of his major arguments, but for years his original work has remained the standard approach to thematic relations between linguistic elements. Recently, research in this area has been extremely productive, and many new insights have been gained in Grimshaw (1990) and Williams (1989), among other work. I will simply assume the lists of the thematic relations sketched in Jackendoff and Grimshaw.

Now let us consider how thematic roles apply to LDA binding. First of all, following Giorgi (1984), Benedicto (1991), Jackendoff (1990), Grimshaw (1990), Kim (1991) and Momoi (1985), I will propose the thematic hierarchy given in (5):

(5) Thematic Hierarchy
Agent
Experiencer
Goal, Theme, Patient, Source
Locative

I argue that LDA binding is subject to the Thematic Hierarchy Constraint stated in (4):

(6) Thematic Hierarchy Constraint (THC):
LDA must be bound by the thematically higher NP than itself according to the thematic
hierarchy.

THC (6) states that the NP which is higher in the thematic hierarchy is qualified to be LDA's antecedent. When there is only one possible antecedent, it must be thematically higher than LDA. If a possible antecedent NP is thematically lower than, or equal to LDA, it violates THC. If there are more than two possible antecedents in a sentence which are thematically higher than LDA, they are all qualified to be LDA's antecedent. When LDA is included in an NP, I will assume that it bears the thematic role of the NP that includes itself. THC applies even though the thematic roles are assigned by different predicates. Thus in a complex sentence, the Agent role assigned to an NP by one predicate should be considered higher than the Experiencer role assigned to another NP by other predicate.

Let us see how THC applies to *caki* binding. Sentence (7) has traditionally been viewed ungrammatical due to the violation of c-command condition. This unacceptable *caki*-binding can be explained by the violation of THC since the thematic relation between *caki* and its antecedent *John* violates the constraint:

(7) *Caki$_i$-ka John$_i$-ul pipanhayssta.
| |
Agent Theme
self-nom John-acc criticized
'He$_i$ criticized John$_i$.'

THC predicts straightforwardly that (7) is unacceptable since *caki* taking an agent role cannot be bound by *John* taking a theme role.

In sentence (8) *John* is thematically higher than *caki* (theme), and *Tom* is thematically equal to *caki*, violating THC. This disqualifies *Tom* as an antecedent:

(8) John$_i$$^1$-i Tom$_j$$^2$-ekey caki$_{i/j}$-eytayhay malhayssta.
| | |
Agent >Goal = Theme
John-nom Tom-dat self-about told
'John$_i$ told Tom$_j$ about himself$_{i/j}$.'

This is confirmed by a similar example (9), where *Tom* is not an available antecedent for *caki*, since *Tom* is thematically equal to *caki*:

(9) John$_i$-i Tom$_j$-eytayhay caki$_{i/*j}$-eykey malhayssta.
| | |
Agent >Theme = Goal (violation of THC)
John-nom Tom-about self-dat told
'John$_i$ told himself$_{i/*j}$ about Tom$_j$.'

Notice that only *John* is thematically higher than *caki*, thus being an exclusive antecedent. In addition, THC correctly predicts that the following sentence (10) is unacceptable, since there is no possible antecedent for *caki* that is thematically higher than itself:

(10) *Caki$_{*i/*j}$-ka John$_i$-eykey Tom$_j$-eytayhay malhayssta.
| | |
Agent > Goal Theme
self-nom John-dat Tom-about told
'Himself$_{*i/*j}$ told John$_i$ about Tom$_j$.'

Let us turn our attention to the psych-constructions whose special syntactic behavior has been reported in a number of languages by Postal (1971), Giorgi (1984), Pesetsky (1987b), Belletti (1984) and Rizzi (1988). In the Korean psych-verb construction, an experiencer NP may bind *caki*, as seen in (11)-(13), even though it is not in a c-commanding position:

(11) [**Caki$_i$**-ka tayhakipsi-eyse tteleciessta-nun] sosik-i **John$_i$**-ul silmangsikyessta.
self-non college entrance exam-in failed-comp news-non John-acc disappointed
'The news that he$_i$ failed in the college entrance exam disappointed John$_i$.'

(12) [Bill$_j$-i **caki$_i$**-lul miwehanta-nun] sasil-i **John$_i$**-ul kwelophyessta.
Bill-nom self-acc hate-comp fact-nom John-acc bother
'The fact that Bill hates him$_i$ bothers John$_i$.'

In each sentence, *caki* in the embedded clauses is bound by the accusative NP *John* which does not c-command it.

The c-command violation between *caki* and its antecedent can be nicely accounted for with THC. (13) shows that even though *John* is in a lower position structurally than *caki*, it can be *caki*'s antecedent, since it is thematically higher according to THC:

(13) [Bill$_i$[2]-i caki$_{i/j}$-lul piphanhayssta-nun] sosik-i John$_j$[1]-ul silmangsikiessta.
| | |
Agent > Theme < Experiencer
Bill-nom self-acc criticized-comp news-nom John-acc disappointed
'The news that Bill$_i$ criticized him/himself$_j$ disappointed John$_{i/j}$.'

Notice that in (13) both *Bill* (agent) and *John* (experiencer) are thematically higher than *caki* (theme), in accordance with THC. The fact that *John* takes a preferred antecedent among two possible antecedents will be attributed to other constraints (Large Domain Preference Constraint) which I will discuss in the next section. Thus, THC suffices to explain that *caki* has two potential antecedents in the whole sentence. Recall that the thematic relations assigned by different predicates do not matter in this psych constructions, since LDA-binding pays no attention to which verb is assigning the thematic role.[2]

THC seems to be counterexemplfied by the active-passive pairs in (14a,b). The active sentence (14a) obeys THC and thus *John* is a perfectly acceptable antecedent of *caki*, but passive sentence (14b) does not and thus *John* cannot be an acceptable antecedent, even though both sentences share the same thematic hierarchy:

(14) a. John$_i$-i caki$_i$-lul pipanhayssta.
| |
Agent > Theme
John-nom self-acc criticized
'John$_i$ criticized self$_i$.'

b.*Caki$_i$-ka John$_i$-eyuyhay pipan-tanghay-ss-ta.
| |
Theme < Agent (satisfies THC)
self-nom John-by was criticized
'Himself$_i$ was criticized by John$_i$.'

