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Investigation of cross-language structural priming between Korean and English passives during comprehension*

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Lee, Gayoung and Miseon Lee. 2024. Investigation of cross-language structural priming between Korean and English passives during comprehension. *Linguistic Research* 41(3): 431-452. This study examines cross-language structural priming between Korean and English in highly proficient Korean-English bilinguals. A self-paced reading experiment was conducted to investigate whether structural priming occurs in passive constructions from L1 Korean to L2 English. Results revealed no significant difference in reading times for English passives between passive and unrelated prime conditions, suggesting an absence of structural priming from Korean passives to English passives. Notably, however, reading times for English passive targets were significantly longer following Korean active primes than after either passive or unrelated primes. This is likely due to interference between the syntactic representations of the two languages. These findings support the connected-syntax model, suggesting that while syntactic representations in Korean-English bilinguals are distinct, they interact during sentence processing. **(Hanyang University)**

Keywords Korean-English bilinguals, structural priming, passives, self-paced reading, interference effect, semantic overlap

1. Introduction

Structural priming, also known as syntactic priming or structural persistence, refers to the phenomenon where the structure of a recently produced or comprehended

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sentence influences the structure of a subsequent sentence (Bock 1986). Priming occurs at various levels, including orthographic, phonological, lexical, and sentence levels (e.g., Nas 1983; Van Heuven et al. 1998; Bock and Griffin 2000; De Groot et al. 2000). For example, Bock (1986) demonstrated that when English speakers produced a specific syntactic structure, such as a ditransitive double-object (DO) construction (e.g., *A rock star sold an undercover agent some cocaine*), they were more likely to use the same structure in subsequent production. This phenomenon has been widely studied in both monolingual and bilingual contexts.

Cross-language structural priming is particularly valuable as it provides insights into how syntactic representations are stored and processed across two languages. Despite its significance, research on structural priming remains limited, especially for languages with distinct word orders. While some studies have explored structural priming between such languages, comprehension-based research is notably scarce, particularly for Korean-English bilinguals. Addressing this gap, this study investigates cross-language structural priming during comprehension, focusing on passive constructions in proficient Korean-English bilinguals.

1.1 Models of bilingual syntactic representation

Research on cross-language priming has proposed several accounts of how bilinguals access and process syntactic structures in their two languages. They can be grouped into three main models: the shared-syntax model, the connected-syntax model, and the separate-syntax model.

The *shared-syntax model* posits that bilinguals have a single, unified syntactic representation that can be activated and accessed by either language. According to this model, when bilinguals produce or comprehend a sentence in one language, the syntactic structure used should influence the subsequent production or comprehension in the other language. Hartsuiker et al. (2004) provided strong evidence for this model using a production task. In their study, native Spanish speakers, proficient in English, produced more English passive sentences after being exposed to Spanish passive sentences compared to Spanish active sentences. This finding suggests that the syntactic structures of both languages are stored in a shared, language-unspecific representation.

The theoretical foundation for this model extends Pickering and Branigan's (1998)

residual activation account, which originally focused on monolinguals, to include language nodes. Hartsuiker et al. (2004) proposed that combinatorial nodes are language-unspecific and specify the structures with which they can occur (e.g., active, passive). Lemmas are also represented in a shared lexicon (Hartsuiker and Pickering 2008) and are connected to these language-unspecific combinatorial nodes. For instance, as illustrated in Figure 1 (left), when a bilingual listener hears a prepositional object (PO) sentence in English (e.g., *A rock star sent some gifts to his fan*), the verb lemma (e.g., *send*) activates the corresponding combinatorial node for the PO structure. This activation can persist across languages, thereby leading to the use of the same structure in Swedish.

The shared-syntax model is further supported by several experimental studies demonstrating strong cross-language priming in structures such as dative constructions and relative clause attachment (e.g., Desmet and Declercq 2006; Schoonbaert et al. 2007). Notably, this priming effect was observed not only between language pairs with similar word orders but also between those with different word orders. Similar results were reported in a study involving artificial versions of Dutch-English and Spanish-English pairs (Khoe et al. 2023). These findings suggest that structural configurations are represented in a single, unified form that can be accessed by either language, regardless of word order differences. Conducting a meta-analysis of structural priming studies across various language pairs, including German-English, Japanese-English, and French-English, van Gompel and Arai (2018) concluded that most priming experiments support this idea.

