



## CV AS A PHONOLOGICAL UNIT IN KOREAN

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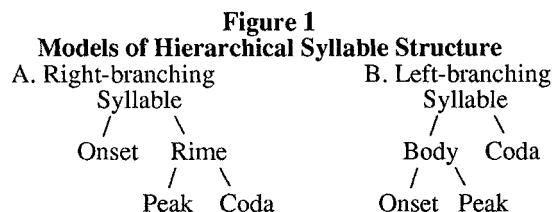
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### ABSTRACT

The rime as a viable phonological unit in English has been supported by a wide range of sources of evidence: language acquisition, speech errors, a rime-based poetic tradition, experimental word games, etc. In Korean, however, there is evidence for CV (or the body), a unit composed of a vowel and the preceding consonant. This paper discusses (I) some evidence for the body unit in Korean, (II) a word-blending experiment that shows the correlation between the sonority value of a prevocalic consonant and its stickiness to the vowel, and (III) a recent extension involving sound similarity judgments that confirms the body as a major sub-syllabic unit in Korean.

### I. EVIDENCE FOR THE BODY AS A MAJOR SUB-SYLLABIC UNIT IN KOREAN

Most theories about the internal structure of the syllable have agreed that the syllable has a hierarchical structure with some sub-syllabic units in between individual segments and a whole syllable [1]. It has also been recognized that depending on the degree of cohesiveness among these sub-syllabic units, there are various possibilities, two of which are represented below.



Model A implies that the major boundary within a syllable is *before* the peak, and that the peak is more closely related to the coda than to the onset. Most phonologists adopt this model and argue for the universality of the rime [2]. Model B represents the direct opposite tendency from Model A: the major boundary is *after* the peak, and the peak is more closely linked to the onset than to the coda. This section summarizes various sources of evidence for Model B for the Korean syllable. It is interesting to note that almost all sources of evidence for the rime in English can also be found for the body in Korean.

#### 1.1 Orthography

In the Korean orthography *hangul*, there are some evidence that suggest that the vowel is more closely related to the preceding consonant than to the following consonant. To form a syllable-like orthographic unit, all vowel-letters with vertical strokes are written on the same horizontal line as the preceding consonant (e.g.,  $\text{강}$

/kam/). This is also true for syllables beginning with a vowel, in which the silent letter "o" is added as a place marker for the "missing" consonant symbol (e.g.,  $\text{오}$  /am/). The fact that vowel-letters form a unit with the preceding consonants but not with the following ones is also observed in children's acquisition of the spelling. Gim [3] reported that Korean children learn to recognize, for example,  $\text{강}$  by "ka plus m makes kam" but not by "k plus am makes kam."

#### 1.2 Language Games

In English there is a language game called pig Latin, in which words have to be first divided into the onset and the rime (e.g., *pig* becoming *igpay*), justifying the right-branching structure. In Korean, however, there are two language games that indicate the left-branching structure (see [3] for detailed illustrations). The "nosa" game inserts *nosa* between the body and the coda (e.g., *kam* becoming *kanosam*), and the "pV-insertion" game that inserts the sequence of *p*+the same vowel of the input syllable also requires the division between the body and the coda (e.g., *kam* becoming *kapam*).

#### 1.3 Phonological Rules

There are some phonological rules that refer exclusively to the body. For example, in palatalization (*t, t<sup>h</sup>* becoming */c, c<sup>h</sup>/* in front of high front vowels) and labialization (*/i/* becoming */u/* after bilabial consonants), the vowels and preceding consonants affect each other, but there are no rules whatsoever that involve vowels and following consonants.

#### 1.4 Fast Speech Retraction and Speech Errors

Cheon [4] reported some examples from fast speech, in which CV sequences are deleted as follows:

ca-sip-sə → cap-sə 'reference book'  
ya-mip-saŋ → yapsaŋ 'somewhat hateful'

There are also some speech errors which exchange two CV's:

ci-l-sə-ka-mun-lan-ha-ta 'Something is not in order.' →  
mu-l-sə-ka-ci-n-lan-ha-ta

These examples show that the body behaves as one unit.