What is wrong with this sentence in terms of THC? I will argue below that this case should be explained by the c-command condition. Consider another example (15) to see how THC explains LDA-binding in active and passive sentences:

(15) a. John$_i$-i Bill$_j$-ul [caki$_{i/*j}$-uy cip-eyse] poassta.
| | |
Exp > Theme > Loc
John-nom Bill-acc self-of house-in saw
'John$_i$ saw Bill$_j$ in his$_{i/*j}$ house.'

[2] A similar view can be found in Grimshaw (1990), where it is argued that thematic transfer occurs in complex sentences from embedded sentences to matrix sentences to form one huge theta grid. Thus thematic hierarchy uniformly (dynamically) applies to either simple sentences and complex sentence. I leave the details open for further investigation.

b. Bill$_i$-i John$_j$-eyuyhay [caki$_{i/j}$-uy cip-eyse] poieciessta.
| | |
Theme < Exp > Loc
Bill-nom John-by self-of house-in was seen.
'Bill$_i$ was seen by John$_j$ in his$_{i/j}$ house.'

Note that *John* plays the Experiencer role and *Bill* the Theme role in (16a) and the same thematic hierarchy holds for the passive counterpart in (15b). Both *John* and *Bill* in passive sentence (15b) are acceptable as *caki*'s antecedents, unlike its active counterpart (15a). Why does the impossible antecedent *Bill* become a possible antecedent by passivizing? The answer seems to lie in the subject-orientedness constraint, which roughly states that if *Bill* occupies subject position, it automatically becomes a possible LDA antecedent due to the strong subject-orientedness of LDA. I will return to this issue shortly.

## 2.2. The Larger Domain Preference Constraint (LPC)

*Caki* generally prefers to seek its antecedent in the larger of two domains. Thus in the examples in (16)-(19), the antecedents in the larger domain will always be chosen as a best choice of antecedent for *caki*:

(16) a. [$_{NP2}$ [$_{NP1}$ John]$_i^2$-uy chinkwu]$_j^1$-ka caki$_{i/j}$-uy emmeni-lul salangha-n-ta
John-of friend-nom self-of mother-acc love-prs-dec
'John$_i^2$'s friend$_j^1$ loves his$_{i/j}$ mother.'

b. [$_{NP3}$ [$_{NP2}$ [$_{NP1}$ John]$_i^2$-uy chinkwu]$_j^1$-uy siche]$_k$-ka caki$_{i/j/*k}$-uy kohyang-e mwuthiessta.
John-of friend-of corpse-nom self-of hometown-at bury-caus-pst-dec
'John$_i^2$'s friend$_j^1$'s corpse$_k$ was buried in his$_{i/j/*k}$ hometown.'

(17) [$_{S2}$ John$_i^1$-un [$_{S1}$ Bill$_j^2$-i caki$_{i/j}$-lul miwehanta-ko] mitnunta.]
John-top Bill-nom self-acc hate-comp believe
'John$_i^1$ believes that Bill$_j^2$ hates him$_{i/j}$.'

(18) [$_{S2}$ [$_{S1}$ Bill$_i^2$-i caki$_{i/j}$-lul piphanhayssta-nun] sosik-i John$_j^1$-ul silmangsikiessta]
Bill-nom self-acc criticized-comp news-nom John-acc disappointed
'The news that Bill$_i^2$ criticized him/himself$_{i/j}$ disappointed John$_j^1$.'

(19) [$_{S2}$ [$_{S1}$ Bill$_i^2$-i **caki$_{i/j}$**-lul piphanhayss-ul ttay] **John$_j^1$**-i khun silmang-ul nukkiessta.]
Bill-nom self-acc criticize-comp time John-nom big disappointment felt
'When Bill$_i^2$ criticized him/himself$_{i/j}$, John$_j^1$ felt a big disappointment.'

As the antecedent preference superscript numbers show in examples (16)-(19), NPs in the larger categorial domain win over NPs in the smaller categorial domain in all examples. Notice that in (16a), *caki* takes NP2 as its best choice of antecedent since it is in a larger domain than NP1. In (16b), *caki*'s antecedent preference goes to NP2 only because it is in a larger domain than NP1. From these examples I obtain the following generalization (20), assuming that the domains represent S(entence) or NP:

(20) Binding preference of LDA
$[_{\text{Domain3}}\ \alpha_i^{1}\ [_{\text{Domain2}}\ \alpha_j^{2}\ [_{\text{Domain1}} \ldots \alpha_k^{3} \ldots \mathit{LDA}_{i/j/k} \ldots ]\ ]\ ]$
where α = LDA's antecedent and braket refers to S, or NP.

The generalization in (20) states that given multiple domains, LDA's antecedent $\alpha_i$ is the best choice, $\alpha_j$ is the next best choice, $\alpha_k$ is the next choice, and so on. Based upon this generalization I propose the Higher Domain Preference Constraint (21) with respect to this property of LDA.

(21) Larger Domain Preference Constraint. (LPC)
Given potential antecedents for LDA in different domains, the more distant the domain, the stronger the binding preference.

This LPC plays a crucial role in determining the best choice of antecedent when two antecedents with identical thematic roles compete with each other to be LDA's antecedent. Consider example (22), where two agents *John* and *Bill* are competing:

(22) $[_{S2}$ John$_i^{1}$-un $[_{S1}$ Bill$_j^{2}$-i caki$_{i/j}$-lul ttayliessta-ko] malhayssta.]
Agent Agent
John-top Bill-nom self-acc hit-comp said
'John$_i^{1}$ said that Bill$_j^{2}$ hit him/himself$_{i/j}$.'

*Bill* fails to be the best choice for *caki*'s antecedent simply because it is in a smaller domain S1 than *John* in S2. I will assume that LPC is universal constraint in the languages which allow LDAs.[3]

[3] Although the same LPC effect has been confirmed by Japanese native speakers through personal communication, the LPC effect is not obvious in Chinese. Y. Huang (1994) proposes in his pragmatic approach to Chinese *ziji* that Chinese LDA's antecedents should be checked from a local domain to the larger one. This view conflicts with LPC. However, it is not clear whether Y. Huang's concern was to account for the preference relation between different choices of antecedents. It seems rather to me that his concern is simply to find any antecedent in a given domain. I leave Chinese open for further investigation.