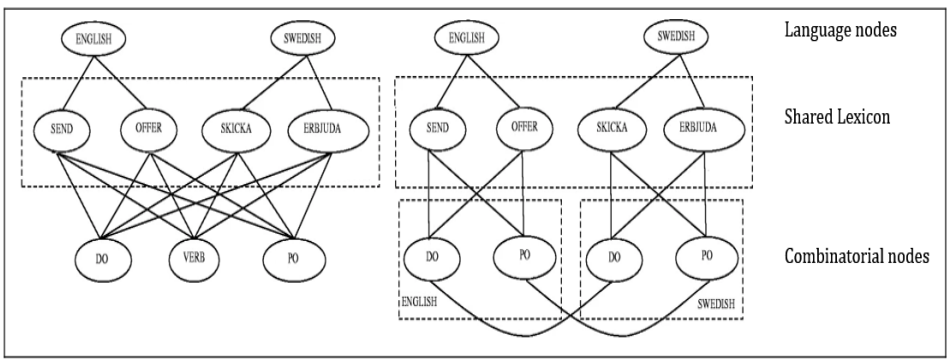

Figure 1. Shared-syntax (left) vs connected-syntax (right) models of bilingual language representation (adapted from Kantola and van Gompel 2011)

However, van Gompel and Arai (2018) also discussed evidence that cross-language priming effects are weaker when the structural configurations differ significantly. The weaker priming effect points to the *connected-syntax model* that some syntactic representations may still be language-specific to a degree (e.g., De Bot 1992). This model posits that lemmas from both L1 and L2 are stored in a shared lexicon, but each lemma is linked to the combinatorial nodes specific to each language, as illustrated in Figure 1 (right). For example, the lemmas for the English verb *send* and the Swedish verb *skicka* 'send' are stored in a single lexicon but linked to separate combinatorial nodes for PO structures in English and Swedish.

Within this model, priming is generally stronger within a language, where it occurs through a single syntactic representation. In contrast, cross-language priming is expected to be weaker, as it involves indirect activation between separate combinatorial nodes (Hartsuiker et al. 2004; Hartsuiker and Pickering 2008). The strength of cross-language priming depends on structural similarities between languages, particularly word order. Much weaker priming is expected for distinct word orders, a pattern observed in many studies (e.g., Loebell and Bock 2003; Meijer and Tree 2003; Bernolet et al. 2007). For instance, Loebell and Bock (2003) found priming for ditransitive constructions (DO/PO) but not for active/passive structures between English and German. They attributed this difference to the parallel word orders in ditransitives but the different word orders in passives, where the main verb appears at the clause-final position in German.

However, some comprehension studies have shown that the presence of translation equivalents between prime and target sentences can increase the likelihood of cross-language structural priming, even when the syntactic structures differ. For example, Weber and Indefrey (2009) found a priming effect in comprehension when L1 Dutch passive primes and L2 English passive targets shared a verb with identical meanings (e.g., *maken*/*make*). In contrast, no priming effect was observed when semantically unrelated verbs were used in the prime and target sentences (e.g., *schilderen* 'paint' in a Dutch prime/*make* in an English target). Similar results were found across other language pairs, including Japanese and English (Arai et al. 2007), Dutch and English (Schoonbaert et al. 2007), Italian and English (Carminati et al. 2008), and Cantonese and Mandarin (Chen et al. 2023).

In contrast to the shared-syntax and connected-syntax models, the *separate-syntax model* argues that L1 and L2 syntactic representations are distinct. This model is

grounded in Ullman's (2001) declarative/procedural model, which suggests that L1 and L2 involve two separate learning and memory systems for rule-governed grammar. According to this model, the learning, representation, and processing of L1 grammar depend upon procedural memory, while L2 grammar relies more on declarative memory. Consequently, the separate-syntax model does not predict structural priming between languages, even when word orders are parallel or when translation-equivalent words are present (e.g., Mercan and Simonsen 2019). However, there is limited supporting evidence for the separate-syntax model so far, and it contrasts with previous findings of both robust and weaker cross-language structural priming. Tooley and Traxler (2010) noted in their comprehensive review that the absence of cross-language structural priming in some studies might be due to methodological limitations that are not sensitive enough to detect the priming effects accurately.

In summary, structural priming has proven valuable for investigating bilingual syntactic representations, yet the evidence is mixed. Some studies have observed robust cross-language priming, supporting the shared-syntax model that proposes integrated syntactic representations across languages. The connected-syntax model explains weaker priming effects by positing separate but connected syntactic representations that allow for some level of cross-language priming. In contrast, accounting for the absence of cross-language priming, the separate-syntax model argues for distinct syntactic representations for each language. Given the conflicting findings in previous studies, further research is needed to compare these models and clarify the nature of bilingual syntactic representations, particularly by examining various syntactic structures in diverse bilingual contexts.

1.2 Studies of structural priming in Korean-English bilinguals

Exploring structural priming in Korean-English bilinguals offers valuable insights into bilingual syntactic representations, especially given the significant structural differences between these languages. The contrast between Korean SOV and English SVO word orders makes cross-language structural priming particularly meaningful, as it can reveal how distinct syntactic structures are processed and represented in bilingual minds. However, research on structural priming between Korean and English remains limited, with existing studies yielding mixed results and providing inconclusive evidence

regarding the underlying models of bilingual syntax.

