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Prime Repetition and Korean EFL Learners' Comprehension and Production of Passives

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Abstract: The occurrence of structural priming in second language (L2) speech production has received increased attention over the last decade (McDonough and Trofimovich, 2009; Trofimovich and McDonough, 2011). Although L2 researchers have implemented a variety of priming methods, few studies to date have investigated whether repeating prime sentences affects L2 speakers' understanding and use of target structures. Therefore, the current study investigated whether prime repetition facilitates English L2 speakers' comprehension and production of passive constructions. Korean EFL learners ($N=50$) were randomly assigned to carry out communicative tasks under three conditions: passive prime sentences with repetition, passive prime sentences without repetition, or active prime sentences (active comparison). All groups completed three comprehension and oral production tests and two priming sessions over a four-week period. The results indicated that repeating passive primes facilitated subsequent production of passives, but was not more effective at promoting comprehension. The results are discussed in terms of the potential role of prime repetition in promoting L2 learners' comprehension and production of target structures.

Keywords: structural priming, interaction-driven learning, English passives, prime repetition

1 Overview of structural priming

Structural priming refers to the tendency for speakers to produce a structure that occurred in the recent discourse rather than an alternative structure that could be used to express a similar meaning (Bock 1986). For example, during a conversation, one speaker might produce a passive construction, such as *the volunteers were given directions*. Later in that conversation, the same speaker or an

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interlocutor is likely to produce another passive construction (*the project goals were explained*) although alternate structures that express a similar message are available, such as an active construction (*the coordinator explained the project goals*). In the last two decades, structural priming has been increasingly explored as evidence for abstract syntactic representations as well as language processing of both children and adults (see Pickering and Ferreira 2008 for a review).

Since Bock's (1986) original study using the picture description task, the overall consensus is that priming occurs because speakers build and represent sentence structure independently of lexical items. Studies have supported this claim using various types of constructions including passives, datives, phrasal verbs, and complex noun phrases in both oral and written discourse (e. g., Branigan et al. 1999; Branigan et al. 2000) as well as in naturalistic corpora (Gries 2005) (e. g., see McDonough & Trofimovich 2009; Pickering and Ferreira 2008 for a review). These studies have also explored whether the magnitude of priming effects differ by various factors such as age (i. e., younger versus older) and lexical boost (i. e., shared open-class lexical items) (e. g., Kidd 2012; Rowland et al. 2012).

In terms of the function of structural priming, an increasing number of first language (L1) studies have examined the relationship between structural priming and implicit language learning (Bock and Griffin 2000; Brooks and Tomasello 1999; Chang et al. 2006; Kaschak et al. 2011a, 2011b; Pickering and Ferreira 2008). Researchers who argue for the implicit learning account claim that based on the connectionist model, when one construction such as English passives is heard, the model weights are adjusted such that it is more likely that learners produce the same construction on a subsequent sentence (Bock and Griffin 2000; Chang 2009; Chang et al. 2000; Chang et al. 2006; and Chang et al. 2012). Understanding or producing a linguistic structure involves form-meaning connections, and in implicit learning conditions, these mappings are often acquired through experience in which a particular meaning relationship is expressed through a particular processing sequence corresponding to constructing a target structure without consciousness. According to Pickering and Ferreira (2008), structural priming could strengthen the form-meaning mappings by hearing or producing the prime without explicit instruction.

Implicit language learning accounts of priming have been supported by various studies which showed that priming effects lasted despite intervening time and material between primes and targets (Bock and Griffin 2000; Chang et al. 2006; Hartsuiker et al. 2008). For instance, Bock and Griffin (2000) found that structural priming endured beyond adjacent sentences over 10 intervening sentences, which suggests that there is long-term adaptation in the cognitive mechanisms of sentence creation. Furthermore, researchers supported the implicit learning account by showing the persistence of priming effects over time. Savage et al. (2006) showed that priming can last up to one month following

initial testing. In terms of research design, Kaschak et al. (2011b) argued that priming effects should be researched beyond the single-session experiments. Furthermore, they suggested that the relationship between structural priming and language learning can be investigated by examining cumulative structural priming effects over a longer time period. Their research findings revealed that the cumulative priming effect can be observed after a delay of one week, suggesting that structural priming is an example of implicit/procedural memory in the language production system.

Inspired by L1 priming research, second language (L2) studies have investigated the occurrence of priming in L2 speech production, and studies have shown that priming occurs in English with datives (Gries 2005; Gries and Wulff 2005; McDonough 2006; Shin and Christianson 2012), relative and adverbial clauses (McDonough et al. 2015), particle placement (Gries 2005), and passives (Kim and McDonough 2008). To date, previous L2 studies have provided evidence that structural priming occurs during L2 speech production, and that carrying out communicative activities with prime sentences positively impacts L2 learners' subsequent production of the target structure. For instance, L2 learners produced passives after passive primes significantly more frequently than after active primes during communicative priming activities (e. g., Kim and McDonough 2008). Additionally, studies which adopted a pretest-posttest research design revealed that priming effects were sustained two weeks following the priming activities (e. g., McDonough and Kim 2009; McDonough and De Vleeschauwer 2012). Building on L1 structural priming studies, L2 priming studies have suggested that priming conditions such as the lexical boost between primes and targets (Kim and McDonough 2008), primes with explicit instruction (Shin and Christianson 2012), priming task types (Marsden et al. 2013) and the type frequency of targets (McDonough and Kim 2009) impact the occurrence of priming or the subsequent production of target structures. Furthermore, learner factors such as proficiency (Kim and McDonough 2008), working memory (McDonough and Kim in press); and pattern detection ability (McDonough and De Vleeschauwer 2012); have also seen as mediating variables. Despite a growing interest in the role of priming conditions on the occurrence of L2 structural priming, the potential impact of prime repetition, which has received increasing attention in L1 priming research, remains an open question.

Previous L2 speech production studies which used communicative priming activities during face-to-face interaction have not followed the same research design and/or materials as in L1 priming studies (e. g., McDonough and De Vleeschauwer 2012; McDonough and Kim 2009). For instance, several studies have used communicative priming activities (i. e., pedagogical tasks with embedded primes) during interaction as a treatment condition. These studies

were carried out using a pre-post-delayed posttest study design to conduct between group comparisons for identifying the optimal priming conditions and/or within group comparisons for long-term effects of structural priming. Virtually all L2 priming studies have focused on whether priming facilitates the subsequent production of target structures.