### 2.3. The Subject-Orientedness Constraint (SOC)

Subject orientedness, as relevant to binding, has been discussed by Chomsky (1986) for English, Shibatani (1976) and Kuno (1978) for Japanese, and Kim (1991) and Moon (1995) for Korean. Chomsky (1986:174) points out a subject-object asymmetry for anaphors; when they are bound to a long-distance antecedent, they must be subject-oriented, unlike anaphors in simple sentences, as illustrated in (23):

(23) a. They$_i$ told us$_j$ about each other$_{i/j}$.
b. They$_i$ told us$_j$ that pictures of each other$_{i/*j}$ would be on sale.

In (23a) *each other* may be bound to either of *they* and *us*, thus showing no subject-object asymmetry. But in (23b) it must be bound to *they*, not *us*, showing a subject-object asymmetry. In other words, English anaphors, when bound to a long-distance antecedent, must be subject-oriented.[4] In a similar vein, *caki* is also generally subject-bound, though it is not a requirement, as illustrated in (24) and (25):

(24) John$_i$-i Bill$_j$-ul caki$_{i/*j}$-uy pang-eyse poassta
John-nom Bill-acc self-of room-loc saw
'John$_i$ saw Bill$_j$ in self$_{i/*j}$'s room.'

(25) John$_i^1$-i Bill$_j^2$-ul caki$_{i/j}$-uy pang-ey katwuessta
John-nom Bill-acc self-of room-loc locked
'John$_i^1$ locked Bill$_j^2$ in self$_{i/j}$'s room.'

In (24) only *John* can be *caki*'s antecedent. But in (25) *caki* can be bound not only to the subject NP *John*, but also to the object NP *Bill*, though subject-binding is strongly preferred.[5]

Subject-orientedness also occurs in the passive construction. Consider the contrast in example (26) and its passive counterpart (27):

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[4] From a slightly different perspective, the subject-orientedness may also be compatible with the claims of Burzio (1991). He argues that a featureless, personless reflexive obtains its features through agreement, which is realized in a SPEC-head relation. In a finite or infinitival sentence, the only element that is a head and carries overt or nonovert phi-features is INFL (which is coindexed with its SPEC, the subject). In order to satisfy the agreement requirement, therefore, the reflexive must adjoin to INFL. As a consequence, a personless reflexive is always subject-oriented.

[5] The less strict subject-orientedness of example (25) seems to be attributable, to a certain degree, to the thematic hierarchy discussed in Jackendoff (1989) or to the argument prominency hierarchy of Grimshaw (1990). Notice that the thematic grids of the verbs *po* 'see' in (24) and *katwu* 'lock' in (25) are somewhat different. In the former case an experiencer (subject) and a theme (object) is required, whereas in the latter case not only agent and a theme, but also a locative NP is required. It is important to note that in (24), since *John* is an experiencer, not an agent, *John*'s seeing does not affect *Bill* physically. However, in (25) the agent *John* affects a theme *Bill*. This seems to make difference in allowing an object to be *caki*'s antecedent. We will return this issue in detail later.

(26) John$_i$-i Bill$_j$-ul caki$_{i/*j}$-uy pang-eyse poassta.
John-nom Bill-acc self-of room in saw
'John$_i$ saw Bill$_j$ in self$_{i/*j}$'s room.'

(27) Bill$_i$-i John$_j$-eyuyhay caki$_{i/j}$-uy pang-eyse po-ieci-essta.
Bill-nom John-by self-of room-in was seen
'Bill$_i$ was seen by John$_j$ in self$_{i/j}$'s room.'

In the active sentence (26), the object *Bill* cannot be *caki*'s antecedent, whereas in passive sentence (27) it can be. Binding in passives strongly suggests that subject-orientedness is crucially relevant to *caki*-binding.

Let us now turn our attention to the subjected-orientedness observed in a complex sentence like (28), where there are three possible binding NPs:

(28) John$_i^1$-i Bill$_j^3$-eykey [Tom$_k^2$-i caki$_{i/j/k}$-lul miwehanta-ko] malhayssta.
John-nom Bill-dat Tom-nom self-acc hate-comp said
'John$_i^1$ said to Bill$_j^3$ that Tom$_k^2$ hates self$_{i/j/k}$.'

Notice that the higher subject NP *John* is chosen as the best choice of antecedent and the lower subject *Tom* is the second choice. And the dative NP *Bill* is the final choice simply because it is not a subject. From these observation I propose the Subject-Orientedness Constraint (29):

(29) Subject-Orientedness Condition (SOC):
LDA must be bound by a subject NP.

This SOC straightforwardly explain why the subject antecedents are picked up as the best choice of antecedents in the examples (24)-(28).

However, there are some cases which SOC cannot predict. For example, example (33) in the psych verb construction shows that not only subject but also object NP can be LDA's best choice of antecedents:

(30) [Bill$_i^2$-i caki$_{i/j}$-lul piphanha-n] sasil-i John$_j^1$-ul naktamsikiessta.
Bill-nom self-acc criticized-comp fact-nom John-acc depressed
'The fact that Bill$_i$ criticized him/himself$_{i/j}$ depressed John$_j$.'

Notice also that the subject *Bill* is not chosen as the best choice of antecedent, which is against the prediction of SOC. We will return shortly to the issue of how this conflict can be explained in OT approach.

## 2.4. The C-Command Constraint (CCC)

In this section, I will argue that LDA binding is subject to a C-Command Condition, just like other pronominals. The c-command concept was first introduced by Reinhart (1976) to state conditions for coreference possibilities. C-command has been used as a basic notion in structural approaches to some linguistic phenomenon. In the current literature, the notion of c-command is defined as either (31) or (32):

(31) C-Command:
α c-commands β iff α does not dominate β and every branching node dominating α dominates β.

(32) M-Command:
α c-commands β iff α does not dominate β and every maximal projection dominating
α dominates β.

The first definition is known as the 'strong' definition of c-command, and the second one is the 'weak' version, often referred to as m-command.

Now let us turn our attention to *caki*-binding and see how the c-command condition works. In general, *caki* is bound by a c-commanding NP, as illustrated in (33):

(33) a. John$_i$-i caki$_i$-uy nonmwun-ul piphanhanta.
John-nom self-of article-acc criticize
'John$_i$ criticizes self$_i$'s article.'

b.*Caki$_i$-ka John$_i$-uy nonmwun-ul piphanhanta.
self-nom John-of article-acc criticize
'Self$_i$ criticizes self$_i$'s article.'