These studies have primarily focused on production tasks to investigate cross-language priming effects in this language pair. For instance, Shin and Christianson (2009) explored whether hearing Korean ditransitive constructions could prime the production of English ditransitives. They found significant structural priming between Korean dative primes with agent-goal-theme order (e.g., *Appa-ka atul-eykey swuhak-ul kaluchi-ess-ta* 'Dad taught his son math') and English PO dative targets (e.g., *The lawyer gave a gift to the child*). This suggests that syntactic processing in bilinguals can be shared at an abstract level, independent of argument orderings. Son (2020, 2021) expanded on this research using a picture description task and showed that Korean-English bilinguals were more likely to use the same type of dative construction (DO or PO) they had just encountered in a Korean prime when completing an English fragment to describe a picture. Together, these results support the shared-syntax model, suggesting that Korean and English may share an abstract syntactic representation, regardless of their linear word orders.

Ahn and Ferreira (2024) conducted a cumulative structural priming experiment, where participants described photos by completing sentence fragments, providing support for the connected-syntax model. Instead of the typical trial-by-trial approach, they used structural priming across blocks with longer intervals between prime and target sentences to reduce frequent switches, addressing a common limitation of standard priming paradigms. Their findings revealed robust within-language structural priming effects for English but no such effects for Korean. Additionally, they observed significant cross-language priming only from English dative primes to Korean dative targets, though this effect was smaller than the within-language priming effect. These mixed results challenge both the fully-shared-syntax model and the separate-syntax model. Ahn and Ferreira argued that English and Korean structural representations are maintained separately but are connected to some extent.

In contrast, Ahn et al. (2021) reported evidence supporting the separate-syntax model using an extended picture-word interference paradigm, in which participants described images while simultaneously viewing distractor words. They measured how Korean-English bilinguals produced noun phrases with different linear word orders in English and Korean (e.g., *the lemon below the lobster* and 'lobster-below lemon,' respectively). By measuring participants' articulation times for each word in a phrase, when presenting distractor words such as *apple* (distractor for *lemon*) and *crab*

(distractor for *lobster*), they found that participants accessed only the phrase structure of the language they were actively speaking at the time. This finding suggests that bilinguals maintain distinct syntactic representations for each language and do not simultaneously access structures from both languages when speaking in one.

Focusing on production tasks, these studies leave a notable gap in understanding how structural priming operates during comprehension. To address this gap, the current study investigates whether structural priming extends to passive constructions with translation-equivalent words during comprehension in proficient Korean-English bilinguals. Using a self-paced reading experiment, we focus on passive constructions—an understudied structure in this context—and consider the distinct morpho-syntactic features and word orders of Korean and English. Our research aims to provide additional insights into bilingual syntactic representations and contribute to the ongoing debate on shared versus separate syntax. To the best of our knowledge, this is the first study to examine structural priming in passive constructions during comprehension among Korean-English bilinguals, offering a more comprehensive understanding of bilingual syntactic processing.

2. Methods

This study draws on the materials and data from Lee (2024).

2.1 Participants

We recruited 30 Korean-English bilinguals, of which 5 were excluded from the analysis for not meeting the inclusion criteria. The remaining 25 participants (mean age = 25.4 years, 17 females) were early bilinguals who began learning English at an average age of 6.6 years (SD = 2.7, range = 2-14 years). A power simulation using the G*Power 3.1 (Faul et al. 2007) indicated that a sample size of 25 participants was sufficient to achieve 80% power at an alpha level of .05. The participants demonstrated high English proficiency, scoring over 950 on the TOEIC listening and reading examination. Self-assessed proficiency levels on a Likert scale from 0 (none) to 10 (native fluency) revealed an average of 7.4 (SD = 1.7) for speaking, 8.28 (SD = 1.1) for listening, 8.48 (SD = 1.1) for reading, and 7.24 (SD = 1.6) for writing. Based on previous findings

that higher L2 proficiency leads to more robust cross-language priming (e.g., Bernolet et al. 2007; Cai et al. 2011), we included only participants with advanced English proficiency. All participants provided written informed consent prior to the experiment, in accordance with the protocol approved by the Institutional Review Board/Research Ethics Committee of our institute. After the experiment, participants completed a survey on their linguistic backgrounds and received monetary compensation for their participation.

2.2 Materials

A total of 66 experimental prime-target pairs were initially constructed. The target sentences were created in L2 English passive forms, and the prime sentences were in L1 Korean. The rationale for priming from L1 to L2 is based on the greater reliability of priming effects from the dominant to the non-dominant language across various linguistic levels, including lexico-semantic and structural levels (e.g., Hartsuiker et al. 2004; Schoonbaert et al. 2007).

