

TIMING PROPERTIES OF NEW ZEALAND ENGLISH RHYTHM

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ABSTRACT

Recent analyses of full vs. reduced vowel realisations of a set of grammatical words with potentially reduced vowels suggest that New Zealand English (NZE) — like many other varieties of English — is exhibiting a tendency towards a syllable-based rhythm, and that this may be under the influence of contact with Maori. The current research examines the timing patterns that underly these claims for syllable rhythm, using acoustic measures of vowel, syllable and foot duration, as well as derived measures of local timing variability. These analyses confirm that in comparison with samples of British English, NZE shows greater equality of full and reduced vowel durations, and less foot-based syllable compression. However, NZE does not exhibit as strong a tendency towards syllable-based rhythm as has been reported for other varieties such as Singapore English. Within NZE varieties, the tendency to syllable-timing is strongest for Maori English, suggesting a contact influence on NZE.

1. INTRODUCTION

While English rhythm is generally assumed to be nearer the stress-timed end of a continuum from stress-based to syllable-based timing [10], recent evidence suggests that New Zealand English (NZE) shares a tendency towards syllable-based timing also exhibited by a number of other varieties [5, 9]. As with some of these other varieties, it has also been argued that this tendency is due to a contact influence, in this case from Maori.

Previous studies of the rhythm of NZE have used a qualitative measure, namely the incidence in newsreader text samples of full vowel realisations of grammatical words from a list compiled by Gimson [6], which may be optionally realised with either full or reduced vowels [1, 2, 7, 8]. These studies have shown a greater proportion of full vowel realisations in NZE than in British English, and more in Maori English (the first-language English spoken by those identifying themselves as being of Maori ethnicity) than in Pakeha English (Pakeha is a term denoting New Zealanders of European descent). This aspect of Maori English (ME) was noted over 30 years ago in a study of Maori school-children, who were observed to use full vowels where other English speakers (including by inference Pakeha) would be expected to use reduced vowels. This full-vowel use was reported to result in a 'jerky rhythm' [3]. Such an influence on NZE from ME is generally traced back to the Maori language itself, which has mora-timing. Note though that most ME speakers today are not themselves proficient in Maori, so the association has become one of ME with Maori ethnicity rather than with the Maori language itself.

While the tendency to use full vowels rather than reduced is compatible with an assumption of a more syllable-based rhythm in NZE, it is not clear whether the tendency is a result of such a

rhythmic pattern, or the cause of one, at least perceptually. Looking at Maori as a potential source does not help greatly here, since this language does not use reduced or centralised vowels to the same extent as English, though contact with English may be changing this. In other words, a greater tendency towards using full vowels instead of reduced in ME (and more generally in NZE) could be linked to influences from the Maori vowel system rather than from rhythmic factors per se. Thus the current study includes a more detailed acoustic analysis of the entire texts used in the previous research, as well as looking at additional materials designed to investigate the issue of NZE rhythm.

2. ACOUSTIC STUDIES

2.1. Newsreader data

The original auditory analysis of newsreader data took 5 samples from a range of newscasts [1]. Four were NZE texts, including ME data from Mana News, and 3 Pakeha English (PE) samples of which two were from commercial stations (ZMFM and Windy), and one from the more conservative National Radio. The fifth sample was from the BBC World Service, representing a conservative British English (BE) style. The study showed higher incidences of full vowels in ME than in all the other samples, and in the conservative PE texts than in both the commercial PE stations and the BE sample, a pattern of results that was interpreted as reflecting both a NZE-BE difference and a stylistic difference within NZE. That is, the BE sample had a smaller proportion of full vowels than the NZE of the stylistically similar National Radio because of a dialect difference, while the commercial stations had lower full vowel counts than National because of the faster and less formal style of the commercial networks. The higher full vowel incidence in ME was taken as indicative of a dialectal ME-PE difference. The overall interpretation of these data was that they reflected differences on a varietal dimension from BE through PE to ME, and a stylistic dimension distinguishing the commercial PE texts and National.

2.1.1. Speech rate effects. An initial question addressed in the subsequent acoustic analysis reported here relates to the stylistic difference noted for the PE samples. The acoustic study aimed to confirm the claimed rate differences between these samples, but also to address the possibility that similar rate differences may be associated with other contrasts between samples. To this end speech rates in syllables per second were computed for each of the samples used in the original study (which were each approximately two and a half minutes in length), and these speech rates were then related to full vowel incidence (Figure 1). These data confirm that the commercial stations have a more rapid delivery than National, but show also that speech rate may be a factor in the comparison of full vowel counts in ME and PE,

since full vowel count increases progressively as rate decreases between these four NZE texts.

