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RHYTHMIC STRUCTURE OF WORD BLENDS IN ENGLISH

Anne Cutler† and Duncan Young††

† MPI for Psycholinguistics, Wundtlaan 1, 6525 XD Nijmegen, The Netherlands.
††Laboratory of Experimental Psychology, University of Sussex, Brighton BN1 9QG, U.K.

ABSTRACT

Word blends combine fragments from two words, either in speech errors or when a new word is created. Previous work has demonstrated that in Japanese, such blends preserve moraic structure; in English they do not. A similar effect of moraic structure is observed in perceptual research on segmentation of continuous speech in Japanese; English listeners, by contrast, exploit stress units in segmentation, suggesting that a general rhythmic constraint may underlie both findings. The present study examined whether this parallel would also hold for word blends. In spontaneous English polysyllabic blends, the source words were significantly more likely to be split before a strong than before a weak (unstressed) syllable, i.e. to be split at a stress unit boundary. In an experiment in which listeners were asked to identify the source words of blends, significantly more correct detections resulted when splits had been made before strong syllables. Word blending, like speech segmentation, appears to be constrained by language rhythm.

1. INTRODUCTION

Spontaneous speech behaviour provides many sources of useful data on the processes and representations used in speech production. One such aspect of speakers' behaviour is the formation of new words, which may either be nonce-words (used on a single occasion, for instance as a pun), or neologisms which aspire to incorporation in the vocabulary (used to name a new concept or object, for example). One way in which speakers form new words is by blending together parts of two existing words.

Such word blends can occur deliberately in nonce formations (calling an editorial with a nervous tone an *edgytorial*, for instance), or in more established creations (such as *smog* from *smoke* and *fog*, or *brunch* from *breakfast* and *lunch*). They can also occur inadvertently in speech errors, such as saying *sleast* instead of either *slightest* or *least*, or *stop* instead of either *store* or *shop*.

Extensive research on the properties of both inadvertent and deliberate word blends by Kubozono [1, 2, 3, 4] has established that there are interesting cross-linguistic differences in the patterns observed. Blends in Japanese preserve moraic structure; thus *tomare* (to-ma-re) and *sutoppu* (su-to-p-pu) can blend to *tomappu* (to-ma-p-pu) but not *tomoppu* (to-mo-p-pu). Blends in English, on the other hand, tend to split words between syllable onset and the following vowel (as in *smog*, *brunch* and *stop* above).

Moreover, Kubozono's most recent research [4], in which speakers of both languages were asked to produce deliberate blends of identical sets of stimulus words, has shown that Japanese-speakers apply moraic blending even to English, preferring to combine, say, *team* and *such* as *teach*. In contrast, English-speakers combine *team* and *such* as *touch*, again making a split between syllable onset and vowel, rather than between vowel and coda.

These findings are consistent with other research on speech production in Japanese and English. For example, Kubozono [1] has observed that the same moraic constraint applies in other types of speech error (such as anticipation, perseveration, substitution and exchange of phonetic material) in Japanese. Likewise, Treiman [5, 6, 7] has observed that a division between syllable onset and rime is the preferred choice of English native speakers making deliberate blends, or rating nonword acceptability.

Moreover, evidence from speech perception also suggests that moraic structure plays a role in the recognition of Japanese [8, 9], while divisions between syllable onset and rime are salient for English listeners [10]. However, the relevant perceptual research also suggests another perspective within which the moraic effects in Japanese can be viewed. The question at issue in the experiments which established moraic effects in recognition of Japanese [8, 9] was the segmentation of continuous speech: how listeners establish where to divide an incoming speech stream appropriately for efficient recognition of the words of which it consists. In this regard, the results suggest that Japanese listeners segment speech at mora boundaries. English listeners, on the other hand, segment speech at the onset of strong (but not at the onset of weak) syllables, i.e. they segment speech at stress unit boundaries [11, 12]. Results from yet a third language, French, suggest that listeners segment speech in that language at syllable boundaries [13].

These apparently different segmentation procedures can be unified in a universal account: segmentation exploits language rhythm. The rhythm of Japanese is mora-based, the rhythm of French is syllable-based, and the rhythm of English is stress-based, and thus the results of the segmentation experiments in these three languages exactly reflect the characteristic rhythm of each language.

Speech production, too, exhibits effects of rhythmic structure: when speech errors in English result in an utterance with a rhythm which is different from that which the intended utterance would have had, the error tends to be more regular than the intended utterance would have been [14]. It is therefore of interest to ask whether the effects of moraic structure observed by Kubozono in the production of Japanese may at least in part reflect more general constraints of rhythmic structure, and whether they might not therefore be paralleled by, for instance, effects of stress unit patterns in English. Note that Kubozono's cross-linguistic studies using English materials did not address this issue, since only monosyllabic stimulus words were used; monosyllables form single stress units and therefore contain no internal stress unit boundaries.

In order to test whether word blending is also more generally constrained by rhythmic structure, i.e. to test whether English listeners' blend preferences are sensitive to stress unit boundaries, we conducted two studies involving English polysyllabic words rather than monosyllables as in the previous work. The first examined a corpus of spontaneous word blends in English, while in the second listeners' perception of spontaneous blends was investigated.