Building on the implicit learning account of priming in the L1 speech production literature, it can be hypothesized that if priming facilitates L2 learners' access to abstract syntactic information based on exemplars in the input without consciousness, it may promote implicit learning (Ellis 2002). Furthermore, whether structural priming impacts learners' development of both comprehension and production of target structures has not been investigated. Situated within this line of research, the current study examines whether prime repetition facilitates the comprehension and production of target structure (i. e., English passives) for those who have not acquired form-meaning connections.

2 Prime repetition

In the classic picture description task created by Bock (1986) and used in numerous studies (e. g., Bencini and Valian 2008; Bock and Griffin 2000; Bock et al. 1992; Hartsuiker and Kolk 1998; Hartsuiker et al. 1999; Loebell and Bock 2003), participants hear and repeat a prime sentence prior to describing an unrelated, target picture using the verb provided. However, subsequent studies modified the task by eliminating repetition of the prime sentence so that participants only hear the prime sentences prior to describing the target picture (e. g., Bock et al. 2007), or by using a scripted interaction task in which participants hear an interlocutors' prime sentences but do not repeat them (Branigan et al. 2000; Branigan et al. 1995; Pickering et al. 2000). Bock and colleagues (Bock et al. 2007) reported priming effects without prime repetition that were similar to those found when participants repeated the prime sentences (Bock and Griffin 2000).

Some L1 priming researchers hypothesize that repeating primes in addition to merely hearing them during priming sessions may facilitate children's access to and use of abstract syntactic information, which in turn enhances priming effects (Shimpi et al. 2007). Thus they have carried out comparison studies that investigated whether or not repeating prime sentences is necessary for prime effects. For instance, Bock and colleagues (Bock et al. 2007) reported priming effects using the modified picture difference task, i. e., without prime repetition,

that were similar to those found when participants repeated the prime sentences (Bock and Griffin 2000). Huttenlocher et al. (2004) compared whether the priming effect varied depending on whether the four- and five-year old child repeated the researcher's sentence (i. e., production to production priming) or simply listened to it (i. e., comprehension to production priming) using transitives and datives. The results showed that the priming effect was similar in size whether or not the child repeated the priming sentence. Savage et al. (2003) also reported similar findings with 4-year-old children. Their results suggest that there was no difference in the priming effects between production to production priming and comprehension to production priming. In sum, the findings of previous L1 studies have shown that there is no apparent difference in the strength or persistence of structural priming based on prime repetition for adults and older children.

However, with three-year-old young children, some researchers found benefits for prime repetition (Shimpi et al. 2007). For instance, Shimpi et al. (2007) examined whether priming effects exist with both 3- and 4-year old children targeting both active/passive for transitive and double-object/prepositional for datives. Whereas four-year-old children showed priming effects in both transitive and dative conditions, three-year-old children showed more significant priming effects when they were asked to repeat the primes. Consequently, previous research suggested that whereas there is no apparent difference in the strength or persistence of structural priming in the two contexts for adults and older children (Bock et al. 2007; Huttenlocher et al. 2004; Savage et al. 2003), studies with younger children (Shimpi et al. 2007) reported that repeating the primes facilitate their access to abstract syntactic representations due to the benefit of additional "task demands" (p. 1334).

If repeating the primes benefit young children, does the same procedure also promote L2 learners' access to syntactic information? In L2 structural priming research, the role prime repetition has not been widely addressed. However, L2 adult priming studies have similarly shown that prime repetition is not necessary for priming to occur (e. g., McDonough 2006 for prepositional datives). In addition, previous L2 studies that provided priming activities with models of only one target structure positively impacted participants' subsequent production even though they did not require repetition of prime sentences (e. g., McDonough and Kim 2009; McDonough and De Vleschauer 2012). One possible factor that could impact whether prime repetition influences L2 speakers' production of target structures is their previous knowledge of that structure. Shimpi et al. (2007) suggested that exposure and repetition may play a larger role in very young children's access to and use of syntactic information compared to older children. According to Shimpi et al., this might be because although younger learners possess abstract syntactic

representations to some extent, there are limits in their ability to access this information for production. Thus specific priming conditions which can strengthen priming effects through getting additional exposure to exemplars in the input and/or storing the information in the short-term memory such as repetition procedure would facilitate the activation process.

Based on previous L1 studies with young children who have different levels of syntactic knowledge, L2 learners' knowledge of target structure, rather than their overall proficiency, is expected to be associated with the role of prime repetition in structural priming effects. Although McDonough (2006) did not show the benefits of prime repetition, the participants in her study were adult international students in the US. Thus whether or not learners with limited knowledge of target structures would benefit from prime repetition needs to be further investigated. With regard to subsequent learning effects, because previous L2 priming studies have focused on the production of target structures, they used oral production pretest to demonstrate a lack of production knowledge prior to priming activities (e. g., McDonough and Kim 2009; McDonough and De Vleeschauwer 2012). Methodologically speaking, in order to demonstrate learners' preexisting syntactic knowledge, both comprehension and production tests are necessary.

Furthermore, although previous L2 priming studies have shown priming effects in the subsequent production of the target structures, how structural priming affects L2 learners' comprehension of target structure has not been investigated. Thus an additional avenue of research that has potential to shed light on the relationship between production and comprehension concerns the impact of structural priming on speakers' comprehension of target structures. Bencini and Valian (2008) explored this issue by testing whether carrying out production to production priming activities with repetition of the prime sentences impacted both the production and comprehension of English passives by 3-year old L1 children. Whereas the children who were primed with passives produced significantly more passives than those who were primed with actives, there were no differences in their comprehension of passive constructions.

3 Purpose of the study

In sum, previous L1 research in production and comprehension priming suggests that repetition of prime sentences facilitates young children's access to and use of target structures because it requires storage in short-term memory and provides additional exposure to the target structure. Although previous L2 studies with adult learners did not show clear evidence of the benefits of

prime repetition, these studies focused only on oral production. These studies also have not explored whether prime repetition facilitates comprehension or production of target constructions by L2 learners who have incomplete knowledge of the target structure. It is possible that L2 learners who have less-developed syntactic representations, like young L1 acquirers, may also benefit from priming tasks that include repetition of prime sentences. Furthermore, despite the potential links between the comprehension and production systems, only one study to date (Bencini and Valian 2008) has investigated whether carrying out production priming activities also facilitates comprehension of target constructions. Therefore, the purpose of the current study was to compare the effectiveness of communicative priming activities with and without prime repetition on promoting production and comprehension of English passives by L2 learners with limited knowledge of the target structure. The current study was guided by the following three research questions:

- (1) Does prime repetition impact Korean EFL learners' immediate production of passives during communicative priming activities?
- (2) Does prime repetition impact Korean EFL learners' subsequent comprehension of passives?
- (3) Does prime repetition impact Korean EFL learners' subsequent production of passives?