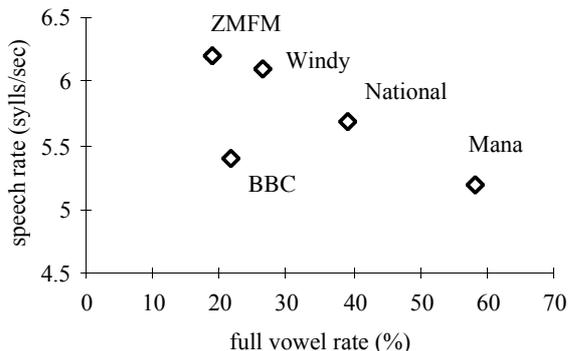


Figure 1. Speech rate and full vowel counts

If it were not for additional confirmatory findings of differences in full vowel usage in ME and PE in a range of conversational texts [2, 7, 8], it would be tempting to explain the differences between NZE varieties simply in terms of rate differences.

Clearly, though, more is involved in the comparison of BE and NZE than a rate difference. To evaluate the claim that the differences in full vowel counts between the samples of newsreader texts are due to differences in rhythmic structure, the syllable and foot timing patterns of the full texts were analysed further.

2.1.2. Variation in syllable and foot durations. A priori, it might be expected that a more syllable-timed language would show small variation in syllable durations, but greater variation in foot durations (the latter defined with reference to accented syllables). Conversely, stress-timed languages should show small variation in foot (inter-stress) intervals, and larger variation in syllable durations, since syllables tend to be compressed in feet with larger numbers of syllables. A measure of variability in speech timing that has been suggested as a more accurate indicator than the variance or standard deviation of durations is the Pairwise Variability Index (PVI) used by Low in a comparison of Singapore English (SE) and BE [9]. This measure averages relative differences in the durations of adjacent units, and normalises for local variations in speech rate. Syllable and foot PVIs for the newscast samples are given in Table 1.

newscast	BBC	Mana	National	Windy	ZMFM
variety	BE	ME	PE	PE	PE
syllable PVI	48.7	39.8	44.2	42.8	46.4
foot PVI	38.4	41.3	35.3	42.5	37.3

Table 1 Syllable and foot PVIs, in arbitrary units (see text).

Analysis of the syllable PVIs shows (by Fisher's Protected LSD) that ME has less variation in syllable durations than BE and each of the PE samples, that the PE texts do not differ from one another, and that BE shows more variation than both ME and the commercial station Windy. While the foot PVIs do not show any significant differences, it is noteworthy that the samples with lower variation in syllable durations have the larger variations in foot durations, and vice versa. This pattern may well be indicative of the relative importance of the foot and the syllable

as the unit of rhythmic organisation, and supports the contention that ME is more syllable timed than PE, and that the NZE samples — like SE in Low's study — are generally more syllable timed than BE.

2.1.3. Relationship between syllable and foot durations.

Given that the PVI data have shown that there is variation in foot and syllable duration, what are the constraints on such variation, and do these in turn reflect the different rhythmic tendencies of the samples? It was hypothesised that foot duration would be more dependent on the number of syllables in the foot in NZE than in BE, and conversely that syllables are more likely to be compressed as foot length in syllables increases in BE than in NZE. To test these hypotheses, two regressions on foot length (in syllables) were computed for each newsreader sample, firstly of foot duration (in msec), and secondly of syllable duration (in msec).

For the first of these regressions, foot duration was re-expressed as a function of the average syllable duration for the sample, in order to normalise for speech rate differences. If rhythm is strictly syllable-based, then foot duration will be a linear product of the average syllable duration and the number of syllables in the feet. The regression lines in Figure 2, together with the R² values, show that syllable count accounts for a significant proportion of variance in foot duration in all cases. The functions are stronger for ME than for the PE samples, and weakest for BE. In addition, comparisons of the regression functions [4] showed that the slope for ME (0.81) is significantly steeper than for all other samples, which do not differ from one another.