### II. A WORD-BLENDING EXPERIMENT

The word-blending (WB) technique has been used as a tool to determine the way segments are grouped together within a syllable, i.e., whether the syllable is a mere sequence of segments or it has internal structure of some sort. Using a series of WB experiments for English syllables, Treiman [5,6,7,8] found that vowels were more closely associated with their following consonants than with the preceding consonants. Subjects heard two mono-syllabic nonsense words, for example, /krɪnt/ and /glæpθ/, and were asked to pronounce a new CCVCC

monosyllable by taking parts of the two input syllables. Overall, /krəpθ/ (onset of the first syllable + rime of the next) significantly outnumbered /klɪpθ/ (body + coda) and other possible combinations. Derwing et al [9] used a perception version of the WB task, and replicated Treiman's results from production tasks. This perception experiment was a forced-choice test, in which subjects had to mark on their answer sheet the most naturally sounding blend out of two or four choices provided. Overall onset-rime blends were preferred over body-coda blends by 69%:31%. All of the above results from English confirmed the rime as a major sub-syllabic unit in English.

Another important finding from these WB experiments was the effect of postvocalic consonants [6,8]. After experimenting with several novel word games, Treiman [8] concluded that "subjects treat rimes differently depending on the type of consonant that follows the vowel (p. 41)." Specifically, liquids cohered with the preceding vowel most closely, nasals in between, and obstruents were least closely tied to the vowel. Derwing & Nearey [10] used three methodologies (WB, substitution-identification, and syllable boundary tasks) to test this phenomenon of "vowel-stickiness." All three independent methodologies showed a consistent correlation between the sonority value and vowel-stickiness: the more sonorous the postvocalic consonants were, the more likely they were tied to the vowel. A consequence of this finding was that the boundaries between sub-syllabic constituents (especially, between the peak and the coda in English) were not so implied by a strictly hierarchical model of syllable structure.

The WB technique was first applied to Korean by Derwing et al [11]. They found the direct opposite results from English: Korean subjects preferred body-coda blends to onset-rime blends, suggesting the left-branching structure in the Korean syllable. However, some problems were found which deviated from the overall preference for body/coda blends. In some test items containing real word choices, body-coda blends were chosen by less than 40% of the subjects, in spite of higher than 60% of overall preference for body-coda blends. This was probably because subjects chose the blends on the basis of the spelling of the most common meaning of those real words.

## 2.1 Method

The present experiment was designed to replicate the general preference for the body-coda blends in Korean, and to test the effects of prevocalic consonant type. To circumvent the real word effects discussed above, all outputs of the blending were controlled to be nonsense words. Subjects were 48 undergraduates of Sogang University who were all native speakers of Korean. A total of 50 test items were divided into three major categories: (1) 20 items to test the effects of prevocalic consonants; (2) 20 items to re-test the general preference for body-coda blends; and (3) 10 items to see if subjects were following the instructions. All 50 items were randomized and read to subjects as follows:

p'əŋ cup: (a) p'əŋ cup - p'ap (b) p'əŋ cup - p'up

Subjects were instructed to choose either (a) or (b), whichever sounded better or more natural to them as a blending of the two stimuli by taking the first part of the first CVC and the last part of the second.

In category (1), the basic template of test items was organized as CV<sub>1</sub>N + FV<sub>2</sub>P. C was the various types of consonants in question: 9 stops (3 aspirated, 3 fortis, and

3 lenis), 2 fricatives, 3 nasals, 3 liquids, and 3 glides. The main interest here was in the magnitude of difference in preference for the CV<sub>1</sub>P blends. To focus on the effects of C in question, other factors were controlled as much as possible: V1 and V2 were one of /a,ə,u/, N was one of /m,n,ŋ/, F was one of /s,c,h/, and P was /p/. N and F were always different from each other with respect to their place of articulation.

The purpose of including category (2) was two-fold: one was to re-test the general preference for body-coda blends, the other to dissuade subjects from inventing some extraneous strategy for answering test items in category (1). (In a previous experiment solely on category (1), some subjects commented after the experiment that they had been concentrating on the vowel alternations.)