4 Method

4.1 Design of the study

The current study used a pretest-immediate posttest-delayed posttest design to compare the effectiveness of prime repetition on EFL learners' comprehension and production of English passives. The independent variable was prime repetition, and participants were randomly assigned to carry out the treatment activities (i. e., communicative priming activities) according to three conditions: a) passive prime sentences with repetition (repetition group), b) passive prime sentences without repetition (no repetition group), and c) active prime sentences (comparison group). The repetition group repeated the researcher's passive prime sentences prior to generating their own sentences from the prompts. In contrast, the no repetition group generated sentences from the prompts without repeating the researcher's passive primes. Finally, the active comparison group was not exposed to any passives during the treatment activities. The dependent variables were the number of passives produced during treatment sessions (RQ1) as well as comprehension

(RQ2) and production (RQ3) of English passives. Comprehension was operationalized as the accurate selection of the picture that correctly corresponded to the meaning of passive sentences, using a forced-choice aural comprehension test. Production was operationalized as use of passive constructions while carrying out the oral production test tasks during the pretest, immediate and delayed posttests.

4.2 Participants

A total of 82 Korean EFL university learners (24 men and 58 women) enrolled in a variety of undergraduate programs (Education, English Literature, Social Sciences) were recruited for the initial participant pool. They ranged in age from 18 to 26 years, with a mean of 20.6 years ($SD=1.96$). All participants took at least six years of mandatory English classes at their junior high and high schools (three hours per week). Approximately 23 students reported that they have studied other languages in addition to English, which included Japanese, Chinese and German.

The current study focused on the role of prime repetition on the comprehension and production of English passives by L2 speakers who have not yet fully acquired the passive construction. In order to select participants with incomplete knowledge of passives, the pretest results were used to establish inclusion criteria. Participants' preexisting knowledge of the English passive was assessed through a forced-choice aural comprehension test that had a total of 12 items as well as an oral production task (see methods and results sections for further information about the tasks). The results of the comprehension test showed that the average score was 6.33 ($SD = 3.19$) and the median was 6.00 out of a total possible score of 12 (min = 1, max = 12). With regard to the production test, the mean number of passives on the pretest was .16 ($SD = 0.46$) out of 13 picture prompts. The mean and median of the comprehension test scores was used as a cut-off score of the inclusion category, because almost all participants produced one or zero passives on the pretest. As a result, only 50 learners (16 males, 34 females, average age = 20.2) who scored 6 or lower on the comprehension pretest were included in the final participant pool (repetition = 14, no repetition = 17, active comparison = 19). Since all of the students who were majoring in English Literature were eliminated due to their high comprehension scores, none of the final participants were studying English at the time of data collection.

4.3 Target structure

The target structure was the English passive construction, which has been widely used in L1 structural priming studies because adult speakers alternate between

passive and active constructions. However, young L1 speakers and L2 learners may have difficulty processing and producing passives during spontaneous oral communication or may underuse them compared to more proficient speakers (Kim and McDonough 2008; Bencini and Valian 2008). Because passives are a later-acquired form, L1 acquisition researchers have targeted alternation between actives and passives as a way to investigate the relationship between priming and language development (e. g., Huttenlocher et al. 2004; Kidd 2012; Messenger et al. 2012).

Because our participants were adult learners who already acquired passives in their L1, (i. e., Korean), it is necessary to explore the differences between Korean and English passive constructions. In English passives, the patient serves the grammatical subject followed by auxiliary *be*, a lexical verb in the past participle form, and optional *by*-phrase with the agent. Turning to the participants' first language, passives in Korean consist of subject (recipient) + agent + particle (*by*) + verb (with passive suffix) (Lee and Ramsey 2000). Examples (1) and (2) show Korean active and passive constructions. To form a passive in Korean, the object of an active sentence is first changed to the subject of the passive sentence. And the transitive verb is passivized by adding one of the four variants in the passive suffix (i. e., *-i-*, *-hy-*, *-li-*, or *-ki-*) to the verb stem. The main function of the passive particle is to trigger alternation between the subject/object and the agent/theme role in the corresponding active/passive forms. Thus, the argument structure of the active sentence (1) is syntactically and semantically altered by the passive particle '**-hy-**' in the passive (2). Then the subject of the active sentence is made the agent phrase with a locative marker (e. g., **-hanthey**). While a passive marker is obligatory and serves a crucial role in passive construction in Korean, the agent phrase followed by a locative particle can be omitted unless necessary in the context.

(1) Korean Active

순경이 그 도둑을 잡았다
 swunkyeng-i ku totwuk-ul cap-ass-ta
 police-NM the thief-AC catch-PST-DC
 "The police caught the thief."

(2) Korean Passive

그 도둑이 순경한테 잡히었다.
 ku totwuk-i swunkyeng-**hanthey** cap-**hy**-ess-ta
 The thief-NM police-DAT catch-PAS-PST-DC
 "The thief was caught by the police."
 (example adapted from Sohn 1999)

Note: Abbreviations for glosses are: AC (accusative case particle), DC (declarative sentence-type suffix), DAT (dative particle), NM (nominative case particle), PAS (passive suffix), PST (past tense and perfect aspect suffix)

Korean EFL learners often have difficulty using the passives correctly or avoid using them during conversation (Adler 2012). For example, these participants produced passive constructions on the pretest with omitted auxiliary *be* (e. g., *the sign smashed by the car*), reversed agents and objects (e. g., *the car smashed by the sign*), and incorrect verb forms (e. g., *the baby was scaring by the bird*).

4.4 Materials

4.4.1 Comprehension tests for passives

The comprehension tests consisted of an aural forced-choice picture identification task that was administered through DMDX. Each test contained 30 items: 12 passive targets and 18 fillers, which were sentences with relative clauses, dative constructions, or prepositional phrases of location (six items of each type) (see Appendix A for a list of target passive items). The length of the passive targets and fillers ranged from eight to 10 syllables. The verbs and nouns used in the passive items were checked for occurrence on the General Service List (West 1953; adapted by Baumann and Culigan 1995) to increase the likelihood that the learners would be familiar with their meaning and use. None of the nouns used as agents or patients were repeated across the tests, and none of the verbs were included in the treatment activities or production tests.

