A CROSS-LINGUISTIC EXPERIMENTAL INVESTIGATION OF SYLLABLE STRUCTURE: SOME PRELIMINARY RESULTS

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ABSTRACT
Prior research has shown that there is more to English syllables than a mere linear sequence of phonemic segments. The present research attempts to extend the use of techniques developed in the English investigations to the study of comparable phenomena in other languages of diverse types. A preliminary report is given on the status of sub-syllabic units in Taiwanese and Korean, together with some new findings on Korean syllable boundaries.

1. BACKGROUND

The experimental investigation of syllable structure began with the work of Treiman [1,2, etc.], who used a variety of string manipulation tasks (notably word-blending) to determine whether such hypothesized units as the onset, rime or coda were viable for English. Dow [3,4, etc.] continued this work, using primarily a unit-substitution task. Taken together, this research lends support to the idea that English syllables have an onset+rime or right-branching structure.[2] Treiman & Danis [6] have recently extended this investigation to the question of syllable boundaries in English, putting such notions as the Maximal Onset Principle to experimental test. A chief purpose of the present study was to extend or adapt the methodologies developed in these English language investigations to other languages of diverse types, in order to explore the question of the generality of the findings.

2. SUB-SYLLABIC UNITS IN TAIWANESE AND KOREAN

2.1 Taiwanese

Since the initial attempts to apply Dow's unit-substitution task to Arabic, Blackfoot and Taiwanese proved impractical, it was decided to try a forced-choice version of Treiman's word-blending task that could be group administered. Since the main question of interest related to the direction of the primary bonding between the vowel and adjacent consonants, subjects were given two alternative 'blendings' of a pair of Taiwanese words, one which combined the onset of one with the rime of the other and a second which combined the head of one with the coda of the other, as illustrated by the following example: SAN1 + CIM1 —> (a) SIM1 (b) CIN1. (The numbers following each Taiwanese word indicate tone.) Also included on the test were several word pairs like the following, where both choices were of a single type: TA5 + PI5 —> (a) TI5 (b) PA5. By comparing the results on these items with the first group, we could assess whether there was a distinct preference for one type of blend over the other.

The forced-choice word-blending task was conducted in Taiwan in November 1990 and in January 1991, yielding 95 subjects in all. The results, however, revealed no distinct preference in favour of either onset-rime or head-coda blends, as responses to the 'choice' and 'non-choice' items were indistinguishable: in both cases responses were essentially random, except for a slight overall bias in favour of choosing the first response, regardless of type. This presumably means one of two things: (1) perhaps our subjects did not understand the nature of the task, or else were simply not able to perform it reliably under the conditions it was presented; (2) alternatively, perhaps the simple monosyllables of this language, involving no consonant clusters and very severe internal collocational constraints, are not readily analyzable by speakers into smaller units. This second interpretation is consistent with the results of Read et al.[7] from a related dialect, in which ordinary subjects (i.e., subjects not familiar with the *pinyin* alphabetic transliteration scheme) proved unable to perform the simple task of replacing the initial consonant (onset) of a Mandarin word by another consonant; instead, their performance was highly parallel to that found by Morais et al. [8] in a similar task with illiterate Portuguese speakers. (See [9,10] for further discussion of problems with the notion of the phoneme as a universal unit of speech segmentation.)

2.2 Korean

The Korean language is of much interest to this investigation, as there are reasons to believe that syllables in this language reflect a head + coda structure rather than the onset + rime organization of English (i.e., unlike English, vowel nuclei in Korean seem to adhere more closely to preceding consonants than to following ones). Native speakers report this to be the case on the basis of their own intuitions, and even the standard orthography reflects a judgment of this kind. The syllable SAN (meaning 'mountain'), for example, is represented at two vertical levels, with the Korean letters for SA placed on top and the letter for N placed below it, thus implying an organization like (SA)N rather than S(AN). In addition, Youn has recently conducted an informal word-blend production task, whose results to date support this analysis (see [11]). A Korean version of the forced-choice word-blending task is now under way to firm up these preliminary findings, but the results of that study are not yet available.

3. SYLLABLE BOUNDARIES IN ENGLISH AND KOREAN

3.1 English

Initial attempts to apply the Treiman & Danis (T&D) syllable-inversion task to other languages were generally unfruitful: less than 10% of our Arabic subjects, for example, were able to perform any inversions at all. When a similar problem emerged in the early stages of the Blackfoot investigation, it became clear that a new, simpler technique was going to have to be developed, one that would not require literacy skills to perform. (This was especially critical for Blackfoot, as few speakers know the orthographic system that has been developed only recently by linguists for that language.)

A new technique that worked involves what we call the 'pause-break' task. In this task subjects are asked to choose which of two or three alternative 'breakings' of a word sounded the 'most natural.' To illustrate for the English word MELON, for example, the following three alternatives were offered (where ... indicates the location of the pause):
(a) /m ε...l ə n/ (where /l/ is treated as the onset of the second syllable),
(b) /m εl... ə n/ (where /l/ is the coda of the first syllable), or (c) /m εl...l ə n/ (where /l/ is ambisyllabic). In an extensive pilot study, this task was presented to 95 undergraduate English students, all native speakers with little or no prior exposure to linguistics or phonetics. The main purpose of this pilot study was to evaluate whether the earlier T&D results, using more difficult tasks, could be replicated, and, as indicated in [5], the answer was in the affirmative. This new task has thus been adopted for testing or re-testing in most of the languages in the project, but only the Korean data are available at this time.