The passive construction was selected as the target structure because it has often shown strong priming effects in cross-linguistic studies, even when word orders differ between languages (e.g., Weber and Indefrey 2009; Bernolet and Hartsuiker 2010; Chen et al. 2023). This can be attributed to prediction errors generated by less expected structures, as proposed by the implicit learning model (Chang et al. 2000). Passives exemplify such less expected structures: they are less frequent and more marked than actives, involving a unique syntactic operation where the theme is promoted to the subject position and the agent is realized as an optional adjunct. This increased unexpectedness leads to higher syntactic surprisal, which in turn exert stronger structural priming during processing (e.g., Hartsuiker et al. 2004; Jaeger and Snider 2013).

The Korean prime sentences were divided into three conditions: passive, active, and unrelated. As illustrated in Table 1, the passive and active prime conditions described the same situation but differed in their syntactic forms and word order. In these two conditions, translation-equivalent verbs were used for a pair of Korean prime and English target sentences, based on previous findings that translation-equivalent words can increase the likelihood of cross-language structural

priming, even when the syntactic structures differ (e.g., Weber and Indefrey 2009).

Table 1. Examples of experimental stimuli

	Prime Sentence (Korean)	Target Sentence (English)
Active (incongruent) condition	경찰이 금방 도둑을 잡았다. Kyengchal-i kumpang totwuk-ul cap-ass-ta. Policeman-NOM soon thief-ACC catch-PAST-SE 'The policeman soon caught the thief.'	The flying ball was caught by the pitcher.
Passive (congruent) condition	도둑이 금방 경찰에게 잡혔다. Totwuk-i kumpang kyengchal-eykey cap-hi-ess-ta. Thief-NOM soon policeman-DAT catch-PASS-PAST-SE 'The thief was soon caught by the policeman.'	
Unrelated condition	은호가 미용실에서 수염을 만졌다. Unho-ka miyongsil-eyse swuyem-ul manci-ess-ta. Unho-NOM hairshop-at mustache-ACC touch-PAST-SE 'Unho touched the mustache in the hairshop.'	

The passive prime condition was congruent with the structure of the English target sentences at an abstract syntactic level, as both were passivized through the same syntactic process. In both languages, passivization involves promoting the internal argument (the theme) to the subject position, which is empty because passive morphology absorbs the external agent role (Chomsky 1981, 1995). The agent, if expressed, appears in an adjunct phrase. In English passive targets, this phrase was headed by the preposition *by* (e.g., *by the pitcher*), while in Korean passive primes, it was marked with particles such as *-ey* or *-eykey* (e.g., *kyengchal-eykey* 'by the policeman') (Sohn 1999).

Despite this shared syntactic process, the two languages differ in their formation of passive verbs. English passive verbs were formed by combining an auxiliary verb with the past participle of the main verb (e.g., *was caught*). In contrast, in Korean, passive verbs were created by attaching one of the suffixes *-i*, *-hi*, *-li*, *-ki* to the stem of a transitive verb (e.g., *cap-hi-ess-ta,* 잡혔다, 'was caught'). Among the different types of passives in Korean, we chose syntactic (or suffixal) passives to maintain consistency in syntactic structure between the two languages, as described above.[1]

1 In addition to syntactic (or suffixal) passives, Korean also has lexical and phrasal types of passives

This choice also ensured consistency in verb length across all three Korean prime conditions (e.g., *cap-hyess-ta*, 잡혔다, 'was caught' for the passive prime; *cap-ass-ta*, 잡았다, 'caught' for the active prime; *manci-ess-ta*, 만졌다, 'touched' for the unrelated prime).

The active and unrelated primes were structurally incongruent with the English passive targets. While both were constructed in the active voice, the unrelated condition only included semantically unrelated verbs that are never passivized.

The experimental sentences uniformly consisted of four *ecels* in Korean and eight words in English. The length of English passive targets was controlled across conditions by using the same sentence for all three prime sentences. Specifically, participants read the same passive target following each triplet of active, passive, and unrelated primes, as shown in Table 1. This ensured that the word length of targets was consistent across conditions and would not influence RT differences.

If Korean passive sentences prime English passives, we expect faster reading times for English target sentences following passive (congruent) primes compared to active (incongruent) and unrelated primes. This facilitation effect would indicate cross-language structural priming between Korean and English. In contrast, no significant differences between conditions would suggest the absence of cross-language structural priming.

