Korean Journal of English Language and Linguistics, **Vol 25, August 2025, pp. 1214-1231**
DOI: 10.15738/kjell.25..202508.1214

KOREAN JOURNAL OF ENGLISH LANGUAGE AND LINGUISTICS

ISSN: 1598-1398 / e-ISSN 2586-7474

http://journal.kasell.or.kr

Syntactic Sensitivity to Binomial *Each* in Korean Learners of English

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Received: June 10, 2025
Revised: July 18, 2025
Accepted: August 19, 2025

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ABSTRACT

Kim, Jihyun, Wooseung Lee and Myung-Kwan Park. 2025. Syntactic sensitivity to binominal *each* in Korean learners of English. *Korean Journal of English Language and Linguistics* 25, 1214-1231.

This study examines Korean learners' sensitivity to the syntactic licensing conditions underlying Binomial *each* (BE) constructions, a domain that critically involves C-command relations for grammatical acceptability. In BE constructions, correct interpretation requires recognizing that the distributive quantifier *each* must be properly C-commanded by its antecedent. When such structures appear in ellipsis contexts such as sluicing, where parts of the sentence are missing, recovering the correct syntactic configuration becomes even more challenging. Building on theoretical distinctions between structural and non-structural approaches to ellipsis, the study employed a Grammaticality Judgment Task (GJT) to assess learners' sensitivity to C-command relations across fully-fledged declarative and sluicing sentences. Data were collected from 61 Korean L2 learners of English and 38 native English speakers. Three main findings emerged. First, L2 learners exhibited reduced structural sensitivity compared to native speakers, even when full syntactic information was available. Second, sensitivity weakened further in sluicing contexts, suggesting increased reliance on semantic plausibility when structural cues were absent. Third, proficiency modulated structural sensitivity: high-proficiency learners showed greater awareness of syntactic constraints, although their performance did not fully approximate native-like patterns. These results indicate that while L2 learners develop some structural competence, their ability to coordinate syntactic and discourse-level information during ellipsis resolution remains less stable. The findings highlight persistent challenges in acquiring syntax-discourse interface phenomena in a second language.

KEYWORDS

Ellipsis, Binomial *each*, C-command, L2 syntax, sluicing

1. Introduction

Ellipsis is a linguistic phenomenon in which certain elements in a sentence are omitted but remain semantically recoverable. Among various types of ellipsis, sluicing is particularly noteworthy as it involves the omission of clausal material in embedded interrogative clauses (Chung et al. 1995, Lasnik 2001, Merchant 2001, Ross 1969).

(1) John met someone, but I don't know who [e].
a. John met someone, but I don't know who John met.
b. #John met someone, but I don't know who Mary loves.

In (1a), the missing content ("who John met") aligns structurally and semantically with the antecedent ("John met someone"), resulting in a coherent interpretation. However, in (1b), the mismatch between the ellipsis site and the antecedent creates incoherence because the elided material ('who Mary loves') cannot semantically or structurally correspond to the antecedent ('John met someone'). This demonstrates that the ellipsis site must align with the antecedent in both structure and meaning for the sentence to be interpretable.

To explain how ellipsis sites are interpreted without overt material, two main approaches have been proposed. The structural approach argues that the ellipsis site possesses a fully-fledged internal structure that is not phonetically realized (Chung et al. 1995, Lasnik, 2001, Merchant 2001, Ross, 1969), derived from the antecedent through a deletion process before reaching the Phonetic Form (PF) representation. In contrast, the non-structural approach posits that the ellipsis site contains a null-pronominal-like element (Hardt 1993, Lobeck 1995) or lacks any syntactic structure altogether (Culicover & Jackendoff 2005, Ginzburg & Sag 2000). These contrasting perspectives raise important questions about how language users process and evaluate elliptical constructions.

Building on these theoretical frameworks, this study investigates how Korean learners of English evaluate sluicing constructions containing Binomial each (BE), a quantificational element that imposes strict syntactic constraints. BE constructions typically involve two noun phrases (NPs): the Range NP (R-NP) and the Distributing NP (D-NP). R-NP identifies the set of entities to be distributed over, while the D-NP specifies the quantity or set assigned to each member of that range (Boeckx & Hornstein 2005, Safir & Stowell 1987, Stowell 2013). For example, in the sentence *The two boys read three books each*, the R-NP "the two boys" denotes the individuals over whom distribution occurs, and the D-NP "three books each" specifies what is distributed to each boy.

BE requires a C-Command relationship between the R-NP and the D-NP, making it particularly suitable for testing whether the ellipsis site retains syntactic structure (as predicted by the structural approach) or relies on semantic interpretation (as predicted by the non-structural approach). Consider the following examples in (2).

(2) a. The teachers wrote many books, but I don't know how many books each [the teachers wrote].
b. *The teacher wrote many books, but I don't know how many books each [the teacher wrote].

In (2a), the R-NP ("the teachers") satisfies the structural requirements of BE, resulting in an acceptable sentence. Conversely, in (2b), the absence of a structurally appropriate R-NP renders the sentence ungrammatical. If learners differentiate between (2a) and (2b) by judging (2a) as more acceptable, it would suggest sensitivity to the structural constraints imposed by C-Command, supporting the structural approach. Alternatively, if learners do not show a significant difference in acceptability judgments, it would indicate reliance on semantic and contextual cues, consistent with the non-structural approach.

For second language learners, acquiring such sensitivity is crucial because it reflects the ability to construct and

interpret abstract syntactic representations beyond surface-level understanding. Without it, learners may fail to distinguish between grammatical and ungrammatical configurations that are indistinguishable in meaning but differ in structure. This is particularly important for constructions like BE, where grammaticality hinges entirely on hierarchical syntax. Therefore, examining whether L2 learners can acquire such sensitivity not only informs theories of second language acquisition, but also clarifies the extent to which L2 grammars can approximate native-like syntactic computation.

By examining Korean learners' acceptability judgments of BE-containing sluicing constructions, this study aims to shed light on their evaluation of ellipsis. Specifically, it explores whether second-language learners are capable of reconstructing abstract syntactic structure at ellipsis sites, or whether they default to non-structural strategies based on surface form and contextual plausibility.