2. SPONTANEOUS WORD BLENDS

Materials and Procedure. Wentworth [15] provided a large corpus (nearly 3000 items) of English spontaneous word blends. The sources are very mixed, and include dictionary words such as *brunch*, puns, jokes, advertising coinages and much else. Since there would appear to be no *a priori* reason why source variation should entail variation in phonological constraints on blending, we did not exclude particular sources. However, our analysis was of course restricted to that subset of the corpus which provided evidence relevant to the question of stress unit involvement. Thus we considered only blends of two polysyllabic words which included at least the first vowel (syllable nucleus) of Word 1 and the last vowel of Word 2 and omitted the end of Word 1 and the onset of Word 2.

We found 91 such blends in which there was no overlapping phonetic material between the two source words, and a further 102 in which there was some overlap. Examples of the former set are *crocogator* from *crocodile* and *alligator*, *testifession* from *testimony* and *confession*; examples of the latter set are *nicotunia* from *nicotine* and *petunia*, *cinemusical* from *cinema* and *musical*.

We categorised each blend word according to whether the split in the first and in the second source word occurred prior to a strong or a weak syllable, whereby strong syllables were defined as those including full vowel quality, weak syllables as those with reduced vowels (see [16] for evidence that vowel quality is the basis of the strong-weak distinction in production and perception by native English-speakers). If stress units are relevant in the generation of blends, we would predict that words would tend to be split at stress unit boundaries, i.e. prior to strong syllables (or prior to the vowels of strong syllables, if the tendency for onset/rime divisions is an independent effect which will appear in polysyllabic as well as in monosyllabic blends).

		Blends with no phonetic overlap		Blends with some phonetic overlap	
		word 1		word 1	
		before strong syllable	before weak syllable	before strong syllable	before weak syllable
word 2	before strong syllable	43	18	52	21
	before weak syllabel	20	10	26	3

Table 1. Division point for source words in spontaneous word blends.

Results. Table 1 shows the results of our analysis. As can be seen, in the blends with no phonetic overlap Word 1 was split before a strong syllable in 67% of cases and Word 2 in 69%. In the blends with overlapping phonetic material, the proportions were 71% and 76% respectively. In all cases there were thus more splits occurring before a strong than before a weak syllable. Thus, for example, *crocodile* and *alligator* become *crocogator* rather than *crolligator* or *crocoditor; nicotine* and *petunia* became *nicotunia* rather than *nicotinia* or *nicunia*. The differences in each individual subset were statistically significant: for blends with no phonetic overlap, $z = 3.56$ ($p < .001$) for Word 1, $z = 3.15$ ($p < .005$) for Word 2, and for blends with overlapping material $z = 5.25$ ($p < .001$) for Word 1, $z = 4.26$ ($p < .001$) for Word 2. The two source words did not differ significantly in the degree to which splits tended to occur before strong syllables.

The question of the syllabic position of the splits in these blends (before a syllable onset versus before a rime) is relevant only to the blends with no phonetic overlap. These showed, firstly, a remarkable degree of parallelism, in that the split was at the same syllabic position in both source words in 85 of the 91 cases (the six mixed cases included, for instance, *cruical* from *crucial* and *critical*, *tomtato* from *tomato* and *potato*). Within the 85 parallel cases, 55 were split before an onset and 30 before a rime, a statistically significant difference ($z = 2.6$, $p < .01$).

The question could not be applied to blends with overlapping phonetic material because we had excluded all cases in which the overlapping material was a vowel (since in such cases it could not be determined to which word that vowel, and hence that syllable, belonged). Thus the overlapping material was always consonantal. In Word 1 the overlap was equally likely to be a syllabic onset or a syllabic coda (50:50 out of 102, with two ties - one case which included both coda and onset and one ambisyllabic segment); in Word 2 it was more likely to be an onset (63:21, with 18 ties - one case which included both coda and onset and 17 cases of ambisyllabicity; $z = 4.47, p < .001$).

The tendency for onset/rime division points, though undoubtedly present in the monosyllabic material studied by Kubozono, seems therefore less strong in polysyllabic blends, in which divisions tend to occur instead at stress unit boundaries, and more often at the onsets of syllables.

In our second study, we investigated how listeners perceive word blends. Are listeners better able to process blends which conform to the rhythmic tendencies we observed above?

3. DECODING WORD BLENDS

Materials and Procedure. We assembled a corpus of 32 word blends, most of which were taken from Wentworth's collection and were therefore actual attested cases of blending by English-speakers. In a few cases, the Wentworth material was supplemented by additional blends constructed by the authors, in order to control for number of syllables as described below. The 32 blends fell into four subsets of eight items each. In one subset, both source words in the blend had been split before strong syllables (*crocogator*), in another both had been split before weak syllables (*herigacy* from *heritage* and *legacy*), in the third subset Word 1 was split before a strong syllable and Word 2 before a weak syllable (*vaganegade* from *vagabond* and *renegade*),while in the fourth subset Word 1 was split before a weak syllable and Word 2 before a strong syllable (*testifession*).

