Recognition of Korean V-V Compounds —The Light Verb Effect*

Hyun Kyoung Jung
(University of Arizona)

Jung, Hyun Kyoung. (2013). Recognition of Korean V-V Compounds —The Light Verb Effect. *The Linguistic Association of Korea Journal, 21*(2), 89-113. The masked priming experiment conducted in the present study shows that two types of V-V compounds in Korean have different lexical representations. Syntactic V-V compounds, whose second constituent is considered to be a light verb, are stored and accessed decompositionally. In contrast, lexical compounds, whose two constituent verbs are both fully lexical, are stored as a whole unit. Additionally, the reaction times for syntactic V-V compounds were faster than lexical V-V compounds regardless of the presence of primes. The findings from this study suggest that verbal compounds have a different status from nominal compounds (e.g. Ko et al. 2011) in the mental lexicon and are at odds with the results of Marslen-Wilson et al. (2008), who found an early effect of morphological decomposition irrespective of semantic factors.

Key Words: V-V compounds, serial verbs, light verb, auxiliary verb, lexical access, morphological priming, Korean

1. Introduction

The central question raised in the psycholinguistic studies on morphologically complex words is whether they are stored as a whole unit in the mental lexicon or their constituent morphemes are accessed separately. Three

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representative approaches to recognition of morphological structures provide varying answers to this question. First, according to the full-listing model (Butterworth 1983), a morphologically complex word is represented as its own rather than as the individual morphemes that it consists of. On the other hand, under the morphological decomposition model (Taft & Forster 1975), only the constituent morphemes are located and accessed without activating the whole unit. Finally, the interactive model (Caramazza et al. 1988; Taft 1994), a hybrid of the two previous models, suggests that both the whole word and the constituent morphemes can be accessed.

Accordingly, the representation of compounds is accounted for differently by each model. The full-listing model considers a compound such as *honeybee* as a whole to be stored and accessed as one lexical unit, while the lexical decomposition model assumes that the constituents of the compound, *honey* and *bee*, are independently stored and accessed. According to the interactive model, both *honeybee* and its parts – *honey* and *bee* – are represented and activated with being associated with each other.

In this paper, I investigate how Korean V-V compounds (VVC) are mentally represented. There has been abundant research on processing nominal compounds – compounds consisting of two noun constituents – in various languages (Sandra 1990; Zwitserlood 1994; Juhasz et al. 2003 Libben et al. 2003; Andrew et al. 2004; Dũnabeitia et al. 2007; Ko et al. 2011), presumably because nominal compounds are a common form of morphologically complex words. However, to my knowledge, no experimental study has been conducted on the verbal compounds in Korean. It is this gap that the present study aims to address. While the grammatical category of the compound constituent is different from the N-N compound cases, since VVCs are also a type of morphologically complex words, the same question is raised for Korean VVCs – namely, whether the two constituents of VVCs have separate statuses in the lexicon or are stored as a single unit. Additionally, it would be reasonable to ask whether the tendency observed in the studies on N-N compounds (Juhasz et al. 2003; Pollatstek et al. 2000; Dũnabeitia et al. 2007; Ko et al. 2011) is retained in processing VVCs,[1] as well as whether any peculiarity that Korean VVCs may

1) Specifically, whether the second constituent of a compound plays a more important part in processing VVCs. See section 2.1. for details.

have is reflected in the behavioral data.[2)]

Korean VVCs are interesting in that their formation involves more than just combining two elements, unlike N-N compounds such as *honeybee*. Instead, Korean VVCs are composed of the root of V1 and that of V2, interleaved with a linking vowel *-e/a-*. The whole V*e/a*-V unit is followed by the suffix *-ta* to form a base, as illustrated in (1)-(2).[3)]

(1) V-e/a-V-ta
(2) 틀어-막다
tul-e-mak-ta[4)]
twist-e-close-ta
'block (a hole) by twisting something (such as a cap of a bottle) in'

The specific questions that are explored in this study are: (i) Are Korean VVCs processed through decomposition? And (ii) if so, do V1 and V2 contribute equally in accessing the compound or does the second constituent (i.e. V2) play a more important role in lexical access than the first one, as previous studies on nominal compounds suggest (Juhasz et al. 2003; Pollatstek et al. 2000; Dũnabeitia et al 2007; Ko et al. 2011)? Finally, the paper will also investigate (iii) whether there is a difference in the lexical or syntactic status of the constituent morpheme. The results of a masked priming lexical decision task conducted in