This research contributes to theoretical debates on the representation of ellipsis by providing experimental evidence from second language acquisition, a domain that remains underexplored in the ellipsis literature. Moreover, by employing binomial *each*—a quantificational dependency with rigid structural licensing conditions—as a diagnostic, the study enables a fine-grained investigation of learners' sensitivity to hierarchical syntactic relations such as C-Command. The findings will not only clarify whether L2 learners adopt structural representations during ellipsis resolution, but also help determine how syntactic knowledge develops across levels of proficiency.

2. Linguistic Background

2.1 Binomial *Each* (BE) Constructions

Binomial *each* (BE) is a quantificational element that imposes strict syntactic and semantic constraints on sentence structure. It typically appears in constructions where one noun phrase (the Range NP, or R-NP) determines the domain of distribution, and another noun phrase (the Distributing NP, or D-NP) expresses the quantity distributed to each member of that domain (Boeckx & Hornstein 2005, Safir & Stowell 1987, Stowell 2013).

(3) a. The two boys read three books each.
b. *Three boys each arrived.

In (3a), the plural R-NP "the two boys" licenses the use of BE by providing a distributive domain over which "three books each" can be interpreted. The sentence is interpreted as meaning that each of the two boys read three distinct books. In contrast, (3b) is ungrammatical because *each* appears without an appropriate distributional context—there is no clear plural antecedent that can establish a range for distribution.

Crucially, BE is not freely licensed by any plural NP; rather, it must satisfy a C-command condition in order for the distributive interpretation to be grammatically licensed. Following Reinhart (1976, 1983), the standard definition of C-command is as in (4).

(4) A node α C-Commands a node β iff the first branching node dominating α also dominates β.

This condition ensures that the R-NP hierarchically dominates or is in a structurally higher position than the D-NP containing *each*. Consider the following pair in (5), adapted from Kim (2023).

(5) a. The teachers who the student respects wrote two books each.
b. *The teacher who the students respect wrote two books each.

In (5a), the R-NP "the teacher" C-commands the BE-containing phrase "two books each", satisfying the structural licensing conditions. In (5b), although the subject "the teacher" structurally C-commands the BE-containing phrase, it is singular and thus fails to satisfy the plural licensing requirement, rendering the sentence ungrammatical.

Kim (2023) further confirms that BE's C-command requirement is robust and consistently enforced, distinguishing it from other anaphoric dependencies such as reflexives. For instance, reflexive pronouns have been argued to allow some licensing by non-C-commanding antecedents in discourse-prominent or logophoric contexts (Pollard & Sag, 1992; Reinhart & Reuland, 1993). In contrast, BE does not exhibit such flexibility: its licensing is determined strictly by syntactic structure, with no evidence of discourse-based or pragmatic licensing when structural conditions are not met.

Additionally, BE is subject to a locality condition: the R-NP and the D-NP must occur within the same clause as in (6a). Long-distance licensing across clause boundaries results in ungrammaticality, as shown in (6b).

(6) a. The boys said that they each read two books.
b. *The boys said that two books each were read.

The strict syntactic licensing requirements of Binomial *each*—including constraints on plurality, hierarchical structure, and locality—make it an ideal diagnostic for probing the presence of internal syntactic structure. In particular, its sensitivity to C-command and clause boundaries allows researchers to test whether ellipsis sites, such as those in sluicing, are resolved via structural reconstruction or through discourse-level inference alone.

2.2 Theoretical Approaches to Ellipsis

The interpretation of ellipsis sites—positions in a sentence where certain clausal material is omitted but semantically recoverable—has been the focus of two primary theoretical approaches: the structural approach and the non-structural approach. These approaches differ fundamentally in whether they posit that ellipsis sites are syntactically represented or whether they are interpreted through semantic and pragmatic mechanisms alone. According to the structural approach, ellipsis sites contain full-fledged syntactic representations that are present in the syntactic derivation but undergo phonological deletion at the Phonetic Form (PF) level. That is, the syntactic structure exists throughout the derivation and is only "unpronounced" at the surface level (Hankamer 1979, Sag 1976, Lasnik 2001). This approach accounts for the grammatical parallelism observed between ellipsis sites and their antecedents, assuming that syntactic identity underlies ellipsis resolution.

(7) a. John met someone, but I don't know who [e].
b. John met someone, but I don't know who [John met].

In (7a), the ellipsis site [e] is structurally derived from the antecedent clause "John met someone" via deletion, as illustrated in (7b). While earlier accounts posited that ellipsis deletion operates at PF, more recent structural approaches have proposed that the relevant structure may exist only at the Logical Form (LF) level, where it is reconstructed through a process of structure copying (Chung et al. 1995, Fiengo & May 1994). Under this LF-based structural account, a phonologically null element in the ellipsis site is syntactically represented at the

interpretive level, as in (8).

(8) John met someone, but I don't know who [John met] (LF representation).

In contrast, the non-structural approach denies the existence of syntactic structure at the ellipsis site. Instead, it claims that ellipsis is interpreted directly based on semantic compatibility and contextual inference, without any syntactic reconstruction (Culicover & Jackendoff 2005, Ginzburg & Sag 2000). Under this view, the wh-phrase in sluicing is treated as a syntactic orphan or a nominal constituent (e.g., [NP who]) that is semantically licensed via indirect licensing from the discourse.

(9) John met someone, but I don't know [$_{NP}$ who].

The wh-phrase *who* is treated not as the remnant of a full embedded interrogative clause but as a syntactic orphan—a constituent that is semantically licensed through its discourse relation to the antecedent. This analysis assumes that interpretive mechanisms can operate over minimal syntactic structure and need not invoke reconstruction of the antecedent clause.

A key area of empirical investigation concerns whether ellipsis sites exhibit connectivity effects—grammatical dependencies between elements in the ellipsis site and the antecedent that are otherwise expected only under syntactic reconstruction. These include phenomena such as case matching, agreement, binding, and C-command dependencies, which are typically taken as evidence for syntactic identity between the ellipsis site and its antecedent. If such effects are observed, they support the structural view by suggesting that the elided material retains syntactic features inherited from the antecedent clause. If such effects are absent or inconsistent, they raise questions about the necessity of positing structure within the ellipsis site.