3.2 Korean

In the Korean writing system (called *hangul*), letters are used for individual segments and written from left to right, much as in English, but, by utilizing the vertical dimension as already noted above, these letters are also grouped into syllable-sized 'bundles.' The *hangul* spelling of each Korean word thus makes a commitment as to the location of the syllable boundary which every literate speaker presumably knows. The purpose of the present investigation, therefore, was to establish whether any general preference could be found that was inde-

pendent of the orthographic norms.

In principle, we saw two possible ways to investigate this. One possible course of action, obviously, would be to carry out the study among illiterate speakers, who would not know the orthographic norms. The second approach, which could be more readily implemented, was to focus the investigation on homophones having a variable placement of the orthographic syllable boundary, depending on the morphological structure of the words involved. The phonemic string MILI in standard Korean, for example, is ambiguously syllabified in the orthography as MI/LI (when it means 'in advance') or as MIL/I (when it means 'wheat + nom'), where a slash is used here to show the location of the break between the syllable-sized *hangul* 'packages.' For subjects who were given the meanings of the Korean words in the oral presentation used in our study, we expected a close conformity to the orthographic norms. For the other group, however, who were not given the meanings, we saw a possibility for some general phonological preferences to emerge.

The first round of Korean data was collected in October 1990 in Seoul, when two groups totaling 117 subjects were presented with six items similar to the one above, as well as a number of supplementary items selected to test cases mostly involving intervocalic tense consonants or consonant clusters. All subjects were undergraduate students in the Department of English at Sogang University, the great majority of whom grew up in the general Seoul area. The results were as follows:[3]
(1) The clearest cases involved single consonants that are restricted phonotactically to syllable-initial position, such as /č/ (as with SA-/CANG [1.00]), or to syllable-final position, such as /ŋ/ (as in PANG-/I [1.00]). (2) The results were also very clear for consonant clusters, where the preferred break occurs between them. This result was virtually unanimous if this break corresponded with the spelling (as in CHENG-/SO [.99] and KUK-/SU [.98]), but remained the majority choice even when the orthography put the break after the second conso-

nant (e.g., AN-C/A [.74] and KAP-S/I [.66]). (3) For tense consonants (written as geminates) the results were also fairly clear, with the preferred break once again after the vowel in spelling-supported cases (e.g., A-/PPA [.99] and KA-/CCA [.79]), but with a major shift to the spelling break if it occurred after the consonant (e.g., MU-KK/E [.45] and KA-SS/E [.32]). (4) In the crucial orthographically ambiguous strings, which mostly involved single intervocalic consonants, the preferred break position was immediately after the vowel; however, as shown in the summary of these results below, the size of the plurality varied considerably as a function of consonant-type.[4] (Note that two figures are given for these words: the first shows the proportion of subjects who broke the words at the hyphen under the 'no meaning' or 'ambiguous string' condition, while the second shows the result when the meanings were supplied.)

MI-/LI   (.91/.95) vs. MI-L/I (.91/.27)
A-/NI (.83/1.00) vs. A-N/I (.81/.20)
I-/PYENG(.66/.97) vs.I-P/YENG(.45/.25)
CE-/KE (.55/.95) vs. CE-K/E (.55/.63)
SO-/KA (.53/.97) vs. SO-K/A (.52/.25)

If the post-vocalic break position was unambiguously supported by the spelling for such consonants, the effect was, of course, maintained and even enhanced (e.g., I-/MOKI [.89/.94]), but if an unambiguous spelling break was located after the consonant, a major shift again occurred in that direction (as in KI-L/I [.48/.54]). (Notice that supplying the meaning had little effect for these two words, which was the general trend for the non-ambiguous items throughout.) The single outlier pair among the ambiguous strings was KO-/KI (.90/1.00) and KO-K/I (.87/.25), which in the 'no meaning' condition (first numbers) both yielded the kind of results expected for non-ambiguous strings, as discussed in (1)-(3) above. (Compare also the second set of figures in the first column above, where disambiguation was achieved by supplying the meanings.) Given the very high frequency and familiarity of the word KO-/KI (meaning 'meat'), we suspect that our subjects were simply insensitive to the spelling ambiguity here under the 'no

meaning' condition (KO-K/I is the nominalized form of a relatively rare word meaning 'musical piece').

4. CONCLUSIONS

Our attempt to expand the experimental exploration of syllable structure to languages beyond English has been slowed by the fact that new experimental techniques have had to be developed in nearly all cases. Nevertheless, the following preliminary results can now be reported: (1) Korean syllables appear to be of the left-branching or head+coda type, challenging the universality of the onset+rime strategy; (2) the syllables of the Chinese dialects (in this case Taiwanese) continue to resist experimental attempts to sub-analysis, casting further doubt on the universality of the phoneme as a basic unit (cf. [10]); and (3) Korean speakers show a decided preference to divide V-/C/V and VC-/C/V sequences at the positions marked by hyphens, even though their orthography permits syllable breaks at all four of the positions marked by slashes.

NOTES

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[2]More recent work has suggested an alternative interpretation that is less hard and fast (see [5], in this volume).
[3]In all of these examples, a hyphen is used to show the judged syllable break and a slash (/) to show where the break occurs in the spelling; if both breaks coincide, the composite symbol -/ is used. The numbers indicate the proportion of subjects who chose to break the words at the place marked by the hyphen.
[4]Note that the suggested hierarchy is much the same as that found for English (see [5], this volume), except that the linkages in Korean, as expected, are to the following vowel, rather than to the preceding one.

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