To ensure naturalness and semantic appropriateness of the stimuli, two rating tasks were conducted separately for Korean and English. The naturalness rating task assessed whether the stimuli were natural and plausible in each language, minimizing potential confounds from unnatural sentences. A group of 15 native speakers of each language rated the sentences on a 7-point Likert scale from 1 (completely unnatural) to 7 (perfectly natural). Sentences with average ratings below the mean value of 4.2 were excluded, but only for the Korean stimuli (e.g., *kitchen.knife-*NOM *sharply knife.seller-*DAT *sharpen-*PASS-PAST-SE 'A kitchen knife was sharply sharpened by the knife seller'). The remaining sentences had an average naturalness rating of 5.9 (SD = 0.7) for Korean primes and 5.2 (SD = 0.4) for English targets. The semantic relatedness rating task

(Sohn 1999). Lexical passives are formed either with distinct passive verbs that differ from their active counterparts (e.g., *macta* 'be hit' vs. *ttaylita* 'hit') or with compound passive verbs (e.g., *conkyeong-patta* 'be respected', where the verbal noun *conkyeong* 'respect' and the verb *patta* 'receive' are combined). Phrasal passives are constructed by combining a verb stem suffixed with *-e/-a* and the inchoative verb *ci-* 'become' (e.g., *cwu-e ci-ta* 'be given'), which conveys a change of state.

then confirmed sufficient semantic overlap in translation-equivalent verbs for the active and passive conditions and verified no semantic overlap for unrelated primes. A group of 24 Korean-English bilinguals rated verb pairs on a 7-point Likert scale, ranging from 1 (completely unrelated) to 7 (completely identical). Only verb pairs in the active and passive prime conditions with ratings below 4.2 (e.g., *kkekk-ta*/*snap*) were excluded. The remaining verb pairs had a mean semantic relatedness of 5.4 (SD = 0.6) for active and passive primes and 1.6 (SD = 0.3) for unrelated primes.

After removal of low-rated items, the final set consisted of 60 prime-target sentence pairs. These 60 pairs were distributed across three experimental lists using a Latin Square design. Each list included 60 experimental trials (20 per condition) and 90 filler trials (15 acceptable and 75 unacceptable pairs).[2] The presentation order of stimuli was randomized for each session.

2.3 Procedure

Participants were tested individually and seated in a dimly lit, soundproof room. Stimuli were presented using the Psychopy software (Peirce et al. 2019), with white text on a gray background on a 21-inch computer monitor. Each trial began with a fixation cross at the center of the monitor for 500 milliseconds (ms). A trial was then presented in two parts: the Korean prime sentence and the English target sentence. Participants pressed the space bar to advance each word and judged the grammaticality of each sentence by pressing a "Yes" or "No" response button as quickly and accurately as possible. No feedback was given on the judgments during the task. An example trial is presented in Figure 2.

2 Korean fillers were all active sentences, consisting of a subject NP, an adverb, an accusative/dative-marked NP, and a predicate, following the structure of the experimental sentences. Unacceptable fillers were created by including an argument with an incorrect case marker (e.g., *Cwunkwu-nun sillo simseng-ul chakha-ess-ta* 'Chwunkwu-TOP truly heart-ACC be.kind-PAST-SE') or a semantically inappropriate verb (e.g., *Seyho-nun yethaykkes pwulmyencung-i chwiha-ess-ta* 'Seyho-TOP until.now insomnia-NOM be.drunk-PAST-SE'). English fillers followed the structure of the experimental target sentences, consisting of a subject NP, *was*, a present/past participle, and a prepositional phrase. Unacceptable fillers were created by introducing inappropriate verbs (e.g., *The nervous bride was unfolding from the chair, The handsome captain was smiled by the photo*).