Kim (2023) explores this issue by focusing on Binomial *each* (BE), a quantificational element that exhibits particularly strong syntactic constraints. Because BE requires a plural Range NP that C-commands the distributive expression within the same clause, its acceptability is highly sensitive to structural factors. As such, BE provides a precise diagnostic for testing whether ellipsis sites preserve hierarchical syntactic relations. In subsequent sections, this study builds on Kim's approach by examining whether Korean learners of English are sensitive to these constraints in sluicing environments, thereby contributing to our understanding of how ellipsis is represented and processed in second language grammars.

2.3 BE in Sluicing: A Test Case

The interaction between Binomial *each* (BE) and sluicing offers a robust empirical test for evaluating the two competing approaches to ellipsis—the structural and non-structural approaches. Sluicing involves the omission of clausal material in an embedded interrogative clause, leaving only the wh-phrase overt. In such constructions, the licensing of BE becomes a particularly revealing diagnostic due to its strict syntactic requirements.

(10) a. The teachers wrote many books, but I don't know how many books each [the teachers wrote].
b. *The teacher wrote many books, but I don't know how many books each [the teacher wrote].

Under the structural approach, (10a) is grammatical because the ellipsis site is assumed to reconstruct the full clausal structure of the antecedent, including the necessary C-command relationship between the plural R-NP (*the*

teachers) and the distributive expression containing BE. In contrast, (10b) is ungrammatical because the relevant structural relation is not present: the singular R-NP (*the teacher*) cannot license BE due to the absence of plural number and C-command.

In contrast, the non-structural approach does not posit syntactic reconstruction within the ellipsis site. Instead, it assumes that the *wh*-phrase is interpreted directly based on contextual or semantic compatibility. On this view, the acceptability of (10a) and (10b) should not differ significantly, since both sentences provide comparable surface cues for interpretation.

The grammatical contrast between (10a) and (10b), however, suggests that BE's licensing constraints remain active even in ellipsis environments. This supports the structural approach by indicating that hierarchical syntactic relations must be preserved or reconstructed within the ellipsis site.

Importantly, this analysis relies on the assumption that the wh-phrase in sluicing—e.g., *how many books each*—is capable of reconstructing to its thematic position in the embedded clause (Barss 1986, Chomsky 1993, Hornstein 1984). Only under such reconstruction does the plural R-NP have the structural relation needed to license BE.

Based on an experimental study, Kim (2023) emphasized that BE serves as a particularly strong diagnostic because it lacks the discourse-based flexibility found in other elements such as reflexives. Unlike binding relations, which may be pragmatically overridden in certain contexts (Pollard & Sag 1992, Reinhart & Reuland 1993), BE's distribution is tightly constrained by syntax. Therefore, its behavior in sluicing constructions provides strong evidence regarding the structural status of the ellipsis site.

The present study builds on Kim's findings by extending this diagnostic to L2 English learners. By examining whether Korean learners are sensitive to the syntactic constraints governing BE in sluicing, this study seeks to determine whether second language users engage in structural reconstruction when interpreting elliptical constructions.

2.4 Previous Studies

The interpretation of sluicing has been extensively studied in the context of native (L1) speakers, with central questions revolving around whether the ellipsis site contains underlying syntactic structure. Following Ross (1969), who first described sluicing as clausal ellipsis in embedded interrogatives, structural accounts have proposed that the ellipsis site is syntactically represented but deleted at Phonetic Form (PF) (Lasnik 2001, Merchant 2001). Under this view, so-called *connectivity effects*—including case matching, agreement, and binding—indicate that syntactic structure is preserved or reconstructed at the ellipsis site. Chung et al. (1995), for instance, argue that successful interpretation of sluicing depends on the presence of syntactic structure that parallels the antecedent clause.

Within this structural framework, Binomial *each* (BE) has emerged as a particularly informative diagnostic due to its strict licensing requirements. BE is only grammatical when a plural Range NP (R-NP) C-commands the BE-containing Distributing NP (D-NP) within the same clause. This relationship has been argued to be unrecoverable via semantic inference or discourse prominence, making BE uniquely resistant to pragmatic licensing (Safir & Stowell, 1987). Supporting this view, Kim (2023) experimentally demonstrated that BE interpretation is tightly constrained by syntactic factors such as C-command. Thus, BE offers a stringent test for whether syntactic structure is present at the ellipsis site, as its acceptability hinges on specific hierarchical configurations.[1]

Kim (2023) provides experimental evidence that native English speakers are highly sensitive to these structural constraints even under ellipsis. In particular, native speakers distinguish between grammatical and ungrammatical

BE constructions in sluicing depending on whether the R-NP satisfies the required C-command relationship.[1] Consider the examples in (11).

(11) a. The teachers who the student respects wrote many books, but I don't know how many books each [the teachers who the student respects wrote].
b. *The teacher who the students respect wrote many books, but I don't know how many books each [the teacher who the students respect wrote].

In (11a), the plural R-NP *the teachers* C-commands the BE-containing DP in the reconstructed structure, licensing BE. In contrast, in (11b), *the students* is embedded within a relative clause and fails to C-command *how many books each*, resulting in ungrammaticality. This contrast supports the structural approach by demonstrating that native speakers reconstruct abstract syntactic relations at the ellipsis site.

In contrast to the growing body of L1 research on sluicing, studies on how second language (L2) learners interpret ellipsis remain limited. One of the few studies to examine this question empirically is Yoshida et al. (2013), who investigated the real-time processing of sluicing among Japanese learners of English using a self-paced reading paradigm. Their findings showed that high-proficiency L2 learners demonstrated sensitivity to structural constraints such as C-command and parallelism, while low-proficiency learners relied more on semantic plausibility and surface-level cues. These results suggest that L2 learners can, under certain conditions, access syntactic structure during ellipsis interpretation, although such processing may be mediated by proficiency level and L1 transfer.

While Yoshida et al.'s study did examine syntactic constraints like C-command within standard sluicing configurations, it did not include constructions such as binominal *each*, which impose even stricter and more rigid syntactic dependencies. Furthermore, their participant group consisted solely of L1-Japanese learners, leaving open the question of how learners from other language backgrounds—such as Korean—interpret ellipsis when syntactic reconstruction is necessary. As Kim (2023) notes, BE serves as a more stringent test of syntactic reconstruction than elements like reflexives or NPIs, which can sometimes be licensed through discourse-based mechanisms.