2) The particular property is the lexical vs. syntactic status of the constituent verb, which is discussed in section 3.1.
3) The form of the linking vowel *-e-* or *-a-* is determined by the last syllable of the preceding V (i.e. V1). The linking vowel *-a-* is used when the vowel of the last syllable is *a* or *o*, the so-called light vowels, exhibiting an instance of vowel harmony. For other verb roots involving dark vowels (i.e. *ay, e, oy, u, wi, u, uy, i*) are followed by *-e-*. In this paper, I will use the underlying *-e-* form in the gloss to represent both V-*e*-V and V-*a*-V cases.
4) Even though (1)-(2) are comprised of four parts, native speakers parse them as two – namely, *tule-makta* with the linking vowel and the *-ta* suffix attached to V1 and V2 respectively. This is because the linking vowel *-e-* is attached to the root for other inflectional purposes such as imperative and interrogative formations *–tul-e-la* 'Twist it (imperative)', *tul-e-ss-ni?* 'Did you twist it?'. Therefore, it is natural to think of *tul-e-* as forming a unit of some sort on a native speaker's mind, given the collocation the root and the linking vowel when inflection takes place. I will use the Korean script of VVCs split in two bits while keeping the English gloss in four bits in order to identify the roots.

the present study show that only a subset of Korean VVCs – namely, those called syntactic VVCs – are primed by VVC primes that share either V1 or V2, whereas the other type – lexical VVCs – is not subject to priming. This suggests that the two groups of VVCs have different representations in the mental lexicon. That is, while the syntactic VVCs are decompositionally stored and accessed, the lexical ones are localized as a whole unit. The results also show that when priming effects are observed, the contribution of V1 and V2 are identical in masked priming experiments. Rather, the key difference in reaction times (RT) is whether the given item belongs to the category of syntactic VVC or lexical VVC. Finally, the reaction times for syntactic VVCs were quicker than those for lexical VVCs.

2. Processing Compounds

Recent studies of N-N compound processing have provided evidence for the interactive model by showing that whether or not a compound is recognized through decomposition depends on the properties of the whole word and those of its constituent morphemes – that is, the frequency information (Andrew et al. 2004; Dũnabeitia et al 2007; Juhasz et al. 2003) as well as the semantic transparency (Libben et al. 2003; Sandra 1990; Zwitserlood 1994) of the constituent morphemes.

2.1. The N2 effect

Juhasz et al. (2003), Pollatstek et al. (2000), and Dũnabeitia et al. (2007) have observed a robust effect of the second constituent compared to the relatively less contribution of the first constituent. Specifically, the frequency effect of the second constituent was significant across different tasks such as naming, lexical decision (with no prime) and eye-tracking studies in English (Juhasz et al 2003) and eye-tracking in Finnish (Pollatstek et al. 2000). The frequency of the second constituent was also shown to be critical in bilingual reading of compounds between English and Korean, where L1 Korean speakers' lexical decision on Korean compounds was affected by whether the translated counterparts in

English had a highly frequent second constituent or not (Ko et al. 2011).[5] In contrast, in a naming task the frequency effect of the first constituent was found to be significant only in by-subject analysis and in lexical decision it emerged only when the second constituent had low frequency (Juhasz et al. 2003).

One might speculate that the robust effects of the second constituent come from the fact that they are usually the head since in English and Finnish N-N compounds are head-final. However, the effect of the second noun was observed even in Basque with head-initial compounds (Dũnabeitia et al. 2007). Therefore, the general conclusion drawn from the previous studies is that the second constituent plays a crucial role in compound processing regardless of whether it is the head or not. One of the questions this study tests is if the second constituent takes a critical part in recognition of Korean VVCs in a masked priming experiment.

2.2. Semantic transparency

The semantic transparency of the relevant compounds is another factor known to affect processing of compounds (Libben et al. 2003; Sandra 1990; Zwitserlood 1994). That is, only semantically transparent ones (e.g. birth-day) are processed through decomposition. The opaque ones (e.g. Sun-day) are not. The idea comes from the fact that *birthday* is primed by *death* while *Sunday* is not primed by *moon*. In the present study, however, the role of semantic transparency will be held constant by constructing the prime-target pairs that contain an identical constituent verb in the related condition, as introduced in section 4.2. Moreover, the effect of semantic opaqueness/ transparency is not relevant in investigating the recognition of Korean VVCs in the first place because all Korean VVCs are in principle semantically transparent, as exemplified in section 3.1.

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5) Ko et al. (2011)'s experiments are lexical decision tasks with no primes. The targets were provided in Korean (e.g. *kkul-bel* 'honey-bee') but the results were affected by the frequency of the corresponding N2 constituent (i.e. *bee*) in English.

3. Properties of Korean VVCs

This section lays out some peculiarities of Korean VVCs since taking these properties into account is necessary in construction of the experimental stimuli. Specifically, it will be shown that (i) some VVCs can be considered syntactic due to the fact that one of the constituent verbs is not "heavy" enough - exhibiting properties of light verbs or auxiliary verbs. I will also note that (ii) the orthographic convention that appears to distinguish the two types of VVCs - lexical and syntactic - is in fact arbitrary.