Non-blend items were included in category (3), in which one of the choices was a proper blend (either onset-rime or body-coda), while the other was merely a repetition of one of the two input syllables. Responses from the subjects who made three or more mistakes on these 10 control items were not included in analyzing the results.

## 2.2 Results and Discussion

Twelve subjects failed in meeting the criterion for the control items. Their responses were considered to have been randomly chosen, and were not included in tabulating the results.

In category (1), overall preference for CV/C blends was significantly bigger than for CVC blends ( $t=3.89$ ,  $p<.0005$ ). Considering consonant types individually, however, we could observe that CV/C blends significantly outnumbered CVC blends only in nasals and glides. The highest percentage (67%) of preference for glides was in fact expected, since glides do not have their own alphabetic characters but are attached to vowel-letters in the Korean orthography.

Table 1  
Preference for CV/C Blends in Consonant Types

Initial C Types	Mean	SD	Significance
Obstruents	.53	.025	none
Liquids	.55	.048	none
Nasals	.62	.047	.01
Glides	.67	.045	.0005
Total	.57	.018	.0005

As for obstruents, CV/C blends were slightly ahead of CVC blends, but no significant difference was found ( $t=1.2$ ). On the other hand, the preference for CV/C blends was bigger for sonorants. The results of nasals and glides in comparison with those of obstruents serve as a nice example of the correlation between sonority values and the degree of vowel-stickiness. In general, obstruents, nasals, and glides seemed to fit well into the frame of the following hierarchy observed also in English [6,8,10]:

Obstruents < ?Liquids? < Nasals < Glides  
sonority & vowel stickiness →

The second analysis involved the individual  $t$ -tests for the above four consonant types. The difference in the preference for CV/C blends between any two consonant types was significant only when they were not immediate neighbors to each other in the above hierarchy: obstruents vs. nasals ( $t=1.7$ ,  $p<.05$ ), obstruents vs. glides ( $t=1.81$ ,  $p<.005$ ), and liquids vs. glides ( $t=2.75$ ,  $p<.05$ ). This

suggests that the consonantal hierarchy in Korean with respect to vowel-stickiness may be less clear-cut than that in English.

In category (2) overall preference for CV/C blends was slightly bigger than the 57% for category (1): Out of the total of 720 items, 425 choices were CV/C blends (59%,  $t=4.91$ ,  $p<.0005$ ), confirming the left-branching tendency and the viability of the body in the Korean syllable.

Summarizing this section, it has been confirmed by the WB technique that the Korean syllable has a left-branching structure with the body as a major sub-syllabic unit, and that there is a correlation between the sonority hierarchy and vowel-stickiness of prevocalic consonants, although this correlation is not so strong as in the case of postvocalic consonants in English.

### III. A SOUND SIMILARITY JUDGMENT EXPERIMENT

The sound similarity judgment (SSJ) task is a promising technique to test the viability of various hypothesized phonological units. A common procedure in the SSJ is to ask subjects to rate on some point scale sound similarity of pairs of stimuli. This technique produced some reliable results in predicting the judged similarity of sounds in English. For example, Vitz & Winkler [12] found that there was a very strong correlation between the number of shared phonemes and the rated similarity, indicating that the phoneme is a basic perceptual unit, at least in English. Another finding from English was that there were differential weights in individual phonemes, such as the rime effect and the importance of final consonants relative to initial consonants in judging the sound similarity (Derwing & Nearey [13], Bendrien [14]). Recent applications to other languages such as Arabic (Beinert & Derwing [15]) and Taiwanese (Wang & Derwing [16]) also revealed that the phoneme did most of the job in predicting sound similarity while language-specific units (e.g., the rime in English, the mora in Japanese, and the C-tier in Arabic) added some fine-tuning. The purpose of the present SSJ experiment was to clarify the role of the body as a language-specific perceptual unit for Korean (as well as to test the universality of the phoneme). The results reported here are part of a comparative study between Korean and English reported in Yoon & Derwing [17].