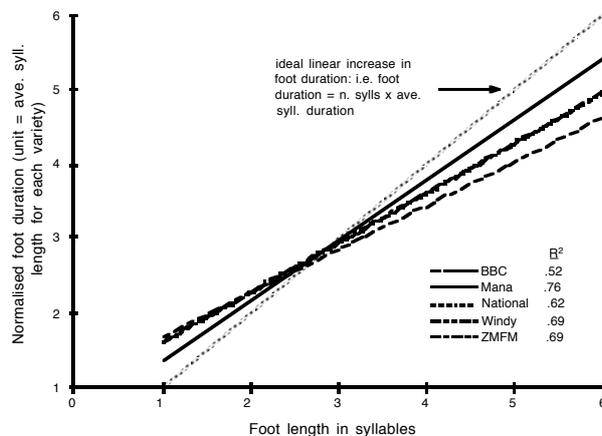


Figure 2. Regression functions of foot duration and length

The second set of regression functions is displayed in Figure 3. For these regressions of syllable duration and foot length it was found that the data were better modelled, for each sample, by a logarithmic function than by a linear one, reflecting the fact that syllable compression becomes increasingly difficult as the syllables become shorter. The curves and R² values in Figure 3 show that compression is stronger for BE than for PE, and weakest for ME. Pairwise comparisons of the slopes of these functions confirms that ME shows significantly less compression than BE, that both ME and BE differ from each of the PE samples, and that the PE samples do not differ from one another.

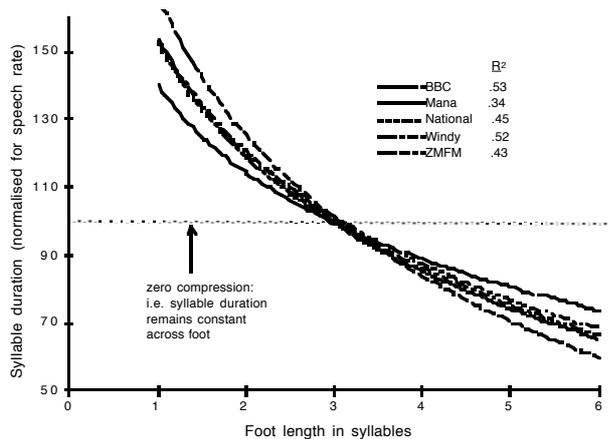


Figure 3. Compression effects: regression function of syllable duration and foot length

These two sets of regression data show clearly that these samples sit on a continuum from a more stress-based timing in BE (with a stronger syllable compression function and a weaker relationship between foot duration and foot length) to a more syllable-based timing in ME (which has weaker syllable compression and a greater effect of foot length on foot duration). The Pakeha NZE varieties lie between these two. Importantly, these PE varieties are not distinguished from one another in the regression functions, which normalise for speech rate differences, suggesting that the differences in full vowel counts reported for these samples are due to rate differences.

This more detailed analysis of the newsreader data provides further support for the claim that there are rhythmic differences between the samples collected, representing a greater extent of syllable-based timing in NZE than in BE, and in ME than in PE. These differences are not limited to the patterning of reduced vs. full vowel forms of a small set of words in the samples, but affect the basic timing structures of the varieties.

2.2. Sentence lists

The data from both the original auditory study of the newsreader samples [1] and from the subsequent acoustic study reported here show a clear pattern of timing differences across the varieties sampled. It should be noted, however, that the content of these news broadcasts differed, and that the range of segments, syllable types, etc. was not closely controlled. In order to confirm the timing differences for these varieties, subsequent work has been considering data from sentence sets read by speakers with different English varieties. These sets are based on those used in a comparison of Singapore English and British English [9], and consist of five pairs of sentences read as part of a larger speech production task. In each pair there is one sentence with (largely) full vowels only, as in (1) below, and a similar one with a more even mixture of full and reduced vowels, as in (2).

- (1) Grace works through huge mounds each Friday
- (2) Grace was tired of Matthew Freeman.

The SE-BE comparison, using 10 female speakers of each variety, showed a clear difference in how PVI values for vowel duration patterned over the two sets of sentences. In SE, the PVI for full vowel sentences was not significantly different from that for full-and-reduced vowel sentences, whereas the BE data showed significantly more variation in the full-and-reduced set than in the full vowel set, which did not differ from the SE full vowel set.

The sentence lists used in the SE-BE study were included in a series of recording sessions exploring a range of aspects of NZE pronunciation. These lists have been recorded by 10 Pakeha English speakers (5 male, 5 female) of a comparable age to the speakers partaking in the SE-BE study. Recordings are currently underway using Maori English speakers, and data from these will be reported at the Congress.