3.1. Constituent V's: lexical or syntactic

One property of Korean VVCs is that the second constituent verb of certain VVCs either cannot stand on its own or its primary meaning does not contribute to the meaning of the whole compound. Therefore, the meaning of the whole compound of this type rests mostly on the meaning of V1. V2, on the other hand, typically functions like a syntactic device with its bleached semantics - it introduces a beneficiary argument and/or adds a benefactive interpretation as in (3), expresses an aspectual change as in (4), or provides an endpoint to the action denoted by V1 as in (5).

(3) 도와-주다
tow-a-cwu-ta
help-*e*-give-*ta*
'give help to'

(4) 잃어-가다
il-e-ka-ta
lose-*e*-go-*ta*
'get to lose'

(5) 참아-내다
cham-a-nay-ta
endure-*e*-put forth-*ta*
'manage to endure'

As Lee (1992) and Kim (1993) point out, the V2's in (3) and (4) do not manifest their primary meaning as they do when used as a stand-alone verb. In (5), the V2 'put forth' adds to the meaning of V1 that the action of V1 is completed successfully. Interestingly, it cannot function as an independent verb and requires a preceding V1, unlike *cwu* 'give' (3) and *ka* 'go' (4).

The kind of compounds in (3)-(5) with their "semi-lexical" status is observed cross-linguistically. A number of analyses were proposed from ones that treat the V2 as a semantically empty predicate licenser (Grimshaw & Mester 1998; Cattell 1984), to those analyze the V2 as a type of auxiliary (Hacker 1958; Hook 1974, 1991, 1993; Abeillé, Godard & Sag 1998; Yoo 2003). There exists, however, a consensus that the V2's in cases like (3)-(5) are light verbs with little semantic contribution (Butt 2003) and they are assumed to have been formed via a syntactic process.[6] Compare (3)-(5) with (6), previously (2), and (7):

(6) 틀어-막다
tul-e-mak-ta
twist-e-close-ta
'block (a hole) by twisting something (such as a cap of a bottle) in'

(7) 알아-듣다
al-a-tut-ta
know-*e*-listen-*ta*
'understand by listening'

Unlike (3)-(5), both constituent verbs in (6)-(7) are fully lexical, with the primary meaning of the second constituent equally contributing to the compositional semantics of the resulting compound as the first constituent. The type of VVCs in (6)-(7) is alternatively called serial verbs, expressing a series of events in which V1 denotes the manner or purpose, whereas V2 indicates the result, for example (Choi 2003; Zubizarreta & Oh 2007). In contrast, the VVCs in (3)-(5) express a single eventuality in Vendler (1967)'s terms, as pointed out by Choi (2003).

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6) It is worth noting that it is more accurate to classify the V2's in (3)-(5) as light verbs, rather than auxiliaries, since they are argument-taking predicates.

Accordingly, in this study I classify the Korean VVCs such as (3)-(5) as syntactic VVCs, and those like (6)-(7) as lexical VVCs. Then, it would be worth exploring whether the recognition of lexical VVCs, which are comprised of two main verbs, and that of syntactic VVCs, with one main verb followed by a light verb/auxiliary, differ.

Notice that neither of the lexical or syntactic VVCs in Korean are semantically opaque compounds (e.g. *Sun-day*) discussed above, since the two verb meanings in the VVCs compositionally derive the meaning of the whole resulting verb in both cases.

3.2. VVCs and orthography

The compound status of both lexical and syntactic VVCs is independently evidenced by the fact that no other element such as adverbial expression, tense or negation can intervene between V1 and V2. However, according to the Rules of Korean Orthography (The National Institute of the Korean Language, n.d. b), in some cases, the two verbs should be detached orthographically. An interesting inconsistency found in the orthography of VVCs is that some of them, which are listed as dictionary entries, are written with the two verbs attached to each other. For example, the Standard Korean Dictionary (The National Institute of the Korean Language, n.d. a) contains (3) as a single word with no space between V1 and V2. In contrast, other VVCs involving the same V2 as in (8)-(9) are written with a space, so that the two verbs look like a sequence of a main verb and a modifier.