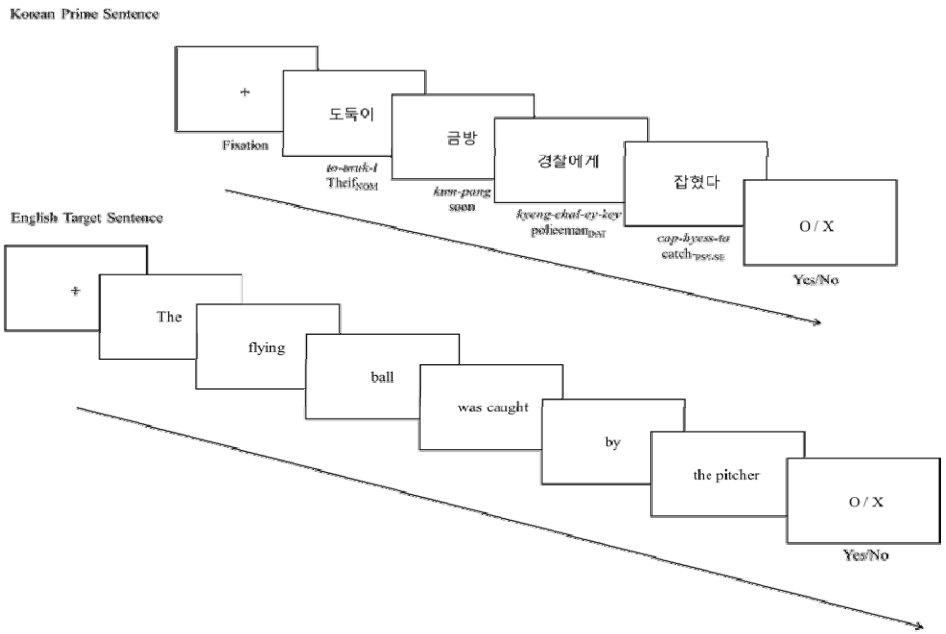

Figure 2. An illustration of a self-paced reading trial

The experiment was divided into two blocks, each containing 75 trials (60 experimental and 90 filler trials in total). Participants were given a break of self-determined duration between the two blocks. Before the experimental session, six practice trials were given to familiarize participants with the procedure. The entire experiment lasted about 35 minutes on average.

3. Results

3.1 Grammaticality judgments

The accuracy of the grammaticality judgments was recorded for each stimulus item. As summarized in Table 2, the mean accuracy was 92.7% for the Korean prime sentences and 94.8% for the English target sentences. These high levels of accuracy indicate that participants paid close attention to the stimuli and understood them well.

Table 2. Means and standard errors of accuracy (%) of the grammaticality judgments

	Condition			
	Active (Incongruent)	Passive (Congruent)	Unrelated	Sum
Prime (Korean)	88.0 (1.3)	92.2 (1.1)	97.8 (0.6)	92.7 (0.6)
Target (English)	94.8 (0.9)	95.2 (0.9)	94.3 (1.0)	94.8 (0.5)

Notably, although the active condition was expected to be the easiest, its accuracy was relatively low at 88%, significantly lower than other conditions ($\beta = 2.65$, SE = 0.28, $p < 0.001$). An individual- and item-level analysis revealed no significant effects ($p > .1$), indicating that the observed accuracy cannot be attributed to specific participants or experimental sentences. One possible explanation is response bias: participants may have become more conservative in their judgments after repeated exposure to ungrammatical active fillers and passive sentences, mistakenly classifying some actives as passives and thus as ungrammatical (e.g., Green and Swets 1966). This possibility is indirectly supported by the high accuracy observed in the unrelated condition. Although also in the active voice, the unrelated primes, unlike the active primes which featured passivizable verbs (e.g., *cap-ass-ta* 'caught'), contained inherently non-passivizable verbs (e.g., *manci-ess-ta* 'touched'), potentially minimizing response bias. This explanation is speculative, however, and further research is needed to confirm whether response bias indeed accounts for the observed accuracy patterns.

3.2 Self-paced reading times

Before analysis, trials were excluded if either the prime or target sentence was unanswered or incorrectly judged by participants. Outliers exceeding 3 SDs from the mean per participant (6.3% of the data points) were also removed for each region, from the verb to the end of the sentence (e.g., *was caught* / *by* / *the pitcher*). Pre-verbal regions were excluded because sentence voice (i.e., active vs. passive) becomes discernible only when verbs are introduced; thus, any syntactic priming effects were expected to appear from the verb region onwards. The remaining data points were log-transformed and analyzed using LME models. The models were estimated using

the lme4 package (version 1.1.28, Bates et al. 2015) in R (version 4.2.0; R Core Team 2021) for each region of interest. The models included fixed effects for prime condition (active, passive, unrelated), region (verb, *by*, NP) and word length (i.e., the number of letters per word) and random effects for participants and items. Marginal means and contrasts were estimated using the emmeans package (version 1.7.2, Lenth 2021). Although the word length of target sentences was controlled as described above, word length was included as a fixed effect to confirm that it did not significantly affect reading times (RTs) in our data ($p = .872$) (Frinsel and Christiansen 2024).

As summarized in Figure 3, the active prime condition resulted in longer RTs for English passive targets compared to both the passive and unrelated prime conditions. LME models revealed a significant effect of prime condition on RTs in the verb (e.g., *was caught*: $\beta = -.04$, SE = .01, $t = -3.05$, $p = .002$) and noun regions (e.g., *the pitcher*: $\beta = -.03$, SE = .01, $t = -2.43$, $p = .015$). Pairwise comparisons with Tukey's adjustment showed that in the verb region, RTs were significantly longer in the active condition than in the passive ($\beta = .02$, SE = .01, $p = .007$) and unrelated conditions ($\beta = .02$, SE = .01, $p = .039$). In the noun region, a significant difference was found only between the active and unrelated conditions ($\beta = .03$, SE = .01, $p = .041$). No significant differences across conditions were found in the preposition region (i.e., *by*) ($p > .1$).