For each comprehension test item, learners listened to a sentence (e. g., *The boy is pushed by his sister.*) and selected the picture that corresponded to its meaning as quickly as possible by pushing a button on a keyboard (i. e., Letter A and Letter B options were marked on a keyboard). Following Bencini and Valian (2008), the passive targets involved pictures of reversible events. For example, as shown in Figure 1, the target item *the boy is pushed by his sister* was paired with pictures of a girl pushing a boy and a boy pushing a girl. Thus learners were asked to choose one option out of two pictures.

In order to control the plausibility of the scenarios depicted in the pictures, only animate nouns were used as the agents and patients. To ensure that the learners had enough time to process the picture cues, the sentences were provided approximately 1,500 millisecond after the pictures appeared on the computer screen. Then, learners were given a 7,000 milliseconds to answer each item.

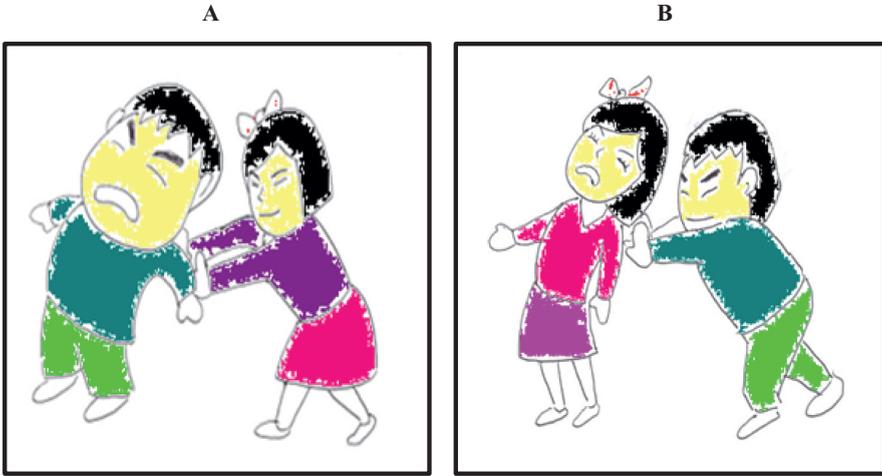


Figure 1: Sample comprehension test item.

4.4.2 Production tests for passives

In order to test learners' use of English passives before and after treatment sessions, three versions of oral production tests were designed to elicit learners' production of English passives in the absence of any passive models. The production tests consisted of one-way information-gap picture description activities with 13 prompts (noun + verb) used to describe events illustrated in pictures. The oral production tests involved learner-researcher interaction. For instance, the researcher's materials consisted of people pictures and activity pictures, and the learner's task was to describe the events using prompts so that the researcher could correctly match the people with their corresponding activities. None of the verbs used in the priming activities were included in the tests.

4.4.3 Treatment activities

Following previous face-to-face interaction-oriented L2 priming studies (e. g., Kim and McDonough 2008; McDonough and De Vleeschauwer 2012; McDonough and Kim 2009), the current study used communicative activities which were carried out between the first researcher and a learner. The treatment materials were six information-exchange activities in which the learners and the

researcher shared information in order to achieve a non-linguistic outcome. Three communicative activity types were selected and adapted from ESL activity books (Obee 1999; Zaorob and Chin 2001), and two activities of each type were created. Appendix B provides a summary of the three interactive priming activity types and the list of verbs used in the primes and prompts. During the three activities, the passive treatment groups (i. e., the prime repetition and the no repetition groups) received a total of 38 passive primes (e. g., snowmen are created by children) aurally and 38 prompts (Noun/Verb or Verb/Noun), and the comparison group received 38 active primes aurally (e. g., children created snowmen) and 38 prompts (Noun/Verb or Verb/Noun).

The first activity type, *Day at home*, involved the participants and the researcher describing activities undertaken by family members in various locations throughout their house and yard. The goal, similar to checkers, was to place game pieces on three adjacent squares of a game board without being blocked by the other player. A game piece could be placed in a square if the player described an event that could happen in that room or area of the yard. A total of 18 primes (e. g., *the counter was wiped by Bob vs. Bob wiped the counter.*) and 18 prompts (e. g., *wood/stack*) were provided on the *Day at home* game cards, which were divided equally between the two activities. The second priming activity type, *What on earth?*, involved an exchange of information about the function of objects and work duties associated with different occupations. The goal was to accumulate as many points as possible by describing objects or occupations that had varying point values as illustrated on a game board. Each of the two *What on earth?* activities provided seven primes (e. g., *strollers are used by mothers versus mothers use strollers*) and seven prompts (e. g., *books/write*) on game cards. The third activity type, *Wildlife facts*, was based on the exchange of information about the physical features and behavior of unusual animal species. The goal was to accurately guess as many animal species as possible based on a partner's descriptions. A total of six primes (e. g., *Small pets are chosen by their mothers vs. their mothers choose small pets.*) and six prompts (e. g., *bury/eggs*) were evenly divided between the two *Wildlife facts* activities.

For all of the activities, the learners and the researcher received game cards that provided prompts in the form of noun/verb or verb/noun pairings which they placed on the game boards when they produced sentences using the prompts. However, the researcher also had a script with complete prime sentences that she referred to while carrying out the activities in order to provide consistent primes to all learners. Additionally, the verbs in the learners' prompts were different from those used in the researcher's prime sentences in order to avoid the lexical boost. All three groups (i. e., passive prime repetition, passive prime without repetition, active primes) used the same materials with the same verbs and nouns.

4.4.4 Pilot study

In order to determine whether both priming materials and testing materials were appropriate for the participants' English proficiency, a pilot study was conducted with a total of 5 Korean EFL students studying at the same university. We focused on examining whether the sentences and pictures were clear, and whether the time length for each item was reasonable. Based on the pilot participants' feedback, some pictures were modified to improve clarity, and some verbs were replaced with more frequently used verbs in the priming materials.