(8) 만들어 주다
mantul-e cwu-ta
make-*e* give-ta
'make (something) for'

(9) 그려 주다
kuli-e cwu-ta
draw-*e* give-ta
'draw (something) for'

This contrast shows that (3) has become lexicalized due to frequent usage and that the orthographic convention is an arbitrary criterion in evaluating whether a complex predicate consisting of two verbs is a compound or not.[7] This inconsistency is analogous to the arbitrariness in English *sailboat* vs. *sword boat* or *greenhouse* vs. *White House*. Therefore, in this study, all VVCs are presented with no space in between so that the presence or absence of space does not affect the subjects' reaction time.[8]

4. Experiment

Taking into account the results of previous studies on morphologically complex words (section 2) and the properties of Korean VVCs (section 3), the present study looks at how VVCs are represented in native speakers' mind. The three main questions I aim to answer with a masked priming experiment are (i) whether or not the VVCs are accessed through decomposition and (ii) if so, whether there is a difference between the role of V1 and that of V2 in locating the compound. That is, does the second constituent V2 have a robust effect in lexical access, while the first constituent does not, as other studies on compounds suggest (Juhasz et al. 2003; Pollatstek et al. 2000; Dũnabeitia et al. 2007)? Finally, I will also explore (iii) whether lexical and syntactic VVCs are stored and accessed via the same or different mechanism.

4.1. Participants

27 adult native speakers of Korean were recruited for participation in the experiment. The subjects were undergraduate/graduate students enrolled at the University of Arizona or Pusan National University with normal or corrected-to normal vision and no history of brain injury (self-report).

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7) Because of the spelling, it is impossible to find the frequency information of the entire syntactic VVC stimuli in the corpus. For example, only the V2's of (4)-(5) are listed without the whole compounds. Not surprisingly, the V2's of syntactic VVCs are of relatively high productivity.

8) As a matter of fact, the Korean speakers I talked to expressed that they did not notice an orthographic difference between lexical and syntactic VVCs before I pointed it out to them.

4.1. Materials

The experiment was a masked priming lexical decision experiment with a 2 (verb sharing between prime and target – related vs. control) x 2 (position of the shared verb – V1 or V2) x 2 (status of target – lexical vs. syntactic) design.[9] The three factors manipulated were (i) whether or not the masked prime and the target share a constituent verb, (ii) whether the shared verb is located in the V1 or V2 position of the prime and the target, and (iii) whether the V2 of the target compound is lexical or syntactic. This yielded 8 conditions as in (10)-(17) with 8 prime-target pairs in each condition, totaling in 64 real word item pairs. Since the prime and the target differed only in one of the two constituent V's, if priming takes place – that is, if the reaction time in the related condition is significantly faster than that in the control condition, it would mean that the constituent verb is stored and accessed as an independent unit in the mental lexicon (Marslen-Wilson et al. 2008).

<Lexical>

(10) Condition #1: V1 related	
Prime 알아-채다 al-a-chay-ta know-*e*-snatch-*ta* 'become aware of'	**Target** 알아-듣다 al-a-tut-ta know-*e*-listen-*ta* 'understand by listening'
(11) **Condition #2:** V1 control	
Prime 낚아-채다 nakk-a-chay-ta fish-*e*-snatch-*ta* 'snatch (something) away as if fishing (it)'	**Target** 알아-듣다 al-a-tut-ta know-*e*-listen-*ta* 'understand by listening'
(12) Condition #3: V2 related	

9) The factor "verb sharing between prime and target" can be understood as effects of priming. It follows that the "related" and "control" conditions refer to the "verb shared" and "verb not shared" conditions, respectively.

Prime	**Target**
몰아-넣다	집어-넣다
mol-a-neh-ta	cip-e-neh-ta
drive-*e*-in-ta	pick-*e*-in-*ta*
'drive (something) in'	'stuff (something) in'
(13) **Condition #4:** V2 control	
Prime	**Target**
몰아-치다	집어-넣다
mol-a-chi-ta	cip-e-neh-ta
drive-*e*-hit-ta	pick-*e*-in-*ta*
'drive (something) to a side'	'stuff (something) in'

<Syntactic>

(1) **Condition #5:** V1 related	
Prime	**Target**
깨어-있다	깨어-나다
kkay-e-iss-ta	kkay-e-na-ta
be.awake-*e*-be-*ta*	be.awake-*e*-get-*ta*
'be awake'	'become awake'
(2) **Condition #6:** V1 control	
Prime	**Target**
녹아-있다	깨어-나다
nok-a-iss-ta	kkay-e-na-ta
melt-*e*-be-*ta*	be.awake-*e*-get-*ta*
'have melted'	'become awake'
(3) **Condition #7**: V2 related	
Prime	**Target**
일러-주다	도와-주다
il-e-cwu-ta	tow-a-cwu-ta
inform-*e*-give-ta	help-*e*-give-ta
'inform (to someone)'	'give help (to someone)'
(4) **Condition #8:** V2 control	
Prime	**Target**
일러-대다	도와-주다
il-e-tay-ta	tow-a-cwu-ta
inform-*e*-repeat-ta	help-*e*-give-ta
'keep informing'	'give help (to someone)'

The links among the 8 conditions are presented in Table 1 below:

Table 1. The 8 conditions of the present study

V sharing / Shared position	Related	Control
V1	Condition #1 (lexical)	Condition #2 (lexical)
	Condition #5 (syntactic)	Condition #6 (syntactic)
V2	Condition #3 (lexical)	Condition #4 (lexical)
	Condition #7 (syntactic)	Condition #8 (syntactic)

Additionally, because there were not enough prime and target items that could be constructed that meet the 8 conditions, the participants ended up being exposed to the real word targets twice as they go through the 8 conditions in (10)-(17). For example, a subject ended up reading 알아-듣다 'know-listen' twice, since it is the target word for both Conditions #1 and #2 in (10)-(11), although the primes were different. In order to address the repetition of the target items, two steps were taken. First, the effect of order (i.e. block 1 vs. block 2) was made into an additional independent variable. Specifically, the participants were divided into two groups for counterbalancing. Group A were exposed to 알아-듣다 in Condition #1 during the first half of the experiment (i.e. block 1), and 알아-듣다 in Condition #2 during the second half (i.e. block 2). For Group B, the order was reversed – they were exposed to 알아-듣다 in Condition #2 during the first half of the experiment (i.e. block 1), and 알아-듣다 in Condition #1 during the second half (i.e. block 2). Second, the effect of order was calculated as well as the other three factors, using the mixed-effects model of the R software.[10)]

The first point of interest in analyzing the data was to see whether sharing a verb between the prime and the target has an effect or not. If so, it would suggest that Korean VVCs are recognized decompositionally. The second point of interest was the interaction between verb sharing and the position of the shared verb in order to test whether V2 position is critical or not as previous literature suggests. If so, the effect of verb sharing will not be the same in the

10) It is one of the advantages of the mixed-effects model to handle various factors retaining the power of the experiment.

two levels of the other factor – namely, V1 and V2, yielding a significant interaction between the two factors. A final point that needs to be examined is whether the make-up of VVCs – two fully lexical verbs vs. one lexical verb followed by a light verb/auxiliary – results in difference in reaction times.

Finally, there were also 64 non-word stimuli, which differed from their real word counterparts by one phoneme on each verb. For instance, for the prime/target pair 알아-채다 'know-snatch'/알아-듣다 'know-listen', 얄아-챼다/얄아-돋다 were used as their non-word counterparts. Note that the purpose of including the non-word items was to simply demonstrate that the reaction times are affected by the lexical status of the stimuli.

4.3. Procedure

The subjects sat in front of a 14-inch laptop. The stimuli were presented and subjects' responses were measured using the DMDX software (produced by Forster & Forster (2003), University of Arizona). For each item set, a masked prime was presented for 50ms, which was followed by a target V-V compound. The participants were asked to decide as soon as possible whether or not the target V-V item was a word in Korean and press the right shift key for words and the left shift key for non-words. 12 practice items preceded the actual experiment. The stimuli within each condition were scrambled and presented in a random order.

5. Results

5.1. Error rates

Table 2 shows the percentage of incorrect responses for real word items and non-word items.

Table 2. Error rates for each condition (%)

[Real words]

Lexical			**Syntactic**		
	V1	*V2*		*V1*	*V2*
control	4.6	4.2	*control*	3.2	2.8
related	4.2	2.3	*related*	0.9	5.6

[Non-words]

Lexical			**Syntactic**		
	V1	*V2*		*V1*	*V2*
control	3.7	3.7	*control*	6.5	4.6
related	5.1	5.6	*related*	6	3.7

The statistical analyses were performed using the mixed-effects model of the R software.[11] The four independent variables entered were (i) verb sharing (i.e. related vs. control), (ii) position of the shared verb (i.e. V1 vs. V2), (iii) the status of target (i.e. lexical VVC vs. syntactic VVC), and (iv) ordering (i.e. block1 vs. block2) and the dependent variable was error rate. For both real word and non-word items, none of the main effects of (i)-(iv), nor the 2-way or 3-way interactions among (i)-(iii) were significant (p's > .1). There was also no significant difference in the error rate between the real words and non-words (t = 1.65, p > .05).

5.2. Reaction times

In comparing the reaction times of the conditions, the correct responses were taken into consideration. Additionally, the responses faster than 300ms and those slower than 1500ms were regarded as outliers, thus were excluded from data analyses. This resulted in discarding 4.6% of the total data points. The statistical

11) The mixed-effects model differs from the traditional ANOVA analyses in that it gives a single p-value, not two – one from the by-subject analysis and another from the by-item analysis. This is because it takes into account the factors of interests (i.e. the independent variables) and the random effects triggered by the subjects and item simultaneously.

analyses were conducted using the mixed-effects model of the R software with the same four independent variables (i) verb sharing (i.e. related vs. control), (ii) position of the shared verb (i.e. V1 vs. V2), (iii) the status of target (i.e. lexical VVC vs. syntactic VVC), and (iv) ordering (i.e. block1 vs. block2). This time, the dependent variable was the reaction times – that is, the time it took to decide whether the target word presented is a legitimate Korean word or not. Tables 3 and 4 show the mean log reaction times for real word and non-word condition, respectively:

Table 3. Mean log RT for **real word** conditions (ms)

Lexical			**Syntactic**		
	V1	*V2*		*V1*	*V2*
control	617.96	625.28	*control*	607	608.24
related	613.71	620.71	*related*	588.95	592.71

Table 4. Mean log RT for **non-word** conditions (ms)

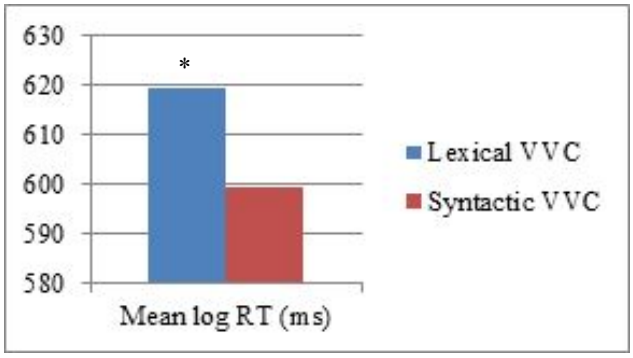
Lexical			**Syntactic**		
	V1	*V2*		*V1*	*V2*
control	619.75	653.87	*control*	661.49	632.85
related	626.85	649.95	*related*	632.01	617.74

Comparing Table 3 and Table 4, it is notable that the subjects generally responded faster on real words than non-words. The significant main effect of lexical status (t = 4.27, p <.001) confirms that the difference between real words and non-words is reliable. Although not addressed in Table 3, the main effects of order were significant (t = 10.9, p <.001), evidencing that for both real words and non-words, subjects made decisions faster when the same target was repeated.

A separate set of tests were carried out for the real word items exclusively in order to test the three questions posed in section 4. The statistical analyses reveal that there was no main effect of prime (i.e. verb sharing) or position of shared verb (i.e. V1 vs. V2), when both syntactic and lexical targets are considered (verb sharing t = 1.73, p > .08, shared position t = 0.35, p > .7).

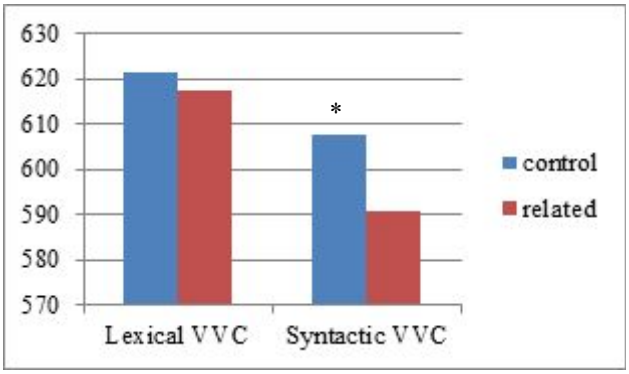
However, there was a meaningful difference in recognizing syntactic VVCs and lexical VVCs, regardless of whether the prime was related or not – that is, irrespective of whether the prime and the target shared a constituent verb or not (t = 2.5, p < .02). The fact that no interaction between priming and target status was observed (t = 0.95, p > .3) indicates that the main effects were reliable. This means that syntactic VVCs were responded to faster than lexical VVCs irrespective of the presence of prime, as shown in Figure 1 below:

Figure 1. Mean log RT (ms) for real words as a function of the lexical vs. syntactic status of V2. * indicates significance.



However, it can be seen from Table 3 that there is a tendency that the primes exerted inhibition on the log RT of lexical VVCs, whereas they were facilitative for the syntactic VVCs. Therefore, it is worth considering the simple effect of prime (i.e. related vs. control) on the syntactic VVCs and that on the lexical VVCs separately, even in the absence of interaction between priming and target status. In other words, it is necessary that we look at the reaction times for the syntactic VVCs and lexical VVCs separately with respect to whether priming took place on each of the syntactic and lexical levels. Figure 2 shows the difference in the effects of priming between the lexical and syntactic VVCs:

Figure 2. Mean log RT (ms) for *control* and *related* conditions for real words as a function of the lexical vs. syntactic status of V2. * indicates significance.



Indeed, the tests on the simple effects of prime show that for the syntactic VVCs, the priming effect was significant (t = 2.03, p < .05). This demonstrates that with syntactic VVCs, the subjects recognized the two constituent verbs independently. In other words, the lexical verb V1 and the light V2 of a syntactic VVC are stored as two bits in the mental lexicon. However, there was no main effect of shared position or interaction between priming and shared position (t's <1, p's > .9). This means that the amount of priming was not affected by whether the prime and the target shared V1 or V2, with no meaningful difference between Conditions #5-6 and Conditions #7-8.