Theoretical accounts of L2 grammar further suggest that second language learners often underutilize hierarchical syntactic information, relying instead on surface form and semantic compatibility (Slabakova 2006, Yoshida et al. 2013). Given BE's rigid structural requirements, it provides a focused empirical context for determining whether L2 learners are capable of syntactic reconstruction in ellipsis resolution.

Addressing this gap, the present study investigates how Korean learners of English process BE in sluicing constructions. Specifically, it examines whether L2 learners are sensitive to C-command relations necessary for BE licensing, and whether they distinguish between structurally well-formed and ill-formed configurations. By testing cases like (11a) and (11b), the study aims to evaluate whether L2 grammars support the reconstruction of syntactic structure under ellipsis, or whether learners rely primarily on semantic plausibility and contextual inference.

[1] While Kim (2023) examined a range of structure-sensitive expressions—including reflexives and negative polarity items—this study focuses on Binomial *each* (BE) due to its exceptionally strict syntactic licensing conditions. Unlike reflexives or NPIs, BE cannot be licensed by discourse prominence or semantic context, making it a more reliable diagnostic for syntactic reconstruction.

2.5 Hypotheses and Predictions

Building on the theoretical and empirical findings reviewed above, the present study tests whether Korean learners of English demonstrate sensitivity to the structural licensing conditions of Binomial *each* (BE) in both overt and elliptical environments. While native speakers reliably distinguish between grammatical and ungrammatical BE constructions based on structural factors such as C-command (Kim 2023), previous research suggests that second language (L2) learners may underutilize such hierarchical information during sentence interpretation (Yoshida et al. 2013, Slabakova 2006). This tendency has been attributed to L2 learners' reliance on shallow syntactic representations rather than detailed structural analyses during real-time processing (Clahsen & Felser, 2006), and difficulties in deploying structural constraints under processing pressure (Omaki & Schulz, 2011). Moreover, L2 processing has been found to be guided by top-down information, such as contextual cues (Pan & Felser, 2011) and probabilistic biases (Dussias & Cramer Scaltz, 2008), which may further reduce learners' reliance on structural constraints. More recent work also highlights that L2 learners often struggle with structure-sensitive constraints due to cognitive resource limitations and reduced sensitivity to grammatical information, resulting in greater susceptibility to memory interference during processing (Felser, 2019).

Although these findings have primarily been observed in online processing studies, similar difficulties may also manifest in offline tasks such as grammaticality judgment. Accordingly, the following hypotheses are proposed to assess how L2 learners interpret BE in both full and sluiced clauses, and how this may be modulated by proficiency.

Hypothesis 1: Korean L2 learners of English will be less sensitive than native speakers to the structural licensing requirements of BE in overt declarative sentences. Specifically, they are not expected to reliably distinguish between structures in which the R-NP C-commands the BE-containing DP (i.e., grammatical) and those in which this structural relation is absent (i.e., ungrammatical). This prediction is based on previous findings indicating that L2 learners often rely on surface-level cues and semantic plausibility rather than hierarchical syntactic structure when interpreting distributive or scope-related expressions (Yoshida et al. 2013).

Hypothesis 2: Among Korean L2 learners of English, sensitivity to the structural licensing requirements of BE will be reduced in sluicing contexts compared to overt declarative sentences. While they may show some ability to distinguish between structurally licensed and unlicensed configurations in full declarative sentences, this sensitivity is expected to diminish under sluicing, where structural cues are not overtly available. This would suggest that Korean L2 learners rely more heavily on semantic plausibility rather than syntactic reconstruction when interpreting ellipsis.

Hypothesis 3: Structural sensitivity in both overt and elliptical contexts will be modulated by L2 proficiency. Learners with higher proficiency are expected to demonstrate greater awareness of BE's structural constraints than those with lower proficiency. However, due to the persistent challenges L2 learners face with fine-grained syntactic dependencies, even advanced learners may not reach native-like levels of sensitivity (Yoshida et al. 2013).

These hypotheses aim to clarify the extent to which L2 grammars support syntactic reconstruction under ellipsis and to what degree L2 learners can access hierarchical structure during the interpretation of strictly licensed expressions like BE.

3. Study

3.1 Participants

The L2 group included 61 Korean university students (mean age = 20.53, SD = 1.48) currently enrolled at universities in Seoul. All participants were native speakers of Korean and had acquired English as a second language in formal educational settings beginning in middle or high school. To assess English proficiency among L2 participants, the study employed their English grade from the College Scholastic Ability Test (CSAT)—Korea's national university entrance examination. The CSAT English grade ranges from Level 1 (highest) to Level 9 (lowest). Based on these scores, participants were categorized into two groups. Those who received Level 1 or 2 were classified as advanced-proficiency learners, most of whom were English majors. In contrast, participants with Level 3 or 4 were classified as intermediate-proficiency learners, and were primarily non-English majors. The L1 group consisted of 38 monolingual native English speakers (mean age = 40.43, SD = 18.68) from a range of English-speaking countries, including the United States, United Kingdom, Canada, and Australia. All participants were volunteers recruited via Linguist List, an international online resource for linguistics research and academic communication.[2]

Table 1 provides an overview of the participant groups, including the number of Korean learners of English at each proficiency level and the number of native English-speaking participants.

Table 1. The Participants in the Study

Language Group	Proficiency level	Number
L1-Korean, L2-English learners (L2)	intermediate	24
	advanced	31
Native English speakers (L1)		38
Total		93

3.2 Materials and Procedures

The materials for this experiment consisted of sentences designed to manipulate the syntactic environment in which *Binomial each* (BE) appeared. Each sentence was assigned to one of four experimental conditions, varying in whether the Range NP (R-NP) C-commanded the Distributive NP and whether the BE construction occurred in a declarative or sluicing sentence. Representative examples for each condition are shown in Table 2.

Table 2. Sentence Types Used in the GJT

Condition	Example
CC/Decl	The teachers who the student respects wrote many books each.
Non-CC/Decl	The teacher who the students respect wrote many books each.
CC/Sluicing	The teachers who the student respects wrote many books, but I don't know how many books each.
Non-CC/Sluicing	The teacher who the students respect wrote many books, but I don't know how many books each.