Example (33a) is good because *caki* is bound to its c-commanding antecedent, whereas example (33b) is bad because the c-command relation between *caki* and its antecedent is reversed. This clear contrast shows that c-command is relevant to *caki*-binding. The c-command condition is also observed between *caki* and its antecedent in the relative construction illustrated in (34):

(34) a. John$_i$-i caki$_i$-lul miwehanta
John-nom self-acc hate
'John$_i$ hates self$_i$.'

b.*[John$_i$-i $t_i$ miweha-n] caki$_i$
John-nom *t* hate-comp self
'Self whom John hated'

As expected, *caki* in (34b) is impossible since it occurs in head noun position, which is not c-commanded by its antecedent *John*. Thus it seems to be generally true that *caki* in most simplex sentences is bound to its c-commanding antecedent. From these observation I propose the C-Command Constraint (35) for LDA-binding:

(35) C-Command Condition on LDA (CCC):
LDA must be c-commanded by an antecedent NP.

CCC accounts for why *caki*-binding is impossible in sentence (36), where *caki* is not c-commanded by the antecedent *John*:

(36) *Caki$_i$-ka John$_i$-ul miwehanta.
self-nom John-acc hate
'Self$_i$ hates John$_i$.'

Moreover CCC explains why *caki*-binding by both the subject *John* and object *Bill* is possible in sentence (37), where *caki* is c-commanded by both *John* and *Bill*:

(37) John$_i^1$-i Bill$_j^2$-ul caki$_{i/j}$-uy pang-eyse ttayliessta
John-nom Bill-acc self-of room-in hit
'John$_i^1$ hit Bill$_j^2$ in self$_{i/j}$'s room.'

Notice here that the subject *John* takes priority over *Bill* due to the SOC. However, it is important to note that the psych construction allows *caki*-binding to the object NP which does not c-command *caki*, as illustrated in (38):

(38) Caki$_i$-uy tulccay atul-i John$_i$-ul koylophinta.
self-of second son-nom John-acc annoy
'Self$_i$'s second son annoys John$_i$.'

Since *caki* is included in the subject NP, it cannot be c-commanded or m-commanded by the antecedent *John*, and thus ungrammaticality is predicted. But in reality *John* binds *caki*, violating CCC. This CCC violation in (38) will be saved as a result of other constraints in OT.

## 2.5. The Discourse Binding Constraint (DBC)

LDA is subject to discourse binding as in (39) or arbitrary binding as in (40) if there is no antecedent available in the sentence:

(39) a. Nwu-ka **John$_i$**-eykey yenge-lul kaluchiessanyo?
who-non John-dat English-acc taught
'Who taught John$_i$ English?"

b. **Caki$_i$**-ka honca paywesseyo.
self-nom alone learned
'he$_i$ did alone.'

(40) a. [Caki$_{arb}$-ka caki$_{arb}$-lul kukpokha-nun] il-un taytanhi elyepta. (epigram)
self-non self-acc overcome-comp thing-top very hard
'It is very hard to overcome oneself$_{arb}$.'

b. Caki$_{arb}$-uy coy-lul hoykayhay-ya kwuwen-ul etnunta. (Bible)
self-of sin-acc repent-must salvation-acc secure
'One$_i$ must repent one$_i$'s sin to secure one$_i$'s salvation.'

Arbitrary binding is only available in very restrictive contexts such as epigram or in the Bible. Thus I will not consider a constraint to cover cases of arbitrary binding. But LDA's discourse binding occurs rather consistently and productively in the common speech, which provides a reasonable motivation to form a constraint to predict it. I propose the following Discourse Antecedent Constraint (41) for the discourse-binding:

(41) Discourse Binding Constraint (DBC)
LDA must be bound by a prominent discourse NP if no sentential antecedent is available.

DBC (41) will capture the general discourse binding property of LDA. In (39b) where there is no sentential antecedent, DBC tells the grammar to search for a most prominent NP in the previous sentence, which is *John* in this case. Thus the sentence receives a proper discourse binding interpretation..

In section 3, I will argue that the constraints proposed in this section interact to produce the best choice of antecedent for *caki*.

## 3. Optimality Theory and LDA-Binding

I propose in this section the constraint-based grammars of Optimality Theory (henceforth, OT) to analyze *caki*-binding. The basic tenets of OT which will be important to *caki*-binding are constraint-based output selection, constraint universality and ranking, and the principle of minimal violation (see Prince and Smolensky (1993) for a comprehensive and more formal presentation, as well as McCarthy & Prince (1993, 1994) and references therein for further details.)

The Structure of OT I basically adopt from the optimality theories recently released from syntax and phonology field can be roughly presented in (1):

(42)

```
                    |------> E --> x
                    |------> V --> x
                    |------> A --> x
Input ---> GEN --   |------> L --> x
                    |------> U --> x
                    |------> A --> o ------> => Optimal Output
                    |------> T --> x
                    |------> E --> x
                           ...
```

Following standard OT assumptions where the input is considered to be a form taken from the lexicon, I assume that the input consists of a set of lexical items out of which candidate structures are formed by GEN. This assumption is more in line with the suggestion proposed by Chomsky (1994) stating that the input to the structure building process is a set of lexical items. A set of lexical items are selected, to a large extent, by the selectional properties of lexical elements. Thus the selection of lexical items for inputs, in general, conforms to the projection principle in order to form a complete structures.

GEN is a generating component which affects the inputs to produce output candidates. It is structured in that it is made up of a specific set of relevant operations. Within its structure GEN performs its operations without constraint: i.e. there are no rules to tell GEN when to apply which operations and how often. However, I assume that GEN is restricted to carrying out relevant linguistic processes on any given input since it is not desirable for GEN to perform even linguistically irrelevant operations. Here I leave out the empirical question how many relevant linguistic processes are carried with respect to a particular linguistic phenomena. A particular issue which concerns this study is whether it is possible to represent binding relation in this GEN structures of OT.

The output candidates are then passed through the evaluation process, where at least one optimal output will be chosen, and hence will be the optimal grammatical surface form with respect to the binding relation. The evaluation consists of a number of universal output constraints such as THC, LPC, SOC, CCC, DBC which are often conflicting and violable so that a candidate will often have to violate one to satisfy another. The optimal output is the one that is the most accordant with the set of constraints which are defined in rank with respect to the binding phenomenon. The candidate set passes through each constraint in turn starting with the most highly ranked in a particular language. Candidate that passes all the constraints is the optimal candidate but the one that does not pass any constraint will be dropped from the candidacy. If there is no candidate which pass all constraints, the next optimal candidate will be chosen among the ones which pass the most highly ranked constraint.