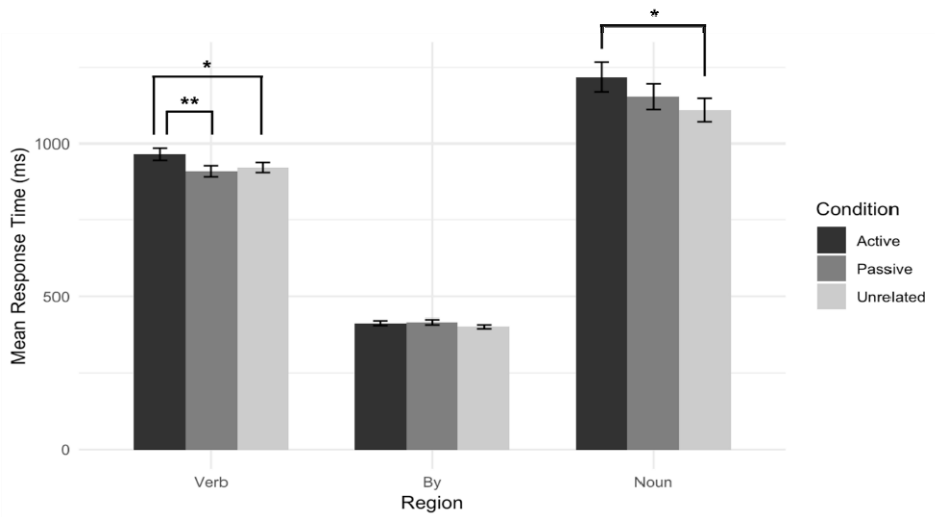

Figure 3. Reading times (ms) of English target sentences in each region of interest with standard error bars (**$p < .01$, *$p < .05$)

The LME models also showed a significant effect of sentence region on RTs (SE = .01, $p < .001$), indicating that RTs varied across different regions. Pairwise comparisons revealed that RTs for the noun region at the end of the sentence were significantly longer than those for the verb region ($\beta = .06$, SE = .01, $p < .001$) and the preposition region ($\beta = -.35$, SE = .01, $p < .001$), as shown in Figure 3.

To examine individual differences in reading speed, we compared a mixed-effects model with by-participant intercepts to one without them (Frinsel and Christiansen 2024). The model with by-participant intercepts provided a significantly better fit ($\chi^2(1) = 623.54$, $p < .0001$), indicating that some participants were consistently faster or slower than others, regardless of the prime condition.

In summary, Korean passive primes resulted in shorter RTs for English passive targets compared to Korean active primes. However, it is difficult to interpret this result as structural priming, given that RTs in the passive and unrelated prime conditions did not significantly differ. Conversely, the active prime condition resulted in significantly longer RTs than both the passive and unrelated conditions throughout the sentence.

4. Discussion

This study investigated cross-language structural priming between Korean and English in proficient Korean-English bilinguals, focusing on passive constructions. The main finding was that RTs were significantly shorter in the congruent passive condition compared to the incongruent active condition, particularly in the verb region where sentence voice becomes apparent. Specifically, participants primed with a passive sentence in Korean processed a subsequent English passive sentence more quickly. This faster processing of English passive targets following Korean passive primes is consistent with previous research showing structural priming across languages, even when their word orders differ, as seen in studies of dative constructions (Desmet and Declercq 2006; Schoonbaert et al. 2007; Shin and Christianson 2009). These findings lend some support to the shared-syntax model, which posits a unified syntactic representation accessible by both languages (Hartsuiker et al. 2004).

However, this interpretation is complicated by another finding that there was no significant difference in RTs between the passive and unrelated prime conditions.

According to the shared-syntax model, passive primes should result in significantly faster processing of passive targets compared to unrelated primes. The absence of such facilitation suggests that the faster RTs observed in the passive prime condition, compared to the active condition, may not be sufficient to indicate robust structural priming. Instead, it may be more appropriate to interpret these results as supporting the separate-syntax model, which proposes distinct syntactic representations for each language, thereby predicting no cross-language priming. While the significant RT difference between the passive and active conditions challenges the separate-syntax model, the lack of facilitation compared to unrelated prime conditions suggests that bilinguals may rely on separate syntactic systems, consistent with prior findings in Korean-English bilinguals (e.g., Ahn et al. 2021).

Notably, sentences preceded by an active prime exhibited longer RTs than those preceded by either a passive or unrelated prime. The consistently longer RTs in the active condition cannot be fully explained by either the shared-syntax or separate-syntax models. Instead, this pattern is consistent with predictions from the *cue-based parsing model* (Lewis et al. 2006), which attributes processing difficulty to similarity-based interference during retrieval from working memory. This model is particularly relevant to comprehension tasks, where comprehenders must retrieve stored representations to process and interpret incoming information. In active-passive pairs with translation-equivalent verbs, the active prime activates a syntactic structure in memory where the subject serves as the agent and the object as the theme. When participants process a subsequent passive target sentence with a similar meaning, the pre-activated structure mismatches with the passive construction, where the subject serves as the theme and the agent is realized as an adjunct. This syntactic mismatch, combined with the lexical-semantic overlap of translation-equivalent verbs, amplifies interference by increasing competition during retrieval, leading to greater cognitive load and longer RTs. This finding highlights the role of comprehension-specific processes in driving the observed interference effects, aligning with the cue-based parsing model.