In the CC/Decl condition, the sentence is structurally well-formed: the plural Range NP (*the teachers*) C-

[2] Linguist List (https://linguistlist.org) is an international online platform widely used by linguists to share research-related announcements, including participant recruitment for experimental studies.

commands the BE-containing Distributive NP (*many books each*), satisfying the syntactic requirements for BE licensing. This condition establishes a grammatical baseline, assessing whether participants can correctly recognize fully visible, well-formed BE constructions in overt syntax. In contrast, the Non-CC/Decl condition contains a violation of the C-command requirement. In *The teacher who the students respect wrote many books each*, although the singular subject *the teacher* structurally C-commands the BE-containing phrase, it fails to serve as a suitable antecedent for *each* due to its singular number, rendering the sentence ungrammatical. This condition tests participants' sensitivity to syntactic violations in declarative contexts.

The CC/Sluicing condition evaluates whether participants can reconstruct a grammatically licensed BE clause within an ellipsis site. In *The teachers who the student respects wrote many books, but I don't know how many books each*, the antecedent clause satisfies the C-command requirement, and BE licensing must be preserved through syntactic reconstruction. This condition probes L2 learners' ability to recover ellipsis structure under grammatical licensing.

The Non-CC/Sluicing condition introduces a structural violation within the antecedent of the sluiced sentence. For instance, in *The teacher who the students respect wrote many books, but I don't know how many books each*, the subject *the teacher* structurally C-commands the BE-containing phrase, but fails to license *each* due to its singular number. As a result, BE is unlicensed in the reconstructed clause. This condition examines whether participants are sensitive to violations that are not visible on the surface, thereby testing their reliance on syntactic reconstruction during ellipsis interpretation.

To reduce predictability and divert participants' attention from the experimental manipulation, eight filler items were included. These filler items contained relative clauses and surface complexity similar to experimental stimuli, but did not involve BE or ellipsis. For example, a filler sentence such as *The kids who the volunteers helped sang many songs at the event* includes a relative clause but is syntactically unrelated to the licensing conditions under investigation. All 24 sentences (16 experimental and 8 fillers) were presented in a fully randomized order for each participant to control for potential order effects.

Participants completed a Grammaticality Judgment Task (GJT) using Google Forms. On each trial, participants were presented with a single sentence belonging to one of the four experimental conditions (CC/Decl, Non-CC/Decl, CC/Sluicing, or Non-CC/Sluicing), and participants were instructed to rate the grammaticality of each sentence on a 5-point Likert scale, with 1 indicating "completely ungrammatical" and 5 indicating "completely grammatical". There was no time limit for responses, but participants were encouraged to read and respond at a natural and comfortable pace.

3.3 Design

This study employed a 2 × 2 within-subjects factorial design, manipulating two factors: C-command (C-commanding vs. non-C-commanding) and Sentence Type (Declarative vs. Sluicing). Each participant was exposed to all four experimental conditions, allowing for within-subject comparisons across syntactic environments and sentence types. The four conditions included declarative sentences in which the Range NP C-commanded the Distributive NP (CC/Decl), declarative sentences with a structural violation (Non-CC/Decl), structurally licensed sluicing sentences (CC/Sluicing), and sluicing sentences with structurally unlicensed antecedents (Non-CC/Sluicing). Each condition was represented by four items, resulting in a total of sixteen experimental sentences per participant.

This design is a streamlined adaptation of the one used in Kim (2023), which originally employed a 2 × 3 factorial structure involving an additional Wh-question condition. The current study omits the Wh-question

condition to reduce the cognitive demands placed on L2 learners, who may face greater processing difficulty than native speakers when interpreting structurally complex ellipsis types. By simplifying the design while preserving the critical manipulation of syntactic licensing under ellipsis, the study aims to focus more directly on learners' structural sensitivity to Binomial *each* in both overt and elliptical contexts.

The dependent variable was participants' grammaticality ratings on a 5-point Likert scale, as described in Section 3.2.

3.4 Statistical Analysis

All statistical analyses were conducted using cumulative link mixed models (CLMMs), which are appropriate for analyzing ordinal outcome variables such as Likert scale ratings. Models were implemented in R (R Core Team 2024), using the ordinal package. Random intercepts for participants and items were included where model convergence permitted. Group and condition-level variables were contrast-coded for interpretability: Group (L1 = -0.5, L2 = 0.5), C-command (CC = -0.5, Non-CC = 0.5), and Sentence Type (Declarative = -0.5, Sluicing = 0.5).

Separate models were fit for each hypothesis. For Hypothesis 1, the model included Group, C-command, and their interaction as fixed effects, with random intercepts for participants and items. For Hypothesis 2, which involved both declarative and sluicing sentence types, the model included Group, C-command, Sentence Type, and all possible two- and three-way interactions. For Hypothesis 3, which focused on differences within the L2 group, the model included Proficiency, C-command, Sentence Type, and their interactions as fixed effects. In all cases, likelihood ratio tests were used to assess the significance of fixed effects, with an alpha of .05.

4. Results and Discussion

4.1 Hypothesis 1: Sensitivity to C-command in Overt Declaratives

Hypothesis 1 predicted that Korean L2 learners would be less sensitive than native speakers to the structural licensing requirements of *Binomial each* in overt declarative sentences. Specifically, while native English speakers were expected to rate structurally unlicensed BE constructions (i.e., those lacking a C-commanding antecedent) significantly lower than licensed ones, L2 learners were not expected to show this contrast.