Diagram (43) shows the basic mechanism of OT in binding relation described so far:

(43) Basic OT Tableau

| Inputs | Constraint 1 | Constraint 2 | Constraint 3 | Constraint 4 | |
|---|---|---|---|---|---|
| A | o | x ~ | (o) | (o) | |
| B | o | o | x | o | ==> Optimal |
| C | x~ | (o) | (x) | (x) | |
| D o | o | x | x~ | | |

'o' represents 'obeying the constraint'
'x' represents 'violation'
'~' represents 'dropped off from optimal output competition'
'( )' represents 'irrelevant information'

In diagram (43) the candidates A,B,C and D are evaluated with respect to the constraints 1-4 which are arranged according to their ranks. Note here that constraint 1 stands highest and constraint 4 stands lowest in this diagram. A candidate is dropped off ('~') when it violates a corresponding constraint that other candidates obey. Once a candidate is dropped off, it cannot be considered optimal, no matter how many lower ranked constraints it obeys. Thus the constraints which dropped candidates obey are irrelevant ('( )') to the binding relation. In this manner, it is possible for the optimal output to be considered grammatical even if it violates any number of constraints. The sketch of OT given above is incomplete in various respects, but I suppose that it suffices to analyze the binding relation of LDA which behave differently from other standard anaphors. The basic tenet of OT I proposed here is intrinsically linked to a conception of constraints as ranked and violable.

For the purpose of LDA-binding, it is initial to determine the input. Recall that GEN requires that input lexical information be unaltered and complete with proper indices in each output. This is compatible with the Projection Principle: each input, being legitimate, will contain all the lexical elements needed to form a complete structure and therefore the candidate set will contain structures in which the selectional requirements of the elements included in the input will be met in some way. If the candidate set contains illegitimate structures, it will be deemed ungrammatical since it will be filtered out by one of the constraints and thus less than optimal.

I will assume that the inputs for LDA-binding include the binding possibilities among the lexical items given in the sentence and the discourse binding possibility. Thus the number of possible inputs of sentence (44) is three, including two possible antecedent lexical items with indices '*i*' and '*j*' in the sentence and one possible discourse antecedent with index '*k*' outside the sentence:

(44) John$_i^1$-i [Bill$_j^2$-i caki$_{i/j/k}$-lul cohahanta-ko] malhayssta.
John-nom Bill-nom self-acc like-comp said
'John$_i^1$ said that Bill$_j^2$ like him/himself$_{i/j/k}$.'

Since two possible lexical NPs *John* and *Bill* and possible discourse NP (mainly 'a speaker' or prominent topic from previous discourse) are potential *caki*'s antecedents, the possible inputs of the sentence (44) are three including discourse binding possibility. I will represent this possible binding relations as illustrated in (45) for the sake of space limitation:

(45) a. $John_i$, $Bill_j$, $caki_i$
b. $John_i$, $Bill_j$, $caki_j$
c. $John_i$, $Bill_j$, $caki_k$

Thus three binding candidates will enter GEN part and will be evaluated as to which one is optimal output. Notice that the reason why I include the index '*k*' in the input list for *caki*-binding is that OT in syntax should provide an input for the discourse or arbitrary reading of LDA, of which antecedents are not in the sentence.

Now let's consider a complex sentence including two embedded clauses inside as in (46):

(46) $John_i$-i [$Bill_j$-i [$Tom_k$-i $caki_{i/j/k}$-lul piphanhanta-ko]mitnunta-ko]sayngkakhanta.
John-nom Bill-nom Tom-nom self-acc criticize-comp believe-comp think
'$John_i$ thinks that $Bill_j$ believes that $Tom_k$ criticizes him/himself$_{i/j/k}$.'

This time four NPs *John, Bill, Tom* and a prominent NP in a discourse are possible *caki*'s antecedents, thus the possible inputs of the sentence (46) are illustrated in (47):

(47) a. $John_i$, $Bill_j$, $Tom_k$, $caki_i$
b. $John_i$, $Bill_j$, $Tom_k$, $caki_j$
c. $John_i$, $Bill_j$, $Tom_k$, $caki_k$
d. $John_i$, $Bill_j$, $Tom_k$, $caki_l$

These four binding candidates will enter GEN part and will be evaluated as to which one among four is optimal output.

## 4. Application of Optimality Theory to LDA

In this section I will first discuss how the constraints must be ranked to predict correctly the preference order relation between LDA's antecedents. And then I will investigate how the properly ranked constraints can account for the LDA binding facts involved in the various constructions discussed so far within OT.

Following Prince and Smolensky (1993), I argue that the five constraints on LDA-binding discussed in section 2 are interacting to produce the best choice of antecedents by competing each other in the evaluation part of the Optimality Theory. In this

interaction of multiple constraints, constraint ranking is the key notion in selecting the optimal output. For LDA-binding I will assume Constraint Ranking (48):

(48) LDA Constraint Ranking
THC > LPC > SOC > CCC > DBC

According to OT, one constraint may often be violated to satisfy another constraint. Thus, for example, THC may be violated to satisfy other constraints, or both THC and LPC may be violated to satisfy either SOC or CCC in selecting the best choice of LDA antecedent.

Bearing in mind the ranking (48), let us consider whether constraint ranking (48) correctly predicts the optimal output in various constructions discussed in earlier and examine how this mechanism can predict the preference relation of LDA binding. Let us first look at the psych predicate construction (49) which includes two binding inputs (the case when *caki* is bound by *John* and the one when it may be bound by a discourse antecedent):

(49) [$_{S2}$[$_{S1}$ **Caki$_i$**-ka sungcinhayssta-nun] sosik-i **John$_i$**-ul kippukeyhayssta.]

Agent > Experiencer
self-nom promote-comp news John-acc pleased
'The news that he$_i$ was promoted pleased John$_i$.'