4.5 Procedure

All participants in the current study scheduled three individual sessions with the first researcher over a four-week period. In week one, they completed the passive comprehension test and production pretest (20 minutes) and carried out the first set of priming activities (40 minutes). In week 2, they carried out another set of priming activities (40 minutes) and the immediate production and comprehension posttest (20 minutes). Two weeks later, the learners completed the delayed production and comprehension posttest (20 minutes) and a background questionnaire (20 minutes). In order to avoid any ordering effects, the order of the priming activities was counterbalanced, as was the order of the oral production and comprehension tests. All interaction between the researcher and the learners was digitally recorded using mp3 recorders.

All three groups followed the same procedure and the only difference among the three groups was the priming condition: (1) The repetition group repeated the passive primes produced by the researcher prior to producing his/her own sentences using prompts (verb + noun, noun +verb); (2) The no repetition group did not repeat the researcher's passive primes prior to producing sentences from the prompts; and (3) the active comparison group received only active primes.

4.6 Data coding and analyses

4.6.1 Comprehension tests

In terms of accuracy, each target passive item was scored dichotomously: one point for selecting the picture that corresponded to the sentence and

no points for selecting the incorrect picture. DMDX automatically scored the comprehension test responses. The reliability of each test was assessed with Cronbach's alpha. The internal consistency for the three tests was .90, .84, and .80. This shows that all items included in each version of oral production tests worked consistently to measure learners' comprehension of passive constructions.

4.6.2 Treatment activities and production tests for passives

The audio-recordings of the priming activities and the production tests were transcribed by a research assistant and checked by the first researcher. The participants' sentences were classified as passive if they had a patient in subject position followed by a verb phrase consisting of *be* + lexical verb, and an optional *by* phrase that expressed the agent. When classifying the learners' sentences as passives, morphological errors involving number, tense, and aspect agreement features were not considered. For example, the sentences *boredom is experienced by John* and *teeth was brushed by Dan* were both classified as passives even though the latter has a subject-auxiliary verb agreement error. Active sentences were defined as sentences in which the agent was expressed as the subject, and the patient was expressed as the object (e. g., *Jessica wrapped present, Bob's grandfather swallowed medicine*). All other responses were classified as other, which included sentences with the copula (e. g., prompt = pocket/empty: *Bill's pocket was empty*), sentences in which the noun and verb provided in the prompt were in separate clauses (e. g., prompt = stress/suffer: *Kevin suffers from his job, because it has very stress*). Both researchers scored 20% of the production data independently, and their simple percentage agreement was 94% (Cohen's kappa = 0.82). The ten disagreements involving passives (out of a total of 611 coding decisions) were resolved through discussion. Each sentence with a passive construction produced during the oral production tests was given one point for the statistical analyses.

4.6.3 Prime repetition

In order to ensure that the learners in the repetition group repeated the primes as instructed, the repetition of primes was analyzed. Their attempts to repeat the prime sentences were classified as verbatim repetition or constituent repetition following Bencini and Valian (2008). Verbatim repetition was operationalized as exact reproduction of the prime including inflectional morphology without any

noun or verb substitutions (e. g., prime = *the shades are lowered by Susie*. learner repetition: *the shades are lowered by Susie*). Constituent repetition was defined as reproduction of the key elements of a passive prime, but with some modifications to the verbal morphology (learner repetition: *the shade is lowered by Susie* and *the shades are lower by Susie*) or noun phrases (learner repetition: *shades are lowered by Susie* and *shade are lowered by Susie*). A third category, missing constituent, was created to classify repetitions in which learners omitted a key element of the passive primes, such as an auxiliary verb (e. g., *the shade lowered by Susie*) or an agent (*the shades are lowered*). Both researchers coded 20 % of the repetition data independently. Simple percentage agreement between their coding was 98 % (Cohen's kappa = 0.94), and disagreements were resolved through discussion.

5 Results

5.1 Preliminary results

In order to ensure that treatment activities were implemented as intended, the learners' repetition of prime sentences was analyzed. The prime repetition group produced verbatim repetitions for 76 % ($M = 28.86$) of the prime sentences (total = 38) and constituent repetitions for 24 % ($M = 9.14$) of the prime sentences. This indicated that the repetition group learners repeated the key elements of the passive primes successfully during the treatment activities.

5.2 Immediate production of passives during communicative priming activities

The first research question asked whether prime repetition affected L2 speakers' immediate production of passives. Because 38 prime and prompt pairs were provided in the current study, the maximum number of passives that could be produced by learners during priming activities was 38. Table 1 summarizes the number of passive, active, and other constructions produced by learners during the treatment activities.

The repetition group produced a total of 27.21 passives, whereas the no repetition group produced 20.71 passives during priming activities. The comparison group did not produce any passives during priming activities.

Table 1: Immediate production of passive, active and other constructions.

	Repetition (<i>n</i> = 14)		No repetition (<i>n</i> = 17)		Active comparison (<i>n</i> = 19)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Passive	27.21	9.32	20.71	11.08	0.00	0.00
Active	8.57	8.91	9.53	8.74	35.53	2.67
Other	2.21	2.58	7.77	7.30	2.47	2.67

The results of one-way ANOVA revealed that there were significant differences in the number of passives among the three priming conditions, $F(2, 47) = 52.496$, $p < 0.001$, partial $\eta^2 = 0.69$, with 69 % of the between-subjects variance accounted for by priming condition (Brown 2008). Bonferroni post-hoc analyses indicated that both repetition and no repetition groups produced significantly more passives than the comparison group ($p < 0.001$); however, no difference was found between the repetition and the no repetition groups, ($p = 0.09$).

5.3 Subsequent comprehension of passives

The second research question asked whether prime repetition affects Korean EFL learners' subsequent comprehension of passives. Table 2 shows the results of comprehension test scores on pretest, immediate posttest and delayed posttest. The total possible score on each of the comprehension tests was 12.

Table 2: Comprehension of passives.

	Repetition (<i>n</i> = 14)		No repetition (<i>n</i> = 17)		Active comparison (<i>n</i> = 19)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Pretest	4.36	1.49	4.06	1.48	3.69	1.34
Immediate posttest	8.14	3.46	8.06	2.69	3.69	2.87
Delayed posttest	7.86	2.96	7.41	2.94	4.47	2.67

As shown in Table 2, all three groups scored similarly on the pretest: 4.36 (repetition), 4.06 (no repetition) and 3.69 (comparison). A mixed ANOVA with

time as the within-groups variable and priming condition as the between-groups variable was carried out to compare their performance across time. The results showed a significant main effect for time [$F(2, 94) = 26.220$, $p < 0.001$, partial $\eta^2 = 0.36$] and priming condition [$F(2, 47) = 11.943$, $p < 0.001$, partial $\eta^2 = 0.34$], and a significant interaction effect between time and condition [$F(4, 94) = 5.671$, $p = 0.001$, partial $\eta^2 = 0.19$]. Effect sizes indicate that approximately 36% of variance in comprehension scores was accounted for by time, while 34% of variance was accounted for by priming condition (Brown 2008). Additionally, 19% of variance in comprehension scores was explained by the interaction between time and priming conditions along with the associated error variance.