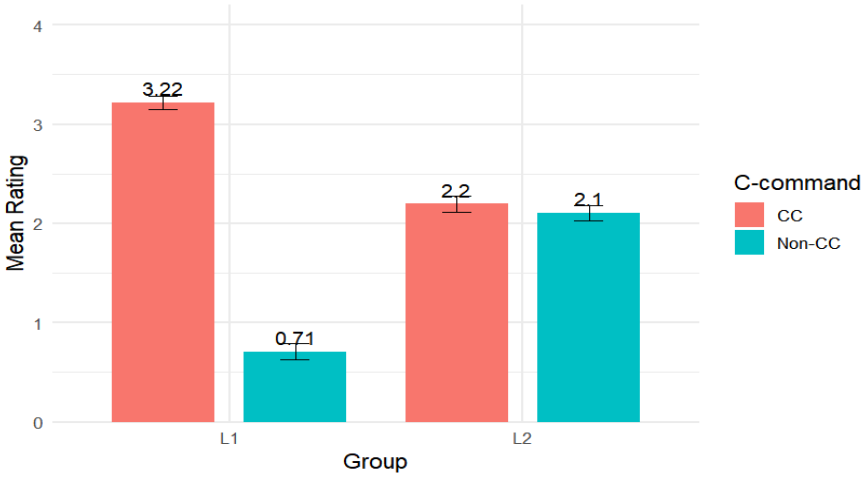

Figure 1. Mean Ratings by Group and C-command Condition

Figure 1 illustrates the mean acceptability ratings across C-command conditions for each group. Native speakers clearly distinguished between the two conditions, penalizing unlicensed BE constructions with lower ratings. In contrast, L2 learners showed minimal differentiation, assigning similar ratings regardless of structural licensing.

To statistically evaluate these differences, a cumulative link mixed-effects model (CLMM) was fitted with Group (L1 vs. L2), C-command (CC vs. Non-CC), and their interaction as fixed effects. Random intercepts for participants and items were included to account for individual and lexical variability. Group was coded as L1 = –0.5 and L2 = 0.5, and C-command as CC = –0.5 and Non-CC = 0.5.

Table 3. Results of the Cumulative Link Mixed-Effects Model (CLMM)

Fixed effect	Estimate	SE	*p*
Group	-2.095	0.359	< 0.001***
C-command	-5.528	0.238	< 0.001***
Group × C-command	5.029	0.262	< 0.001***

Note. Formula: Rating ~ Group * C-command + (1 | Participant) + (1 | Item); *** p<.001

As shown in Table 3, there were significant main effects of Group ($\beta = -2.095$, $p < .001$) and C-command ($\beta = -5.528$, $p < .001$), along with a significant Group × C-command interaction ($\beta = 5.029$, $p < .001$). This interaction confirms that the L1 group exhibited robust sensitivity to structural violations, while L2 learners did not reliably differentiate between C-commanding and non-C-commanding conditions.

These findings are consistent with Hypothesis 1. While native speakers clearly judged unlicensed each constructions as ungrammatical, Korean L2 learners appeared less sensitive to the structural violation, even though the full syntactic structure was overtly available. The group-level main effect indicates that L2 participants tended to be more generous in their acceptability judgments. Rather than strictly evaluating whether the sentences conformed to structural licensing requirements, they appeared to rely more on whether the sentences seemed plausible at a surface level.

Crucially, this difficulty cannot simply be explained by the absence of structural cues, as might occur in sluicing contexts where part of the sentence is missing (Yoshida et al., 2013). Rather, they appear to exhibit a more fundamental insensitivity to hierarchical syntactic relations such as C-command—even when those relations are fully overt and structurally unambiguous. This pattern raises the possibility that L2 learners may lack a robust mental representation of C-command itself.

One plausible explanation for this insensitivity is L1 transfer. Unlike English, Korean does not consistently encode C-command relations in its grammatical structure (O'Grady 1997, Yoon 1990). In Korean, dependencies that are sensitive to C-command in English—such as reflexive binding and quantifier scope—are frequently determined by surface-level cues, including linear order and morphological case marking, rather than by hierarchical syntactic configurations. As a result, Korean learners of English may exhibit reduced sensitivity to C-command as a grammatically relevant relation in their L2, given the absence of a comparable grammatical mechanism in their native language.

4.2 Hypothesis 2: Sensitivity to C-command in Sluicing

Hypothesis 2 tested whether Korean L2 learners would show reduced sensitivity to the structural licensing conditions of Binomial *each* when the relevant structure is not overtly expressed, as in sluicing. While native speakers were expected to reconstruct the elided material and maintain sensitivity to C-command constraints, L2 learners were predicted to rely more on semantic plausibility, leading to diminished differentiation between

structurally licensed and unlicensed sluicing constructions.

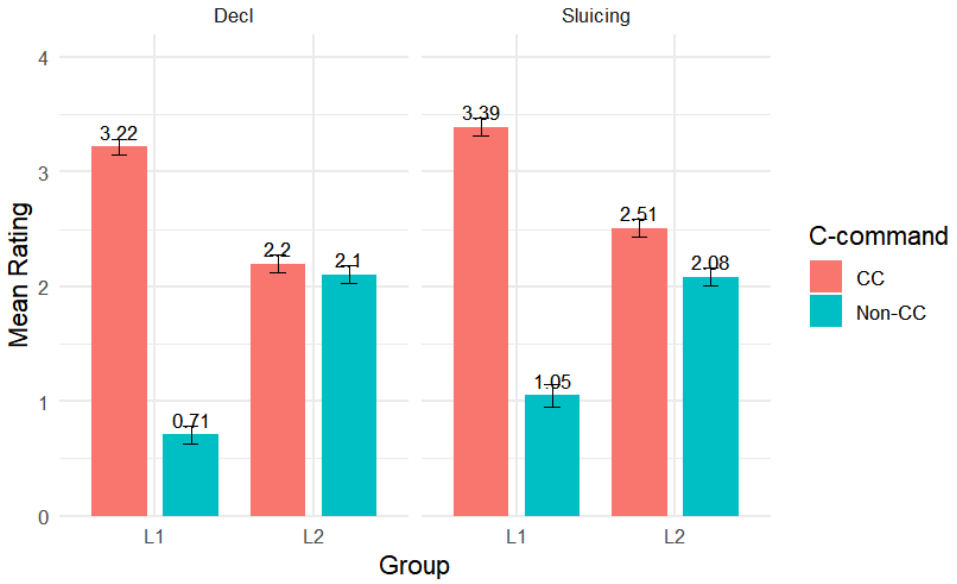

Figure 2. Mean Ratings by Group, Sentence Type , and C-command Condition

Figure 2 presents mean ratings by group across C-command conditions (CC vs. Non-CC) and sentence type (declarative vs. sluicing). Native speakers showed a clear contrast: they rated Non-C-commanded BE constructions substantially lower than C-commanded ones in both declarative (M = 0.71 vs. 3.22) and sluicing (M = 1.05 vs. 3.39) contexts. In contrast, L2 learners exhibited minimal differentiation across conditions, with mean ratings remaining close in both sentence types (Declarative: M = 2.20 vs. 2.10; Sluicing: M = 2.51 vs. 2.08).