Notice that according to the thematic relation, *John* takes Experiencer and *caki* takes Agent role, which violates THC since LDA is higher than its antecedent NP *John*, as illustrated in (49). However, *John*, which is in S2 domain, satisfies LPC because it is in the larger domain than *caki*, which is in S1 domain. Thus, *John*, even if it violates the first ranked constraint THC, is determined as an optimal output by satisfying the second ranked constraint LPC. Notice also that *John*, which is in the object position, cannot satisfy SOC which requires *John* to be in the subject position. Again *John* cannot satisfy CCC either because it does not c-command *caki* which is included in the structurally higher position. DBC is not satisfied because the antecedent is already determined in the sentence level. Thus the OT tableau for the example (49) is illustrated in (50):

| (50) Input | THC | LPC | SOC | CCC | DBC | |
|---|---|---|---|---|---|---|
| [[caki$_i$ ] John$_i$] | x | o | (x) | (x) | (x) | 1=> Optimal |
| [[caki$_j$ ] John$_i$] | x | x~ | (x) | (x) | (x) | |

Note that once the optimal output is picked up by LPC, the rest of the evaluation part is only relevant for deciding which one is the next preference. In (50), there is no second choice because discourse input violates all of the constraints. In other word there is no way for *caki* to refer to a prominent discourse NP in the previous sentence in this sentence since sentential antecedent is available. But if we imagine that there are more

than two possible binding relations which satisfy any of the five constraints, the evaluation part will determine the next preference relation.

Consider another psych construction (51) which has three possible binding inputs:

(51) [**Bill$_i^2$**-i **caki$_{i/j}$**-lul miwehanta]-nun sasil-i **John$_j^1$**-ul koylophiessta
| | |
Agent > Theme < Experiencer
Bill-nom self-acc hate-comp fact-nom John-acc bother
'That Bill$_i^2$ hates him$_{i/j}$ bothers John$_j^1$.'

In example (51) *caki* may be bound by both *John* and *Bill*, but *John* is a preferred antecedent for *caki*. Now consider the OT tableau (52) below:

| (52) Input | THC | LPC | SOC | CCC | DBC | |
|---|---|---|---|---|---|---|
| [[Bill$_i$ caki$_i$] John$_j$] | o | x~ | (o) | (o) | (x) | 2 |
| [[Bill$_i$ caki$_j$] John$_j$] | o | o | (o) | (x) | (x) | 1=> Optimal |
| [[Bill$_i$ caki$_k$] John$_j$] | x~ | (x) | (x) | (x) | (x) | |

Notice that both *John* and *Bill* satisfy the THC because *John* takes Experiencer role and *Bill* takes Agent role, both thematically higher than *caki*'s thematic role 'theme.' Now in LPC column the situation is different. *John* which is in the larger sentential domain satisfies LPC, whereas *Bill* which is in the embedded clause cannot. Thus, only *John* can pass LPC. In this way OT determines *caki*'s optimal antecedent. The rest of the procedures is irrelevant in determining the optimal output since OT already determined its optimal output. But, it is again desirable to go through all the constraints to determine which is the next best choice among the candidates. At the next step, both *John* and *Bill* satisfies SOC because they are subjects. At the next CCC column, only *Bill* can satisfy it. But whether or not they pass the lowly ranked constraint CCC is irrelevant at this point because all the preference order relations are established. There is no discourse binding possibility again since the antecedent can be determined in the sentence level. Sentence (51) will be ungrammatical if discourse binding interpretation is attempted since it violated all constraints in the evaluation part. In this way the preferred antecedent *John* is selected by OT in a psych construction.

Now let us turn to the singly embedded sentence (53) with three binding inputs:

(53) [$_{S2}$ John$_i^1$-i [$_{S1}$ Bill$_j^2$-i caki$_{i/j}$-lul cohahanta-ko] malhayssta.]
John-nom Bill-nom self-acc like-comp said
'John$_i^1$ said that Bill$_j^2$ like him/himself$_{i/j}$.'

Explanation is similar to the psych construction case since in the first column, *John* and *Bill* satisfy THC due to their agent thematic roles as illustrated in (54):

| (54) Input | THC | LPC | SOC | CCC | DBC | |
|---|---|---|---|---|---|---|
| $John_i$, [$Bill_j$, $caki_i$] | o | o | (o) | (o) | (x) | 1=> Optimal |
| $John_i$, [$Bill_j$, $caki_j$] | o | x~ | (o) | (o) | (x) | 2 |
| $John_i$, [$Bill_j$, $caki_k$] | x~ | (x) | (x) | (x) | (x) | |

In the LPC column, only *John* can satisfy it because it is in the larger domain S2. Here *John* is selected as an optimal output and *Bill* as the second best choice. Notice that they both satisfy the SOC and CCC, which is irrelevant in selecting both optimal outputs and preference order relations between them. But there is no chance for the input of discourse binding to be chosen as a possible antecedent because it violates all constraints. Thus, OT tableau in (55) predicts correctly why such preference order relations are set up with singly embedded logophoric sentence in (53).

Now let us turn to the Doubly embedded logophoric sentence (54) with four inputs:

(54) [$_{S3}$ $John_i^1$-i [$_{S2}$ $Bill_j^2$-i [$_{S1}$ $Tom_k^3$-i $caki_{i/j/k}$-lul piphanhanta-ko] mitnunta-ko] malhanta.]
John-nom Bill-nom Tom-nom self-acc criticize-comp believe-comp say
'$John_i^1$ says that $Bill_j^2$ believes that $Tom_k^3$ criticizes him/himself$_{i/j/k}$.'

Notice that all three NPs are agents, which satisfies THC, but in the LPC column, *John*, which is in the largest domain S3, will be picked up as the best choice of antecedent and *Bill* and *Tom* has to compete each other to be selected as the second best choice. Here *Bill* wins over *Tom* because *Bill* is in the larger domain than *Tom*, as illustrated in (55):

| (55) Input | THC | LPC | SOC | CCC | DBC | |
|---|---|---|---|---|---|---|
| $John_i$, [$Bill_j$, [$Tom_k$, $caki_i$] | o | o | o | o | (x) | 1=>optimal |
| $John_i$, [$Bill_j$, [$Tom_k$, $caki_j$] | o | x~ | (o) | (o) | (x) | 2 |
| $John_i$, [$Bill_j$, [$Tom_k$, $caki_k$] | o | x~ | (o) | (o) | (x) | 3 |
| $John_i$, [$Bill_j$, [$Tom_k$, $caki_i$] | x~ | (x) | (x) | (x) | (x) | |

In this way, preference order is determined in the complex logophoric construction, as is indicated by the numerical order in the last column. Notice that CCC is irrelevant in determining the preference order relation because it is determined up until SOC. Again there is no discourse binding possibility because it violates all constraints in evaluation part, which will make the sentence ungrammatical.