In order to understand the interaction effects between time and group, treatment groups' comprehension test scores for each test were examined. The results showed that no significant difference among the three groups was found on the pretest, $F(2, 47) = 0.913$, $p = 0.408$, partial $\eta^2 = 0.03$, whereas a significant group difference was found on the immediate posttest, $F(2, 47) = 12.875$, $p < 0.001$, partial $\eta^2 = 0.35$. The effect size suggests that approximately 35% of variance in the immediate posttest scores was explained by priming conditions. Bonferroni post hoc analyses revealed that both repetition and no repetition groups outperformed the comparison group on the immediate posttest ($p < 0.001$, $p < 0.001$, respectively); however, no difference was found between repetition and no repetition groups ($p > 0.001$). Similarly, on the delayed posttest, a significant difference was found among the three groups, $F(2, 47) = 7.262$, $p = 0.002$, partial $\eta^2 = 0.24$, and both repetition and no repetition groups outperformed the active comparison group ($p = 0.004$, $p = 0.010$, respectively).

The longer-term effect of the structural priming was measured by the delayed posttest, which was conducted two weeks after the immediate posttest. With regards to the time effect for each group, whereas no significant change over time was found for the active comparison group, $F(2, 36) = 1.07$, $p = 0.354$, partial $\eta^2 = 0.05$, both repetition and no repetition groups showed significant time effects, $F(2, 26) = 12.75$, $p < 0.001$ partial $\eta^2 = 0.49$, $F(2, 32) = 18.74$, $p < 0.001$ partial $\eta^2 = 0.54$, respectively. The comprehension test scores of both repetition and no repetition groups significantly increased from the pretest to the immediate posttest ($p < 0.001$, $p < 0.001$, respectively). Furthermore, they maintained the gain at the delayed posttest: Bonferroni post hoc analyses revealed that there was a significant difference between the pre- and delayed posttest ($p = 0.007$ for the repetition group, $p = 0.001$ for the no repetition group).

5.4 Subsequent production of passives

The third research question addressed the role of prime repetition in Korean EFL learners' subsequent production of passives. Table 3 provides the results of production test scores on pretest, immediate posttest and delayed posttest.

Table 3: Subsequent production of passives.

	Repetition (<i>n</i> = 14)		No repetition (<i>n</i> = 17)		Active comparison (<i>n</i> = 19)	
	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>	<i>M</i>	<i>SD</i>
Pretest	0.29	0.47	0.12	0.33	0.05	0.23
Immediate posttest	8.43	4.05	4.47	3.02	0.11	0.32
Delayed posttest	6.71	4.53	3.29	4.54	0.05	0.23

Because each passive construction produced was given one point, a total possible point of each production test was 13. As shown in Table 3, learners produced an average of less than one passive construction on pretest: 0.29 (repetition), 0.12 (no repetition) and 0.05 (active comparison). A mixed ANOVA was carried out with time as a three-level, within-groups factor (pretest, immediate posttest, and delayed posttest) and priming condition as a three-level, between-groups factor (prime repetition, no repetition, and active comparison). The results showed a significant main effect for time [$F(2, 94) = 45.77, p < 0.001$, partial $\eta^2 = 0.49$] and group [$F(2, 47) = 30.685, p < 0.001$, partial $\eta^2 = 0.57$], and a significant interaction effects between time and group [$F(4, 94) = 14.51, p < 0.001$, partial $\eta^2 = 0.38$]. These findings suggest that about 49% of variance in production test scores was accounted for by time, and 57% of variance was explained by priming conditions. Additionally, 38% of variance in production test scores was explained by the interaction between time and priming conditions.

In order to understand the interaction effects between time and priming condition, group differences at each test were examined. There were no significant difference in the number of passives among the three groups at the pretest, $F(2, 47) = 1.902, p = 0.161$, partial $\eta^2 = 0.07$. However, a significant group difference was found at the immediate posttest, $F(2, 47) = 36.813, p < 0.001$, partial $\eta^2 = 0.61$. Bonferroni post hoc analyses revealed that both repetition and no repetition groups outperformed the active comparison group on the immediate posttest ($p < 0.001, p < 0.001$, respectively). With regard to the prime repetition effects, the repetition group outperformed the no repetition group ($p = 0.001$) on

the immediate posttest. Similarly, at the delayed posttest, a significant difference was found among the three groups, $F(2, 47) = 14.149$, $p < 0.001$, partial $\eta^2 = 0.37$. Bonferroni post hoc analyses revealed that both repetition and no repetition groups outperformed the active comparison group ($p < 0.001$, $p = 0.027$, respectively). Furthermore, the repetition group outperformed the no repetition group on the delayed posttest ($p = 0.032$).

A longer-term learning effect of prime repetition on the subsequent production of passives was measured by the delayed posttest. Similar to the comprehension test results, the active comparison group did not show any significant differences between their scores at each test, $F(2, 36) = 0.321$, $p = 0.727$, partial $\eta^2 = 0.02$. Both repetition and no repetition groups showed significant time effects, $F(2, 26) = 26.76$, $p < 0.001$ partial $\eta^2 = 0.67$, $F(2, 32) = 11.94$, $p < 0.001$ partial $\eta^2 = 0.43$, respectively). These results suggest that approximately 67% (repetition group) and 43% (no repetition) of variance in delayed posttest results were explained by time effects. Bonferroni post hoc analyses indicated that the repetition group showed significant improvement between the pretest and immediate posttest and between the pretest and delayed posttest ($p < 0.001$ and $p < 0.001$, respectively). Similarly, the no repetition group showed improvement in their production of passives from the pretest to the immediate posttest ($p < 0.001$), as well as from the pretest to the delayed posttest ($p = 0.036$), suggesting that they maintained the gain at delayed posttest.