To statistically assess this pattern, an ordinal mixed-effects regression model was fitted with Group (L1 vs. L2), C-command (CC vs. Non-CC), Sentence Type (Declarative vs. Sluicing), and all possible interactions as fixed effects. Random intercepts for participants and items were included. Group and C-command were contrast-coded as in the previous analysis; Sentence Type was coded as Declarative = –0.5 and Sluicing = 0.5.

Table 4. Results of the Cumulative Link Mixed-Effects Model (CLMM)

Fixed effect	Estimate	SE	*p*
Group	-2.064	0.390	< 0.001***
C-command	-5.695	0.302	< 0.001***
Sentence type	0.629	0.264	0.017*
Group × C-command	5.444	0.347	< 0.001***
Group × Sentence type	-0.145	0.319	0.648
C-command × Sentence type	0.198	0.372	0.595
Group × C-command × Sentence type	-0.702	0.449	0.118

Note. Rating ~ Group * C-command * SentenceType + (1 | Participant) + (1 | Item); * p< .05, *** p<.001

As summarized in Table 4, the model revealed significant main effects of Group (β = –2.064, p < .001), C-command (β = –5.695, p < .001), and Sentence Type (β = 0.629, p = .017). Crucially, the Group × C-command interaction was also significant (β = 5.444, p < .001), confirming that native speakers were more sensitive to structural violations than L2 learners. However, neither the Group × Sentence Type nor the C-command × Sentence

Type interaction was significant (ps > .5), and the three-way Group × C-command × Sentence Type interaction did not reach significance either (β = –0.702, p = .118).

These results support Hypothesis 2. Among Korean L2 learners, sensitivity to structural licensing was weaker in sluicing contexts compared to overt declarative sentences. While native speakers consistently distinguished between licensed and unlicensed structures across both contexts, Korean L2 learners showed a notable reduction in sensitivity under ellipsis. The observed interaction indicates that the absence of overt structural cues in sluicing made it more difficult for L2 learners to detect unlicensed BE constructions.

This suggests that Korean L2 learners' difficulties with hierarchical syntactic relations, such as C-command, become even more pronounced when structural information is not fully available. Rather than processing sluicing constructions based on syntactic structure, they appeared to rely more on whether the surface meaning of the sentence seemed plausible.

Figures 3 and 4 further illustrate these findings. Figure 3 displays the original results from Kim (2023), while Figure 4 presents the current study's data, converted into z-scores for direct comparison.

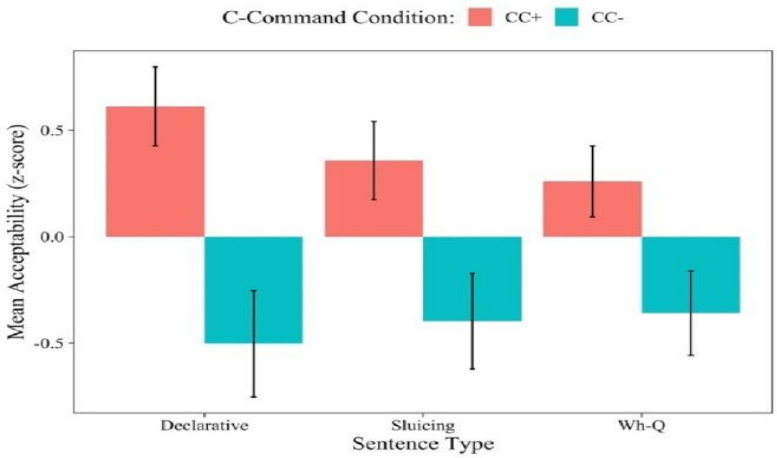

Figure 3. Mean z-scored Ratings across Sentence Types by C-command Condition (Kim 2023)

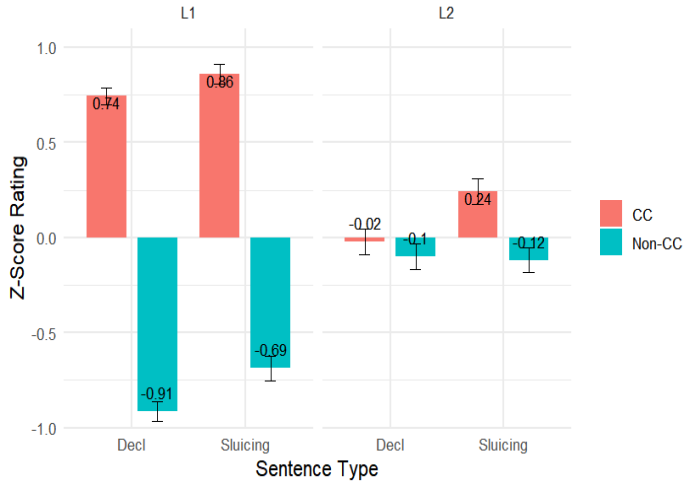

Figure 4. Mean z-scored Ratings across Sentence Types by C-command Condition

Overall, the pattern is consistent across studies: the L1 group showed higher acceptability ratings for C-

commanded structures than for non-C-commanded ones. However, this contrast was somewhat reduced in sluicing compared to declarative contexts, largely because non-C-commanded sluicing constructions were rated more favorably than their declarative counterparts. This pattern suggests that the absence of overt structure under ellipsis may weaken sensitivity to syntactic constraints and promote greater reliance on semantic plausibility.

4.3 Hypothesis 3: Proficiency and Sensitivity to Structural Licensing

Hypothesis 3 tested whether proficiency affects L2 learners' sensitivity to structural licensing conditions. While high-proficiency learners were expected to show greater sensitivity to C-command constraints than low-proficiency learners, particularly under ellipsis, it was also hypothesized that even advanced learners might not fully achieve native-like performance. Figure 3 presents the mean ratings across C-command conditions (C-commanded vs. Non-C-commanded), sentence types (declarative vs. sluicing), and proficiency levels (high vs. low).