Now consider a construction (56) with three binding inputs, where *caki* is used emphatically:

(56) [$_{S2}$ $John_i^1$-i $Bill_j^2$-eykey [$_{S1}$ $caki_{i/j}$-ka ikiessta-ko] malhayssta.]
| | |
Agent > Goal < Agent
John-nom Bill-to self-nom won-comp said
'$John_i^1$ said to $Bill_j^2$ that $he_{i/j}$ won.'

Notice in (56) that *John* takes a thematic role of agent, *Bill* takes goal and *caki* takes agent. Consider OT tableau (57), which shows that both *John* and *Bill* cannot satisfy THC:

| (57) Input | THC | LPC | SOC | CCC | DBC | |
|---|---|---|---|---|---|---|
| $John_i$, $Bill_j$, [$caki_i$] | x | o | o | (o) | (x) | 1=> Optimal |
| $John_i$, $Bill_j$, [$caki_j$] | x | o | x~ | (o) | (x) | 2 |
| $John_j$, $Bill_j$, [$caki_k$] | x | x~ | (x) | (x) | (x) | |

THC is not satisfied since there is no thematically higher NP for *caki*. Recall that THC states that LDA must be bound by a thematically higher NP. Thus the evaluation procedure goes to LPC column. In LPC *John* and *Bill* satisfy it since they both are in the larger domain S2. In SOC column, only *John* will be picked up as a valid input for an optimal output because it is a subject, whereas *Bill*, which is a dative NP, will be dropped off from the optimal output competition list. In the final column, *John* and *Bill* satisfy CCC, but it is irrelevant in determining an optimal output. Thus, LPC and SOC determine the optimal output in this construction. In DBC column no inputs satisfy it. There is no discourse binding chance since it will make the sentence ungrammatical due to overall violation of constraints.

Let us turn to *caki* in a passive construction (58) which shows different binding relation from its active counterpart:

(58) a. [$_S$ $John_i$-i $Bill_j$-ul [$_{NP}$ $caki_{i/*j}$-uy cip-eyse] poassta.]
Exp > Theme > Loc
John-nom Bill-acc self-of house-in saw
'$John_i$ saw $Bill_j$ in $his_{i/*j}$ house.'

b. [$_S$ $Bill_i$-i $John_j$-eyuyhay [$_{NP}$ $caki_{i/j}$-uy cip-eyse] po-ieci-essta.]
Theme < Exp > Loc
Bill-nom John-by self-of house-in was seen.
'$Bill_i$ was seen by $John_j$ in $his_{i/j}$ house.'

Consider an active sentence (58a) first. As is represented in the tableau (59), both *John* and *Bill* satisfy THC and LPC:

| (59) Input | THC | LPC | SOC | CCC | DBC | |
|---|---|---|---|---|---|---|
| $John_i$, $Bill_j$, $caki_i$ | o | o | o | (o) | (x) | 1=> Optimal |
| $John_i$, $Bill_j$, $caki_j$ | o | o | x~ | (o) | (x) | 2 |
| $John_i$, $Bill_j$, $caki_k$ | x~ | (x) | (x) | (x) | (x) | |

Notice *John* takes Experiencer and *Bill* takes Theme and they both are in the same sentential domain, but *caki* is included in an NP taking a Locative role, which satisfy both THC and LPC. In the next evaluation procedure, only *John* can satisfy SOC and it is selected as an optimal output by OT. In the final column, both *John* and *Bill* pass CCC because they all c-command *caki*. Notice that CCC is not relevant in determining the optimal output since it is already determined by SOC. Thus, the right binding relation is correctly predicted by OT in an active sentence (58a).

Now consider how OT predicts the binding relation in the passive sentence (58b). Similar explanation is possible as illustrated in (60):

| (60) Input | THC | LPC | SOC | CCC | DBC | |
|---|---|---|---|---|---|---|
| $Bill_i$, $John_j$, $caki_i$ | o | o | o | (o) | (x) | 1=> Optimal |
| $Bill_i$, $John_j$, $caki_j$ | o | o | x~ | (o) | (x) | 2 |
| $Bill_i$, $John_j$, $caki_k$ | x~ | (x) | (x) | (x) | (x) | |

*Bill* and *John* both satisfy THC and LPC since *Bill* takes Theme and *John* takes Experiencer and both are in the same sentential domain, but *caki* is included in an NP taking Locative role. But this time, in the SOC column *Bill* passes it because it occupies a subject position. Thus the right binding relation is predicted again in the passive counterpart within an OT approach.

So far I showed how OT explained the constructions I discussed in the previous sections. Now let us turn our attention to a problematic sentence which was not discussed so far. Consider an example (61) with two binding input *i* and *j*:

(61) a.$[_{NP}$ $Caki_{i/*j}$-uy atul$]_j$-i $John_i$-ul salanghanta
self-of son-nom John-acc love
'$His_{i/*j}$ $son_j$ loves $John_i$.'

b. $John_i$-ul, $[_{NP}$ $caki_i$-uy atul$]_j$-i salanghanta
John-acc self-of son-nom love
'$John_i$, $his_{i/*j}$ $son_j$ loves.'

(61a) is unscrambled sentence and (61b) is its scrambled counterpart. In the traditional grammar, sentences in (61) have been incorrectly treated ungrammatical with given binding relation between *caki* and *John* since they cannot be explained by c-command condition. But in reality, the binding relation in sentence (61a) is possible along with (61b).

OT can represent this binding relation of (61) nicely, as illustrated in OT tableau (62):

| (62) Input | THC | LPC | SOC | CCC | DBC | |
|---|---|---|---|---|---|---|
| $caki_i$, $[caki_i$-uy atul$]_j$ $John_i$ | x | o | (x) | (o) | (x) | 1=>Optimal |
| $caki_j$, $[caki_i$-uy atul$]_j$ $John_i$ | x | x | (o) | (x) | (x) | 2 |
| $caki_k$, $[caki_i$-uy atul$]_j$ $John_i$ | x | x | x~ | (x) | (x) | |

Binding relation between *John* and *caki* cannot satisfy THC because *John* takes a theme role and *caki* is included in an NP taking an agent role. In the next column, only *John* satisfies LPC because *John* is in the whole sentential domain, whereas *caki-uy-atul* is included in a smallest domain NP. It is LPC that determines the optimal output in this construction. The rest of evaluation procedure is irrelevant in choosing an optimal output. Notice that in the SOC column only *caki-uy-atul* satisfies SOC since it occupies the subject position and in the CCC column only *John* satisfies CCC on the contrary. Notice also if *caki* is bound to *caki-uy-atul*, it will violate Chomsky's i-within-i constraint. Discourse input is ungrammatical because it violates all constraints.