6 Discussion

The current study examined the effect of prime repetition on EFL Korean learners' comprehension and production of English passives. Overall, the results revealed that priming facilitated the participants' immediate and subsequent production of passives. These findings suggest that providing L2 speakers with prime sentences may "grow out of some kind of experience-dependent adjustment within a system that builds utterances" (Bock and Griffin, 2000: 178). This finding confirms previous L2 studies which also found that communicative tasks that provide primes during interaction had a positive impact on EFL learners' subsequent production (McDonough and Kim 2009; McDonough and De Vleeschauwer 2012).

One of the contributions of the current study was to investigate the role of priming effects on learners' comprehension of target structures, which have not been examined in previous L2 priming studies. Unlike Bencini and Valian

(2008), who found no priming effects on the development comprehension of passives among 3-year-old L1 children, the current study suggested a positive relationship between priming and comprehension of passive constructions. More specifically, the comprehension data indicated that both passive priming groups outperformed the active comparison group with no difference in their effectiveness.

The divergent findings may be related to differences between child L1 learners and adult L2 learners. The adult EFL learners in the current study had received explicit instruction about English passives in their previous English courses at junior high school and high school. Their prior courses emphasized the formal features of the passive construction, such as the use of correct auxiliary and lexical verb forms, rather than its meaning, and also often required them to memorize the order of each linguistic element in passive constructions. In addition, practice opportunities were based on manipulating the formal features of sentences, such as transforming active sentences into passive sentences, as opposed to practice in distinguishing the meanings of passive and active constructions. In contrast, the priming activities provided these EFL learners with opportunities to hear passive sentences in the input and help them focus on meaning of passive constructions, as opposed to their formal features, which facilitated greater comprehension. This situation contrasts with the environment of child L1 acquisition, in which primary experiences with language are largely meaning-oriented. Furthermore, as one of the anonymous reviewers suggested, while adult L2 learners already have conceptual understanding of passives through their L1, young children might not have the cognitive maturity to process and comprehend passives. In the current study, having prior conceptual knowledge of passives might have facilitated these adult L2 learners' ability to comprehend passives during the priming activities.

Our findings suggest that communicative priming activities may facilitate the development of English passives. In order to produce or understand a passive structure, a learner must learn that certain meaning relationships (patient having something done to it by an agent) map onto certain functional elements (subject and oblique objects), which map onto critical features of constituent sequences (Pickering and Ferreira 2008). Pickering and Ferreira claim that these mappings are incidentally acquired through experience (i. e., priming): hearing or producing passives strengthened the processing sequence that yield passives. Based on learners' improvement on their comprehension and production test scores after carrying out communicative priming activities, it can be assumed that these EFL learners, who had incomplete knowledge of passives, were able to further refine their understanding of the form-meaning

relationships of English passives. Furthermore, the results of the delayed posttest indicate that the improvement on both comprehension and production was sustained two weeks after the priming sessions. This suggests that priming effects persist as long as for two weeks, which is in line with the implicit learning account of priming.

With regards to the role of repetition, learners in both passive priming conditions (i. e., repetition and no repetition) showed improvement on their comprehension of passives, suggesting no significant advantage for repeating primes. What is notable in the current study was that learners maintained their comprehension knowledge even two weeks after the treatment sessions. The results raise the possibility that the priming activities helped the participants activate and further proceduralize the declarative knowledge that they may have obtained through their previous English instruction (DeKeyser 2007).

When taking the development of production of passives into consideration, the results provide a more complex picture. The findings of the current study suggested that similar to the previous L2 priming studies, prime repetition did not significantly impact the production of passives during priming activities (McDonough 2006). However, unlike prior studies involving older L1 children (Savage et al. 2003; Huttenlocher et al. 2004) and adult L2 learners (McDonough 2006), which reported no advantage for prime repetition, the current findings suggest that priming with repetition had a greater impact on learners' subsequent production. The divergence from the prior L2 study (McDonough 2006) may be due to differences in the target construction (passives versus datives) and the L2 participants' level of previous knowledge of target structures (lower proficiency EFL learners with limited knowledge on form-meaning connections of passives versus international students studying degrees in the US). Some evidence for the potential impact of proficiency also comes from L1 research with younger children which similarly reported the benefits for repetition of prime sentences (Shimpi et al. 2007) while there was no advantage of prime repetition in studies with older children (Savage et al. 2003; Huttenlocher et al. 2004). The current study focused only on the learners who had incomplete knowledge of passives, and in order to gain insights on the role of previous knowledge of target structures, future comparative studies are warranted with those who have different levels of knowledge of target structures.

When considering longer-term effects, prime repetition facilitated greater subsequent production of passives ($M = 6.71$) compared to no repetition conditions ($M = 3.29$) two weeks later. This finding is in line with studies with younger children (e. g., Shimpi et al. 2007) which revealed that the priming effects for

younger children who have not developed their ability to represent abstract syntactic forms were dependent on prime repetition. However, what was noticeable was that in terms of longer-term learning effects, both repetition and no repetition group maintained their gains on the delayed posttest compared to their scores on the pretest. Whereas exposure to passive primes was beneficial regardless of prime repetition for comprehension, prime repetition seemed more beneficial than no repetition in terms of subsequent production. The current study can only provide evidence of priming effects after two weeks, and in order to further examine the long-term effects, more studies with multiple delayed posttest are needed.

Unlike adult L1 speakers, who show ceiling effects when repeating prime sentences (Bock and Griffin 2000), child L1 speakers tend to omit various sentence constituents and grammatical morphemes when repeating passive prime sentences (Bencini and Valian 2008). Similarly, the L2 speakers in the current study also omitted grammatical morphemes (i. e., constituent repetition) or sentence constituents (i. e., missing elements like *be* verbs) for approximately 24% of the prime sentences when repeating the prime sentences. It is possible that prime repetition helps less proficient speakers with incomplete knowledge of target structures establish or reinforce representations of structural forms at an abstract level, which then facilitates production of target constructions in a more complete manner. In other words, the learners' own repetition of the primed sentences in the current study may have provided the benefit of additional exposure in activating abstract syntactic information, which might promote restructuring target features in their interlanguage system (Shimpi et al. 2007). Previous L2 studies suggested that learners' familiarity and knowledge of the target structure may mediate their production during priming activities (e. g., Trofimovich, McDonough and Neumann 2013). Our findings demonstrated that for learners who have limited form-meaning mappings, the syntactic form may be represented at some general level, and yet can be further strengthened through production (i. e., prime repetition) compared to comprehension only processes, particularly for the subsequent production of passives.