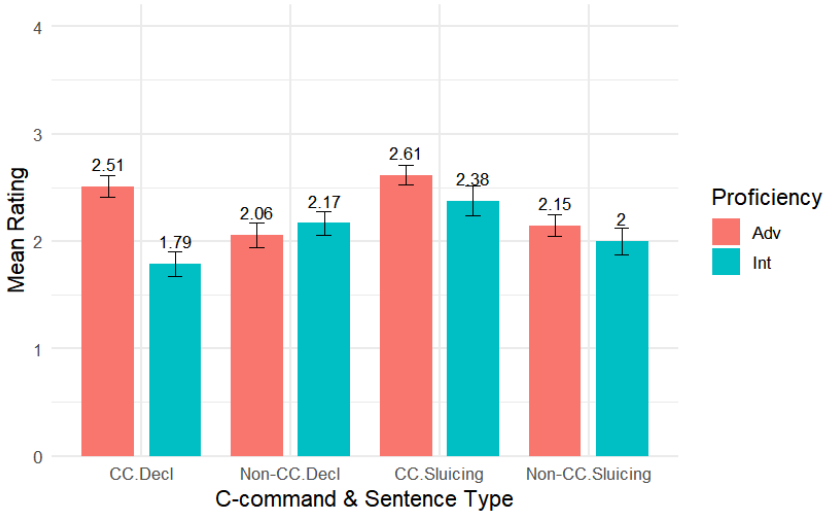

Figure 5. Acceptability Ratings by C-command, Sentence Type, and Proficiency

In general, advanced learners showed a greater distinction between C-command conditions than their lower-proficiency counterparts, across both declarative and sluicing contexts. In contrast, intermediate learners exhibited less consistent sensitivity to structural differences, with ratings that remained relatively close between conditions. One striking pattern is that the intermediate group showed a reversed pattern in declarative sentences: they rated non-C-commanded constructions higher than C-commanded ones. This suggests that intermediate learners may not only lack awareness of structural constraints, but might also ignore or misinterpret sentence structure if the overall meaning seems plausible.

To formally assess these patterns, an ordinal mixed-effects regression model was fitted with fixed effects of Proficiency (intermediate vs. advanced), C-command (C-commanded vs. Non-C-commanded), Sentence Type (declarative vs. sluicing), and all interactions.

Table 5. Results of the Cumulative Link Mixed-Effects Model (CLMM)

Fixed effect	Estimate	SE	*p*
Proficiency	-1.413	0.489	0.003**
C-command	-0.951	0.245	< 0.001***
Sentence type	0.058	0.237	0.809
Proficiency × C-command	1.556	0.367	< 0.001***
Proficiency × Sentence type	0.986	0.367	0.007**
C-command × Sentence type	0.122	0.336	0.715
Proficiency × C-command × Sentence type	-1.414	0.516	0.006**

Note. Rating ~ Proficiency * C-command * Sentence Type + (1 | Participant) + (1 | Item); ** $p < .01$, *** $p < .001$

The model revealed significant main effects of Proficiency and C-command, indicating that more proficient learners gave overall higher ratings and responded more negatively to structurally unlicensed conditions. Crucially, the Proficiency × C-command interaction was significant, suggesting that sensitivity to C-command increases with proficiency. Moreover, the Proficiency × Sentence Type interaction was significant, implying that proficiency also enhances learners' ability to process ellipsis constructions accurately.

Most notably, a significant three-way interaction between Proficiency, C-command, and Sentence Type was observed. This indicates that the interaction between structural condition (C-command) and sentence type (declarative vs. sluicing) differed depending on learners' proficiency level. Specifically, high-proficiency learners showed a stronger contrast between C-commanded and Non-C-commanded constructions in the sluicing condition than in the declarative condition, reflecting increased structural sensitivity in the context of ellipsis. In contrast, low-proficiency learners displayed little sensitivity to C-command violations in either sentence type, showing no interaction between structure and sentence type.

These findings support Hypothesis 3, demonstrating that proficiency influences not only overall structural sensitivity but also the degree to which learners adjust their interpretations based on sentence type. Crucially, the C-command × Sentence Type interaction, typically associated with native-like ellipsis resolution, emerged only among high-proficiency learners. This pattern suggests that while higher proficiency facilitates greater structural sensitivity, L2 learners' ability to integrate syntactic structure with discourse information remains less stable, particularly under ellipsis where structural reconstruction is required.

5. Implications and Concluding Remarks

This study investigated whether Korean learners of English are sensitive to the syntactic constraints governing Binomial *each* (BE) constructions, particularly in sluicing contexts where structural information must be reconstructed. The findings offer three main implications.

First, L2 learners exhibited overall reduced sensitivity to structural licensing conditions compared to native speakers, even when the syntactic structure was fully overt. This suggests that C-command-based hierarchical relations may not be fully integrated into L2 learners' grammatical representations. Second, structural sensitivity further weakened in sluicing contexts, where the absence of overt syntactic cues required learners to rely on reconstruction. Instead of recovering full structural dependencies, L2 learners appeared to rely more on surface-level semantic plausibility, indicating a shift toward meaning-based interpretation under ellipsis. Third, proficiency modulated structural sensitivity: high-proficiency learners showed greater differentiation between licensed and unlicensed structures, particularly under ellipsis, although their performance still fell short of native-like patterns.

This suggests that while syntactic knowledge develops with proficiency, the integration of syntactic and discourse-level information remains a persistent challenge for L2 learners.

Together, these findings underscore that second language acquisition at the syntax-discourse interface is a gradual and often incomplete process. Even advanced L2 learners may struggle to fully integrate hierarchical syntactic knowledge with discourse-level interpretation, particularly when structural reconstruction is required for interpreting ellipsis.

In addition to these theoretical insights, the findings suggest important pedagogical implications. Consistent with the Shallow Structure Hypothesis (Clahsen & Felser, 2006), the results suggest that L2 learners tend to rely more on surface-level semantic cues rather than engaging in detailed syntactic analysis. To encourage deeper syntactic processing, instructional practices should include guided sentence reconstruction tasks and activities that require learners to actively recover omitted sentence elements. Furthermore, providing explicit comparison between grammatical and ungrammatical sentences involving ellipsis can help raise learners' awareness of syntactic constraints. Such approaches may support the transition from shallow to deeper syntactic processing, preparing learners to handle more complex syntax-discourse interface phenomena as their proficiency develops.

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Examples in: English
Applicable Languages: English
Applicable Level: Tertiary