The four subsets were exactly balanced with respect to number of syllables (one 2-syllable, two 3-syllable, three 4-syllable and two 5-syllable blends in each), and within that, for the number of syllables contributed by each source word. The blends were recorded on tape, in random order.

The subjects were 24 undergraduate students at Sussex University, who were native speakers of English with no known hearing defects. They were presented with the tape and asked (a) for each blend, to deduce from which two source words it had been formed, and (b) to indicate for each such judgement how confident they were that their deduction was correct. The confidence ratings were made on a 5-point scale from"not at all confident" to "very confident". After they had finished this first phase of the experiment, the subjects were provided with a list containing the blends and the two source words from which each blend was formed, and they then listened to the tape a second time; on this second occasion they were asked to rate, again on a 5-point scale, (a) the likelihood that the blend might catch on as an English word, (b) the usefulness of the blended concept, and (c) the degree to which the blend sounded like it could have been a real word of English.

Results. Table 2 presents the proportions of cases in which subjects' responses corresponded exactly to the source words from which the blends had indeed been constructed, as a function of the division point (before strong syllable, before weak syllable) of each source word. Table 3 presents a more liberal assessment of the responses, in which subjects' responses were scored as correct if they corresponded correctly to two words containing the phonetic material comprising the blend (and

			Word 1			
			Correct		Incorrect	
			Word 2 Correct	Word 2 Incorrect	Word 2 Correct	Word 2 Incorrect
Word 1 STRONG	Word 2	STRONG	.57	.07	.18	.18
		WEAK	.31	.27	.15	.27
Word 1 WEAK	Word 2	STRONG	.37	.02	.28	.33
		WEAK	.36	.19	.14	.31

Table 2. Proportions of exactly correct source word deductions as a function of source word division point.

			Word 1			
			Correct		Incorrect	
			Word 2 Correct	Word 2 Incorrect	Word 2 Correct	Word 2 Incorrect
Word 1 STRONG	Word 2	STRONG	.68	.06	.07	.18
		WEAK	.38	.27	.08	.27
Word 1 WEAK	Word 2	STRONG	.67	.02	.07	.25
		WEAK	.56	.14	.07	.23

Table 3. Proportions of phonetically acceptable source word deductions as a function of source word division point.

irrespective of whether or not the selection made sense - e.g. *ruler* plus *vino* to create *roulino*). From both tables it can be seen that subjects were successful in decoding the blended words: overall, in only about a quarter of cases did the subjects fail to identify acceptable candidates for both source words. For correct identifications, however, the blends in which both source words were split before a strong syllable proved significantly easier to decode than blends in which either one or both source words were split before a weak syllable. With the more liberal scoring criterion taking into account only phonetic acceptability, only the phonological structure of Word 2 exercised a significant effect: again, subjects were significantly more likely to produce acceptable responses where this word was split before a strong than before a weak syllable.

Table 4 presents the confidence ratings for subjects' source-word deductions. Unsurprisingly, subjects have higher confidence in the cases in which their responses

			Word 1			
			Correct		Incorrect	
			Word 2 Correct	Word 2 Incorrect	Word 2 Correct	Word 2 Incorrect
Word 1 STRONG	Word 2	STRONG	3.49	1.36	1.83	1.0
		WEAK	2.79	1.85	1.65	2.06
Word 1 WEAK	Word 2	STRONG	3.19	1.34	1.65	1.49
		WEAK	2.67	1.63	2.75	1.0

Table 4. Mean confidence ratings (1=very low, 5=very high) for source word deductions as a function of source word division point.

	Word 1			
	STRONG		WEAK	
	Word 2 STRONG	Word 2 WEAK	Word 2 STRONG	Word 2 WEAK
1. Will the word catch on in English ?	2.4	1.74	2.03	1.92
2. Is the concept useful in English?	2.37	1.86	2.15	2.11
3. Does the blend sound English-like?	3.04	2.21	2.46	2.63

Table 5. Mean ratings (1=very low, 5=very high) for blends of known source word as of function of source word division point.

were indeed correct. Within these cases, they were more confident when the source words (especially Word 2) had been split before a strong syllable.

Finally, we analysed also the ratings provided by subjects when given the actual source words in the second part of the experiment. Table 5 shows the mean ratings. Again, it can be seen that the ratings are highest when both words are split before a strong syllable.

4. CONCLUSION

We conclude that word blending, like speech segmentation, is constrained by language rhythm. In spontaneous blends, the source words are more likely to be split before a strong than before a weak syllable, i.e. at the boundary of a stress unit rather than not. Furthermore, blended words which conform to this pattern are easier for listeners to decode, and are more highly rated by listeners as potential and as useful words.

Thus just as perceptual evidence from studies of segmentation [8, 9, 11, 12, 13] suggests that apparent language-specific segmentation procedures reflect a language-universal rhythmic constraint, so now does the evidence from word blending suggest that the same rhythmic constraint applies both to English and, as already demonstrated, to Japanese [1, 2, 3]. We would further predict that the advantage for words blended at stress unit boundaries in the decoding of English blends should also be paralleled by an decoding advantage for Japanese blends joined at mora boundaries.

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