One of our main goals of the current study was to explore the potential links between prime repetition and comprehension of passives, which has not been investigated in L2 literature. Overall, the findings of the current study indicated that exposure to passive primes promoted the improved comprehension regardless of prime repetition. However, it is important to note that the current study did not include a treatment condition that involved comprehension of passives only without opportunities to produce passives. Future studies might investigate whether simply hearing prime sentences also positively impacts learners' subsequent comprehension or production of target constructions. This would provide more insights into the transient activation model of priming.

The current study has several limitations that should be acknowledged. First, the study examined a construction (passives) in a language (English) which has been widely studied in L1 priming research and previously examined in L2 priming research. In order to broaden the empirical base of L2 priming research, future studies might target a wider variety of constructions and languages. In the current study, we focused on L2 learners who have limited knowledge of passive constructions. The inclusion of advanced L2 learners and/or native speakers as comparison groups would have provided further insights on the role of different levels of previous knowledge of target structure as a mediating factor. Additionally, previous L2 structural priming research has suggested that cognitive factors such as pattern detection may mediate the relationship between structural priming and the learners' subsequent production of target structures (e.g., McDonough and De Vleeschauwer 2012). Future research might investigate to what extent learners with different cognitive profiles benefit from structural priming activities that include repetition of prime sentences. Repetition may be particularly beneficial for learners who are less able to detect structural patterns in auditory input. For these learners, simply hearing prime sentences may not be sufficient to promote detection of the prime sentences' underlying structural similarity. Studies that examine the relationships among cognitive abilities relevant to the detection and processing of auditory input, such as phonological memory, auditory pattern detection, and working memory, may help identify the most effective priming activities for learners with diverse aptitude profiles.

In the current study, we did not have specific measures to determine whether the participants were engaged in implicit or explicit learning processes. However, despite the absence of any explicit information about the passive construction, these participants did improve their comprehension and production of passives over time, which is compatible with the implicit learning account of structural priming. Nevertheless, it is possible that learners' overt attention was drawn to the passive construction as a result of hearing and repeating the prime sentences. It is also possible the participants employed a conscious strategy to reuse the structures produced by the researcher. In order to expand our knowledge on the relationship between structural priming and implicit learning with L2 learners, future studies could collect retrospective data such to explore whether learners had any awareness of the target structure. Furthermore, future studies might manipulate the number of fillers or distractors in order to explore implicit learning account of structural priming more narrowly.

Finally, structural priming appears to operate at the level of the presence/absence and order of constituents in an utterance. For the passive construction, this entails placing the patient in the subject position, using a verb phrase consisting of *be* + lexical verb, and including an optional *by*-phrase with the

agent. Because structural priming may be less sensitive to morphological features, carrying out priming activities may have little impact on the accuracy of L2 learners' verbal morphology and agreement features. Future studies might explore which types of interventions also help learners produce target constructions accurately (e. g., Marsden et al. 2013). Our ongoing research focuses on this issue, and aims to identify how to maximize the benefits of structural priming activities in L2 learning so that L2 learners are able to produce target constructions with accurate morphological features.

7 Conclusion

To conclude, the current study provided additional insights into our understanding of the role of structural priming in L2 learners' comprehension and production of syntactic structures. Communicative priming activities facilitated learners' immediate and subsequent production as well as their comprehension of passives over time, which supports previous L2 priming studies (McDonough and De Vleeschauwer 2012; McDonough and Kim 2009). With regards to the role of prime repetition, the results revealed that EFL learners improved their comprehension of passives regardless of prime repetition. However, prime repetition facilitated subsequent production of English passives. The findings of the current study suggest that priming activities could help learners to acquire form-meaning mappings of complex structures, and prime repetition could facilitate the long-term learning effects of structural priming, particularly for the production of target structures.

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Appendix A

A List of Target Passives on the Comprehension Tests

Version 1	Version 2	Version 3
1. The horse is kicked by the zebra.	1. The fireman is attacked by the cat.	1. The panda is colored by the monkey.
2. The pig was followed by the hen.	2. The duck was led by the penguin.	2. The tourist is chased by the seagull.
3. The boy is pushed by his sister.	3. The hero is killed by the robber.	3. The aunt is assisted by her niece
4. The turtle was carried by the sheep.	4. The alligator is watched by the bird.	4. The chicken was scared by the crow.
5. The octopus is grabbed by the shell.	5. The prince is slapped by the princess.	5. The hamster is touched by the baby.
6. The wrestler is helped by his girlfriend.	6. The grandson is found by his grandmother.	6. The king was kissed by his daughter
7. The puppy was licked by the kitten.	7. The uncle was rescued by his nephew.	7. The boxer is punched by the kangaroo.
8. The elephant was washed by the worker.	8. The mom was tickled by her kid.	8. The dog was bitten by the snake.
9. The SUV was passed by the taxi.	9. The chef was surprised by the mailman.	9. The motorcycle was hit by the bus.
10. The policeman is shot by the robber.	10. The bear is lifted by the tiger	10. The husband was fed by his wife.
11. The sun is hidden by the cloud.	11. The surgeon is hugged by the nurse.	11. The brother was spanked by his sister.
12. The skier was crushed by the snowboarder.	12. The fisherman is eaten by the fish.	12. The father was awakened by his child.

Appendix B

Priming Materials

Task type	Day at Home	What on earth	Wildlife facts
Content focus	Household activities	Function of objects and occupations	Habits of animals
Objective	Describe an activity undertaken by a family member in a specific area of the house or yard shown on a game board	Describe the function of an object or an occupation illustrated on a game board	Describe the physical characteristics of unusual animal species
Outcome	“Win” by placing game pieces in three adjacent horizontal, vertical, or diagonal squares on the game board before their partner	“Win” by placing game pieces on squares on the game board that have greater point values than their partner’s squares	“Win” by successfully guessing the name of more animal species than their partner
Prime verbs	Close, cover, cut, dust, fill, flush, hang, install, lay out, lock, lower, mow, pile, place, soak, tie, turn on, wipe	Fly, keep, lose, perform, prefer, produce, protect, provide, seal, sell, sharpen, ship, use, want	Choose, cross, hatch, reduce, release, utilize
Prompt verbs	Build, clean, clear, cook, dry, drain, fold, grow, leave, make, pack, plant, read, remove, stack, store, sweep, turn off	Bake, brew, buy, catch, create, drink, hunt, mix, pack, point, receive, sell, wear, write	Bury, climb, dig, give, hold, locate

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