#### 3.1 Method

A total of 48 Korean CVC pairs were divided into 12 contrasting types, ranging from no phoneme in common to all three phonemes in common. Half of the 12 contrasting types were composed of pairs that shared the phoneme(s) in one of the 6 sub-syllabic units. The other half were composed of pairs with no phoneme in common, with all three phonemes in common, or with shared phonemes in different positions. These pairs were included as filler items and for similar reasons to category (2) items in the WB experiment described above. In each pair all mismatched phonemes were always one distinctive feature apart to control the degree of difference between phonemes; all stimuli were composed of one of the four consonants /p,t,m,n/ and one of the four vowels /i,u,ə,a/. (see [13,14] for the effects of features on SSJ experiments).

**Table 2**  
**Sample Stimuli for the SSJ Experiment**

Sub-syllabic Units		Filler items	
Body	pin - pit	All	pin - pin
Rime	pin - min	None	pin - mut
Margin	pin - pun	Reversed	pin - nip
Onset	pin - put	C1V→VC2	pin - mip
Vowel	pin - mit	C1→C2	pin - mup
Coda	pin - mun	C1↔C2	pin - nup

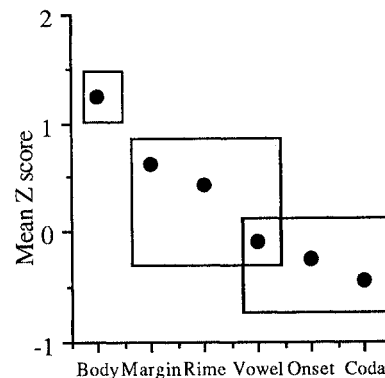
Subjects were 15 Korean graduate and ESL students at the University of Alberta. They were instructed not to pay attention to word meaning but to concentrate on the global impression of sound only. A 10-point scale was used ranging from 0 (totally different) to 9 (exactly the same). Except for the first four pairs, which were purposely selected to help subjects mentally calibrate the scale, all other pairs were randomized and read to subjects as follows:

Number 1 --- pin --- pit ----- Number 2 ---

#### 3.2 Results and Discussion

The first analysis involved the comparison of similarity scores for the above 12 types of pairs. Since subjects greatly varied on their use of scale, Z score was calculated for each test item. An analysis of variance on the mean Z scores for 12 types of pairs showed a significant difference among these types ( $p<.001$ ). In the first three types of pairs sharing two phonemes, pairs sharing the body received significantly higher similarity ratings than the other two, which did not differ significantly from each other. These results indicated an effect of the body on the SSJ which was comparable to the effect of the rime in English. However, there was no significant difference in the three types of pairs that shared a phoneme in the onset, the vowel, and the coda, as depicted below.

**Figure 2**  
**Comparison of Sub-syllabic Units in Sound Similarity**



(Boxes enclose means that are not significantly different.)

Secondly, a linear regression analysis was run on mean Z scores for each test item to test the role of sub-syllabic variables (excluding the margin), as illustrated below. In each of the five sub-syllabic variables, 1 indicates a perfect match for the specific variable, while 0 indicates otherwise. Note that in this analysis all single-phoneme match pairs were coded as 0 for the body and the rime variables.

**Table 3**  
**An Illustration of Linear Regression Analysis**  
Variables

Pairs	Onset	Vowel	Coda	Body	Rime
pin - pin	1	1	1	1	1
pin - pit	1	1	0	1	0
pin - min	0	1	1	0	1
pin - pun	1	0	1	0	0
pin - put	0	0	1	0	0
pin - mit	0	0	0	0	0
pin - mun	0	0	1	0	0
pin - mut	0	0	0	0	0

The overall coverage achieved by just one variable or by combinations of two variables was as follows: coda (26.0%), rime (37.1%), onset (48.1%), body (63.3%), onset+rime (74.7%), body+coda (79.5%). This comparison showed that the body counted much more than the rime. When all three segmental variables (C+V+C) were combined, 89.8% of total variances could be accounted for, suggesting that as in English, segments did most of the job in predicting sound similarity in Korean. Interestingly, adding the body variable to the three segmental variables increased the coverage up to 93.5%, while adding the rime variable did not change the result much (90.3%) from the combination of three segmental variables.