Further support for this idea comes from the absence of interference in conditions with matching features between passive primes and passive targets or when there is no semantic or structural overlap between unrelated primes and passive targets. Although the unrelated primes were also in the active voice, RTs for the passive targets were not significantly slowed, indicating that similarity-based interference did not

occur. The key difference lies in the absence of lexical-semantic overlap in the unrelated condition. Without translation equivalents, unrelated primes and passive targets activate distinct lexical representations in memory, reducing structural interference during retrieval. Conversely, the combination of syntactic mismatch and lexical-semantic overlap explains why interference effects arise only in the active prime condition with translation-equivalent verbs.

These results—no facilitation effect of passive primes and an interference effect of active primes—point toward the connected-syntax model, which posits that bilinguals maintain separate syntactic representations for each language, yet these representations are connected, allowing for some degree of between-language influences. According to this model, structural representations in Korean can indirectly activate corresponding, though distinct, representations in English. This conclusion could be further supported by follow-up studies examining within-language priming in Korean and English active/passive constructions, potentially revealing stronger effects than those observed in cross-language priming. Additionally, as shown by Weber and Indefrey (2009), the presence of translation equivalents between primes and targets may have contributed to the observed results by facilitating the indirect spreading of residual activation from Korean passive primes to English passive targets, even when their word orders differed. These findings highlight the importance of both lexical and syntactic alignment in cross-language priming, suggesting that separate syntactic representations can still interact through a shared lexicon under specific conditions.

Another factor influencing structural priming is participants' L2 proficiency. Previous research has demonstrated that higher proficiency levels could strengthen lexical and syntactic connections between languages, leading to distinct priming effects across proficiency levels. Specifically, structural priming effects are closely tied to the developmental stage of syntactic integration, with less proficient individuals relying more on separate syntactic representations and showing weaker or inconsistent priming effects (e.g., Bernolet et al. 2007; Cai et al. 2011; Hartsuiker and Bernolet 2017). Given that the participants in this study were highly proficient Korean-English bilinguals, their syntactic processing likely reflects advanced integration of syntactic representations.[3] To determine whether the observed patterns are specific to highly

3 It is important to note a potential limitation in our L2 proficiency assessment, which relied on TOEIC scores and self-assessments. While these measures are widely used for evaluating L2 skills, they may

proficient Korean-English bilinguals or represent a broader phenomenon across varying proficiency levels, systematic control and variation of L2 proficiency within this language pair are needed in follow-up research.

A final point of interest is the significant effect of prime condition observed in the noun region at the end of the sentence. The RT difference between the active and unrelated conditions appears unrelated to structural priming, as the final noun was structurally consistent across conditions. Instead, this difference may reflect the sentence wrap-up effect, where readers experience increased cognitive load as they integrate and finalize their parsing of the entire sentence (Just and Carpenter 1980; Rayner et al. 2000). Importantly, this wrap-up process is distinct from the structural priming effects observed earlier in the verb region. However, the lingering interference from the active prime condition may have contributed to the longer RTs in this region, suggesting a potential interaction between structural interference and wrap-up processes. Further research could explore how such interactions influence sentence-final processing in bilingual contexts.

5. Conclusion

This study is the first to examine structural priming in passive constructions during comprehension among proficient Korean-English bilinguals. Although the findings did not provide robust evidence for priming from Korean passives to English passives, reading times for English passive targets were significantly longer after Korean active primes compared to passive or unrelated primes. This pattern can be interpreted as an interference effect driven by the interaction between mismatched syntactic structures and semantic overlap across languages. These results imply that while syntactic representations remain distinct for each language, they are nonetheless connected and interact, possibly through the lexicon, during sentence processing in Korean-English bilinguals.

These findings support the connected-syntax model, emphasizing the importance

not fully capture participants' syntactic processing abilities. If their actual proficiency was lower than assessed, the observed patterns might instead reflect participants at a transitional stage from separate to shared syntax (e.g., Bernolet et al. 2007; Cai et al. 2011; Hartsuiker and Bernolet 2017). While we are confident that our participants were highly proficient bilinguals, more controlled proficiency assessments would provide clearer insights.

of both facilitation and interference effects in cross-language structural priming. To better understand the nature and extent of the separate yet connected syntax in bilinguals, further research is needed. Future studies could consider diverse levels of bilingual proficiency, a broader range of syntactic structures, and more fine-grained real-time measures. These methodological refinements could provide more precise insights into cross-language priming effects and shed light on the complexities of bilingual syntax.

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