Finally, let us consider a sentence (63b) which includes a discourse antecedent:

(63) Discourse Binding

a. Nwu-ka **John$_i$**-eykey yenge-lul kaluchiessanyo?
who-non John-dat English-acc taught
'Who taught John$_i$ English?"

b. **Caki$_i$**-ka honca paywesseyo.
self-nom alone learned
'he$_i$ did alone.'

The binding inputs for (63b) is only one because there is no available sentential antecedent and thus it has no other candidate to compete to become an optimal output, as illustrated in (64):

| (64) Input | THC | LPC | SOC | CCC | DBC | |
|---|---|---|---|---|---|---|
| caki$_i$, [John$_i$] | x | x | x | x | o | => Optimal |

Consequently, *John* in the previous sentence will be chosen as an exclusive optimal antecedent of *caki*.

One remaining question left for us concerning this OT framework is whether the constraint ranking (48) I assumed in the evaluation part is exclusively unique or not. I have not discussed whether there is alternative ranking which will produce the same result with (48). Let us apply some different constraint rankings to some of the sentences we observed so far. If we reverses some of the constraint rankings, the result of the optimal output becomes different. Consider sentence (65) which has three possible binding inputs and see how the OT tableau with a different constraint ranking evaluates the candidates, as illustrated in (66):

(65) [$_{NP}$ Caki$_{i/*j}$-uy atul]$_j$-i John$_i$-ul salanghanta
self-of son-nom John-acc love
'His$_{i/*j}$ son$_j$ loves John$_i$.'

| (66)a. Input | THC | LPC | SOC | CCC | DBC | |
|---|---|---|---|---|---|---|
| caki$_i$, [caki$_i$-uy atul]$_j$ John$_i$ | x | o | (x) | (o) | (x) | 1=>optimal |
| caki$_j$, [caki$_i$-uy atul]$_j$ John$_i$ | x | x | (o) | (x) | (x) | 2 |
| caki$_k$, [caki$_i$-uy atul]$_j$ John$_i$ | x | x | x~ | (x) | (x) | |

| *b. Input | THC | SOC | LPC | CCC | DBC | |
|---|---|---|---|---|---|---|
| caki$_i$, [caki$_i$-uy atul]$_j$ John$_i$ | x | x | (o) | (o) | (x) | 2 |
| caki$_j$, [caki$_i$-uy atul]$_j$ John$_i$ | x | o | (x) | (x) | (x) | 1=>optimal |
| caki$_k$, [caki$_i$-uy atul]$_j$ John$_i$ | x | x | x~ | (x) | (x) | |

I simply reversed LPC and SOC rankings and the result is different as the preference relation indicates in OT tableau. In other word, OT in (66b) predicts the binding relation incorrectly. This suggests that the constraint ranking (48) is well motivated.

Consider a more complicated example (67) which includes two subject NPs and one dative NP:

(67) [$_{S2}$ John$_i$$^1$-i Bill$_j$$^3$-eykey [$_{S1}$ Tom$_k$$^2$-i caki$_{i/j/k}$-lul ttayliessta-ko] malhayssta.]

Agent Goal Agent Theme

John-nom Bill-dat Tom-nom self-acc hit-comp said

'John$_i$$^1$ said to Bill$_j$$^3$ that Tom$_k$$^2$ hit him/himself$_{i/j/k}$.'

In (67) the intuition is that the best choice of antecedent for *caki* is the higher subject *John* and the next best choice is the lower subject *Tom* and the next one is *Bill*. This is well captured in OT tableau I proposed in this section, as illustrated in (68):

| (68) Input | THC | LPC | SOC | CCC | DBC | |
|---|---|---|---|---|---|---|
| John$_i$, Bill$_j$, [Tom$_k$, caki$_i$] | o | o | (o) | (o) | (x) | 1=>Optimal |
| John$_i$, Bill$_j$, [Tom$_k$, caki$_j$] | x~ | (o) | (x) | (o) | (x) | 3 |
| John$_i$, Bill$_j$, [Tom$_k$, caki$_k$] | o | x~ | (o) | (o) | (x) | 2 |
| John$_i$, Bill$_j$, [Tom$_k$, caki$_l$] | x~ | (x) | (x) | (x) | (x) | |

In (68), *John* (agent) and *Tom* (agent) are both thematically higher than *caki* (patient), thus satisfying THC. Notice that *Bill* (goal) is not thematically higher than *caki*, thus violating THC. However, if the THC and LPC is reversed the preference relation is predicted incorrectly, as illustrated in (69):

| (69) Input | LPC | THC | SOC | CCC | DBC | |
|---|---|---|---|---|---|---|
| John$_i$, Bill$_j$, [Tom$_k$, caki$_i$] | o | o | (o) | (o) | (x) | 1=>Optimal |
| John$_i$, Bill$_j$, [Tom$_k$, caki$_j$] | o | x~ | (x) | (o) | (x) | 2 |
| John$_i$, Bill$_j$, [Tom$_k$, caki$_k$] | x~ | (o) | (o) | (o) | (x) | 3 |
| John$_i$, Bill$_j$, [Tom$_k$, caki$_l$] | x~ | (x) | (x) | (x) | (x) | |

Reversed ranking (69) chooses the same optimal output, but it will predict *Bill* as the second best choice and *Tom* as the third choice against our intuition.

In sum, what I tried to show in this section is that the constraints are indeed interacting to yield the best choice of antecedent for LDA and the preference order relation between possible antecedents. Although this study focuses on Korean LDA, the solution developed for this language has wider theoretical implications, involving the kinds of constraints that are available in LDA-binding, how those constraints are formulated, how they interact with each other.

## 5. Conclusion

Throughout this study, I attempted to show that OT predicts the optimal binding relation of LDA in Korean. I conjecture that OT can also be extended to other LDAs in other languages, possibly by changing the rank of the constraints proposed for the Korean data.

OT was initially developed to handle phonological facts, but now we see that it can account for some complicated phenomena which have hitherto resisted adequate accounts in syntactic theories. While some of the issues that I discussed here still remain open for further research, I nevertheless hope that this little contribution lay the foundation for a more finely focused approach to LDA-binding.

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