#### IV. CONCLUSION

Evidence from various sources has been discussed to argue for the body as major sub-syllabic unit in Korean. Experimental support for the body unit has now also been proposed here, using two different experimental tasks: word-blending and global sound similarity judgments. In all cases the body unit seems to play a role in Korean that is roughly parallel to that of the rime unit in English, and this work challenges the supposed universality of the rime.

#### REFERENCES

- [1] E.O. Selkirk. The Syllable. In van der Hulst and N. Smith (Eds.), *The Structure of Phonological Representations*, Part II, pp. 337-383, 1982.
- [2] E. Fudge. Branching Structure within the Syllable. *Journal of Linguistics*, vol. 23, pp. 253-286, 1987.
- [3] C.G. Gim. A Study on Syllable Structure and Some Processes in its nucleus in Korean. *Mal (Language)*, Korean Language Institute, Yonsei University, vol.12, pp. 25-69, 1987.
- [4] S.B. Cheon. Lapsus Linguae-uy um-wun-lon-cek hay-sek (A Phonological Interpretation of Lapsus Linguae), *Linguistic Journal of Korea*, vol. 5.2, pp. 15-32, 1980.
- [5] R. Treiman. The Structure of Spoken Syllables: Evidence from Novel Word Games. *Cognition*, vol. 15, pp. 49-74, 1983.
- [6] R. Treiman. On the Status of Final Consonant Clusters in English Syllables. *Journal of Verbal Learning and Verbal Behavior*, vol. 23, pp. 343-356, 1984.
- [7] R. Treiman. The Division between Onsets and Rimes in English Syllables. *Journal of Memory and Language*, vol. 25, pp. 476-491, 1986.
- [8] R. Treiman. The Internal Structure of the Syllable. In G.N. Carlson and M.K. Tanenhaus (Eds.), *Linguistic Structure in Language Processing*, pp. 27-52, 1989.
- [9] B.L. Derwing, S. W. Cho, and H. S. Wang. A Cross-Linguistic Experimental Investigation of Syllable Structure: Some Preliminary Results. *Proceedings of the 12th International Congress of Phonetic Sciences*, Aix-en-Provence, France, vol. 3, pp. 110-113, 1991.
- [10] B.L. Derwing and T.M. Nearey. The Vowel-Stickiness Phenomenon: Three Experimental Sources of Evidence. *Proceedings of the 12th International Congress of Phonetic Sciences*, Aix-en-Provence, France, vol. 3, pp. 210-213, 1991.
- [11] B.L. Derwing, Y.B. Yoon, and C.W. Cho. The Organization of the Korean Syllable. In P. M. Clancy (Ed.), *Japanese and Korean Linguistics*. Stanford: Center for the Study of Language and Information, Stanford University, vol. 2, pp. 223-238, 1993.
- [12] P.C. Vitz and B.S. Winkler. Predicting the Judged Similarity of Sound of English Words. *Journal of Verbal Learning and Verbal Behavior*, vol. 12, pp. 373-388, 1973.
- [13] B.L. Derwing and T. M. Nearey. Experimental Phonology at the University of Alberta. In J.J. Ohala and J.J. Jaeger (Eds.), *Experimental Phonology*. Orlando, FL: Academic Press, pp. 187-209, 1986.
- [14] T.A. Bendrien. *Sound Similarity Judgements in English CVC's*. B.A. Honor's Thesis, University of Alberta, 1992.
- [15] R.A. Beinert and B.L. Derwing. Segment, Rime, Syllable, Tier or Root? Evidence from Global Sound Similarity Judgements in Arabic. *ESCOL '92: Proceedings of the Ninth Eastern States Conference on Linguistics*, Ithaca: Department of Modern Languages and Linguistics, Cornell University, pp. 1-10, 1993.
- [16] H.S. Wang and B.L. Derwing. Is Taiwanese a Body Language? *Toronto Working Papers in Linguistics*, pp. 679-694, 1993.
- [17] Y.B. Yoon and B.L. Derwing. A Sound Similarity Judgements of Korean CVC's by Korean and English Speakers. *Toronto Working Papers in Linguistics*, in press.

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