In addition to producing a further comparison of ME and PE using more controlled speech materials, the present study aims to evaluate the position of NZE relative to a more clearly syllable-timed variety of English, namely SE. However, this comparison is only valuable if measurement criteria in the two studies are themselves comparable. Therefore, vowel durations in a subset of both the SE and BE recordings were measured by the present author, and the resulting PVI values compared with those reported for the SE-BE study for the same subset. There was very little difference between the original values and the replication, and so the comparison of NZE with these other varieties is not invalidated by differences in measurement criteria.

A further point of interest in the NZE study is the comparison of male and female speakers. Earlier studies had suggested that Pakeha women were using more full vowels instead of reduced than Pakeha men, while there was no comparable gender difference for Maori English speakers [7]. This gender difference for Pakeha speakers was linked to other studies of phonetic variables in NZE which show that there is a greater tendency for Pakeha females than males to adopt speech patterns characteristic of ME. Such gender differences amongst Pakeha speakers have been described in terms of a greater tendency amongst females to show solidarity with minority groups. To further evaluate these claims of gender effects, the current study includes equal numbers of male and female speakers of ME and PE.

PVI data for vowel durations for the speakers so far analysed are shown in Table 2, together with comparison data from the SE-BE study, which only sampled female speakers.

		NZE	SE	BE
female	full vowel	30.9	40.4	31.8
	full & reduced	63.5	46.4	76.6
male	full vowel	33.5		
	full & reduced	54.9		

Table 2 Vowel PVIs for full vowel and full-and-reduced vowel sentences in NZE, SE and BE (see text).

The data in this table show that the female NZE speakers are intermediate between the SE and BE speakers, since their PVI value for sentences with mixed full and reduced vowels is higher than that reported for the former, but not as high as that found for the BE speakers. This finding confirms the indications from the newsreader study that NZE is more syllable-timed than BE.

The gender comparison in the NZE data was examined through Analysis of Variance of average PVI values, with gender and sentence type (full vs full-and-reduced) as independent variables. The interaction of these variables was significant ($F [1,16] = 4.69, p < 0.05$), reflecting the greater difference between full vowel data and full-and-reduced vowel data for females ($F [1,8] = 103.05, p < 0.01$) than for males ($F [1,8] = 28.35, p < 0.01$). The fact that there was no overall gender effect, and no differences in male and female PVI values within either sentence set, clearly fails to support the notion that a move to syllable-based timing is being introduced into PE by females rather than by males. In fact, the stronger sentence type effect for females suggests that they show less evidence of syllable-based timing than the male speakers, for whom mixed vowel sentences are more like sentences with full vowels alone. However, the overall level of the PVI values for the mixed sentences does not differ by gender, and is clearly lower than that reported for BE speakers on the same sentences. It is conceivable that the younger group of subjects than those studied in the previous gender comparison in NZE [7] have taken the change in timing patterns nearer to its culmination than is evidence in the older speakers sampled elsewhere. Further comparison with ME speakers and with older PE speakers producing the same sentences is required.

3. SUMMARY

This paper has been concerned with issues of rhythm in New Zealand English. As its starting point it has taken previously published auditory analyses based on the incidence rates of full vowel realisations of potentially reduced vowel forms. Through a series of acoustic measurements of durations, the current study has shown that the rhythmic patterns claimed in those previous analyses do for the most part correspond to differences in timing properties, with NZE varieties showing a greater tendency towards a syllable-based rhythm than British English, and with a clear difference within NZE varieties between Maori English and Pakeha English. Further differences between different samples of PE can be attributed to rate differences, and it is these rate differences that are most probably the main factor involved in the perceived stylistic differences in the rhythms of a conservative radio station and a pair of more commercial newscasts in NZE. Differences between BE and PE are supported also by the second study reported in this paper, in which controlled sentence sets with different combinations of full and reduced vowels were compared. PE speakers proved to be intermediate between BE and Singapore English in the degree of variation shown in the mixed sentence sets, and there was no clear indication that female NZE speakers show more syllable-based timing than males. Further analysis is in progress, looking at equivalent sentence set data from male and female ME speakers.

Clearly a further area for detailed study concerns the influence on NZE of ME, and patterns of change in rhythmic structures across generations of NZE speakers. Additional questions concern specific aspects of the rhythmic nature of NZE, such as whether the appropriate characterisation is indeed syllable-based timing, rather than an alternative such as mora-based timing, reflecting more accurately the moraic rhythm of the Maori language itself.

ACKNOWLEDGMENTS

My thanks to Helen Ainsworth for making her newsreader data available, and to Ee-ling Low for samples of her British and Singapore English materials. The research reported in this paper was supported by a grant

from the Marsden Fund, administered by the Royal Society of New Zealand.

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