As for the level of lexical VVCs, the inhibitory tendency of primes was not significant (t = 0.51, p > .1). This confirms that priming did not take place in the case of lexical VVCs in Figure 2. That is, the presence of prime, which shared a constituent verb with the target, did not influence the subjects' RT. This implies that the constituent Vs' of lexical VVCs are not stored as two units but exist as a whole compound, contrary to syntactic VVCs.

Since the effects of order (i.e. block 1 vs. block 2) turned out to be the most significant, it is worth comparing the log RTs in block 1 separately to investigate the effects of priming and target status by excluding the target items that were presented for the second time. Table 5 contains the mean log RTs of the real words which were presented in block 1.

Table 5. Mean log RT for **block 1 real words**

Lexical			**Syntactic**		
	V1	*V2*		*V1*	*V2*
control	620.4	627.78	*control*	636.08	651.53
related	644.86	659.35	*related*	589.71	605.84

By removing the ordering effect, the difference between lexical and syntactic VVCs in terms of priming is more evident in Table 5. In addition, compared with the results in Table 3, which include the mean log RT of both blocks, the difference in the mean log RT between the related and control conditions in syntactic VVCs appears to be greater in Table 5. However, none of the main effects of priming and target status, nor the interaction between the two were significant (t's <1, p's > .1). The main effect of position of priming (i.e. V1 vs. V2) was neither significant (t = 0.94, p > .1). The simple effect of priming on the syntactic VVC level (t = 1.18, p > .2), which was tested separately, and that on the lexical VVC level (t = 0.7, p > .4) were not significant, either.

6. Discussion

6.1. The representation of lexical and syntactic VVCs

The results of the current experiment open up a possibility that the two types of Korean VVCs – lexical vs. syntactic – have different representations in the mental lexicon. Specifically, the results in Figure 2. show that while syntactic VVCs are sensitive to the presence of primes, lexical VVCs are not. This indicates that it is only syntactic VVCs that are stored and accessed decompositionally while lexical VVCs are stored as a whole unit. This interpretation is understandable given that the V2 of syntactic VVCs is semantically light, serving a grammatical function, and is used more productively. This contrasts with the V2 of lexical VVCs, whose meaning equally contributes to the meaning of the whole compound as that of V1. Therefore, the two verbs in syntactic VVCs are more likely to be decomposed into two bits while the V1 and V2 of lexical VVCs are cohesively combined to form an single mental entry.

Nevertheless, a question still remains as to why the lexical VVCs behave differently from N-N compounds addressed in the previous literature (e.g. Ko et al. 2011), which revealed that the two fully lexical units are stored and accessed separately (e.g. *kkul-bel* 'honey-bee'). A possible answer is that VVCs require a linking vowel between V1 and V2 and further suffixation to the V-e-V unit, whereas the N-N compounds do not. The two constituents of N-N compounds can be used on its own as free words. This morphological boundness of VVCs could have resulted in the weak representation of the separate roots – V1 and V2 – in the lexicon. Instead, the lexical VVCs are stored as a whole unit. In contrast, the high productivity of the V2 in the syntactic VVCs seems to offset the possible effects triggered by the boundness of the constituents in VVCs and force the decomposition of the compounds into V1 and V2.

The hypothesis that attributes the priming effect in processing syntactic VVCs to the productivity of the V2 light verb in syntactic VVCs naturally accounts for the outcome that syntactic VVCs were responded to faster than lexical VVCs, as reported in Figure 1. Since the V2 of syntactic VVCs are productively attached to a wider range of roots, with less semantic contribution than the fully lexical V2 in lexical VVCs, it is possible that the light verb V2 in syntactic VVCs was read off faster, giving rise to quicker RT for syntactic VVCs in general.

Even so, the account is not consistent with studies such as Marslen-Wilson et al. (2008). Marslen-Wilson et al. (2008) have shown priming between the pair *arch-archer*, where the semantics of the target *archer* is not necessarily related to the prime *arch*, which suggests morphological decomposability at an early stage of visual recognition that is independent of semantic factors. When the prime and target are both morphologically and semantically related (e.g. *brave-bravely*), there were robust priming effects. Since the VVC prime-target pairs used in this study contained an identical constituent verb (e.g. 알아채다 'know-snatch' - 알아듣다 'know-listen'), then we would highly expect priming with the lexical VVCs, contrary to the results of the present study. However, comparing between the English case (e.g. *brave-bravely*) and this study (e.g. 알아채다 'know***e***-snatch***tta***' - 알아듣다 'know***e***-listen***tta***'), one can see that the two pairs are different in what is bound. That is, in Korean VVCs, both constituents – V1 and V2 – in both prime and target are bound roots followed either by the linking vowel *-e-* or the suffix

-ta, while in English *ly* is the only bound element. It would then be interesting to see whether the same priming effect persists in the English pair *braveness-bravely*, where the prime also contains a bound suffix, and in the pair *electricity-electron*, where both the root and suffix in both prime and target are bound.

In order to fully support the present interpretation that morphological boundness causes weak representations, however, an interaction of priming and target status (i.e. lexical vs. syntactic) needs to be shown, which was absent in the present experiment. It seems that the absence of interaction came from the noise in the lexical VVC data or it might have been overshadowed by the effect of ordering between block 1 and block 2, which was robust.

One might argue that if the above difference between lexical VVCs and syntactic VVCs is real but is somehow clouded by the strong effect of order, the interaction between priming and target status should have been observed in Table 5, where only data from block 1 were considered. Furthermore, even the simple effect of prime on the syntactic level was missing, although the mean log RT difference between lexical and syntactic VVCs was more obvious in Table 5 than in Table 3, where both block 1 and block 2 were taken into account. An explanation for this question can be the following: it appears that the simple effect of priming on the syntactic VVC level in block 1 was absent because the two counterbalanced groups were not exposed to all the 8 conditions in block1. That is, in block1, only 4 conditions (i.e. Conditions #1, #3, #6, #8) were presented to Group A, while the other 4 (i.e. Conditions #2, #4, #5, #7) were given to Group B. Therefore, the individual RT difference in recognizing the stimuli and making lexical decision could not be considered, bringing more variance to the data. A follow-up study with more items that dispenses with the repetition of targets could solve this difficulty.

6.2. Absence of effects of shared position

To recall from section 4, the position of verb sharing, if priming effect exists, was another point of interest. The results of the present paper confirm no effect of verb sharing position, as discussed in Table 3. Given that lexical VVCs were not affected by primes, more attention needs to be paid to the syntactic VVCs,

which were subject to priming. In discussing the operative factors on the syntactic VVC level, it has been demonstrated in section 5.2. that neither the shared position nor the interaction between priming and shared position was significant. This indicates that processing the syntactic VVCs, while being sensitive to priming, is not affected by which constituent (i.e. V1 or V2) is shared between the prime and the target.

This behavioral result of syntactic VVCs appears to diverge from that of N-N compounds, in which the second constituent effect is known to be crucial in visual recognition. However, the current experiment involves masked primes and thus, the nature of the experiment is different from that of previous studies showing the N2 effects, which are naming, lexical decision with no primes, and eye-tracking studies (Juhasz et al. 2003; Pollatstek et al. 2000; Dũnabeitia et al. 2007; Ko et al. 2011). The different experimental designs and diverging results, therefore, suggest that the position of shared constituent between prime and target is not relevant in recognizing compounds in masked priming experiments.

6.3. Remaining issue: idiosyncratic interpretation

A remaining issue that has not been addressed in this study is the fact that certain VVCs are ambiguous between a literal meaning as in (2), repeated as (18) and a derived idiosyncratic meaning.

(18) 틀어-막다
tul-e-mak-ta
twist-e-close-ta
(i) 'block (a hole) by twisting something (such as a cap of a bottle) in'
(ii) 'bind (someone's mouth/behavior) to secrecy'

A large portion of VVCs are ambiguous like (18). Then one could raise a question that when a VVC like (18) is provided as a target, subjects could make lexical decisions with different interpretations activated – it could be one of the literal and derived meanings or both. However, if lexical decomposition is blind to semantic factors as is evidenced by Marslen-Wilson et al. (2008), where priming is observed between *arch-archer* but not between *scan-scandal*, the potential ambiguity

of targets like (18) is not expected to have affected the reaction time or the error rate. It would still be interesting to explore if ambiguous VVCs and unambiguous ones trigger different behaviors in future research.

7. Conclusion

The two types of V-V compounds in Korean addressed in this study – lexical VVCs and syntactic VVCs – have different representations on the mind of native speakers. Two findings from this study lead to this conclusion. First, while the two constituents of the syntactic V-V compounds are stored and accessed separately, those of the lexical compounds are stored as a whole unit. Second, the syntactic V-V compounds triggered faster reaction times than lexical V-V compounds. The results of this study imply that the representations of verbal compounds are distinct from those of nominal compounds (Juhasz et al. 2003; Pollatstek et al. 2000; Dũnabeitia et al. 2007; Ko et al. 2011) and that early morphological decomposition (Marslen-Wilson et al. 2008) takes place selectively.

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Hyun Kyoung Jung
Department of Linguistics
University of Arizona
Douglass Building, Room 200E
Tucson, AZ 85721-0028
U.S.A.
Phone: 1-520-971-6154
Email: hkjung@email.arizona.edu

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