

Rhythm and pitch as markers of ethnicity in New Zealand English

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Abstract

This paper investigates the differing rhythmic properties of Maori English and Pakeha English in New Zealand and also examines possible differences in the use of pitch. The results show that Maori English is significantly more syllable-timed than Pakeha English. There seems to be a change toward increased syllable-timing in the dialect as a whole, with young New Zealanders producing more syllable-timed speech. The results relating to pitch show that Maori participants had a significantly higher mean pitch than Pakeha speakers, which demonstrates that rhythm is not the only prosodic factor which serves as a marker of ethnicity in New Zealand.

1. Introduction

Previous work on rhythm in New Zealand has suggested that there may be a difference in timing patterns within the variety, with Maori speakers producing more syllable-timed speech than Pakeha speakers (Holmes and Ainsworth 1996; Holmes and Ainsworth 1997; Warren 1997). The present paper investigates the rhythmic properties of Maori and Pakeha English, as well as possible differences in the use of pitch. This study uses the normalised vocalic Pairwise Variability Index (PVI) suggested in Grabe and Low (2002) for the measurement of rhythm. The PVI is based on the relative difference in duration of successive vocalic segments and is normalised for local rate variations. A low PVI value shows less variation in vowel duration, and as such indicates a more syllable-timed language. Stress-timed languages on the other hand typically demonstrate shorter unstressed vowels alternating with longer vowels, resulting in a higher PVI. Grabe and Low (2002) report PVIs of 57.2 for British English and 52.3 for Singapore English, showing that Singapore English is a more syllable-timed variety of English. A selection of PVI values taken from Grabe and Low (2002) for various languages is shown in Table 1. With the help of PVI values we can plot languages along a continuum of stress- and syllable-timing instead of categorically distinguishing between stress- and syllable-timed languages. One aim of this project was to determine where Maori and Pakeha English would fit along this continuum. A second was to investigate whether other suprasegmental cues might also serve as markers of ethnicity in New Zealand.

2. Methodology

2.1. Speakers

In order to calculate PVI values for Pakeha and Maori English, 36 male and female New Zealanders aged between 18 and 65 were recorded. The recordings were carried out in a quiet room in the participants' own home using a

Table 1: *Rhythm values for some languages (selected data taken from Grabe and Low (2002))*

Language	PVI
Mandarin	27.0
Spanish	29.7
Luxembourg	37.7
Japanese	40.9
French	43.5
Polish	46.6
Rumanian	46.9
Welsh	48.2
Singapore English	52.3
Malay	53.6
British English	57.2
German	59.7
Dutch	65.5
Thai	65.8

Samba AV Digital Player and Recorder which produced files in .wav format. 24 of the speakers were Maori and 12 were Pakeha. The Maori participants were recorded in the North Island so that their recordings could be used in a follow-up perception experiment in the South Island. This significantly decreases the likelihood that the voices will be recognized by participants in the perception experiment, and was felt necessary given the relatively small size of the Maori community in the South Island. Speakers were all recorded reading a passage as well as telling a narrative, producing 72 passages for the analysis. The reading passage consisted of 6 sentences taken from the book titled *The Little Prince* (de Saint-Exupery 1943). (See Appendix for the reading passage.) To elicit more informal, narrative style passages, the speakers were asked to talk about rugby or other sports of their choice.

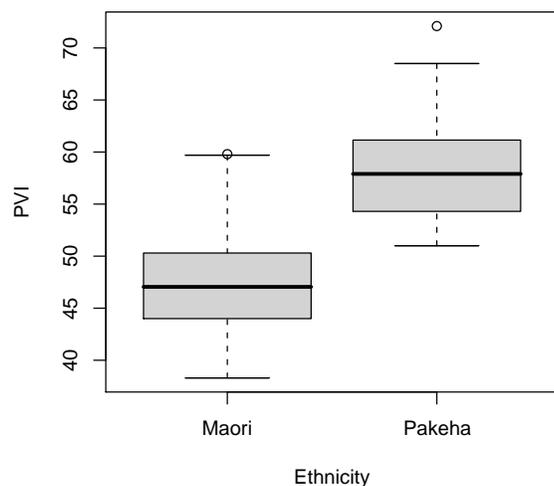


Figure 1: *Rhythm vs Ethnicity* (Wilcoxon-test $p < .0001$)

Previous research on Maori English has indicated that not all people of Maori origin speak with Maori accented English (King 1993). Similarly, not only ethnically Maori speak the dialect. It is also used by some Pakeha who are highly integrated into the Maori community. Impressionistically, not all ethnically Maori participants used in this research sounded equally Maori. Nonetheless, they were all included and analysed in this study. It is the aim of a follow-up perception study to disentangle the various effects of different linguistic cues in order to establish what exactly it means to ‘sound Maori’.

2.2. Maori Integration Index

In order to examine to what extent each speaker has been exposed to Maori English, a Maori Integration Index (MII), similar to that in Robertson (1994), was designed. This was based on background information gathered after each recording. Points were given for ethnicity, competence in the Maori language and general involvement in things Maori. Questions also related to how often the speaker watches the Maori Television or listens to iwi radio stations or visits a marae. The maximum possible score was 14 with actual scores ranging from 0 to 13.5.

2.3. Phonetic segmentation and measurement of rhythm

Phonetic segmentation of the recordings was carried out using the Praat software (Boersma and Weenink 2006). The first 3 sentences of each reading passage were analysed as well as the first 10–15 seconds of each narrative (depending on where the intonation phrase ended). Each passage was segmented into vowel and consonant sequences. Following Grabe and Low (2002), diphthongs as well as adja-

cent vowels were treated as one vocalic segment, whereas initial glides were marked as consonants. Pauses and hesitations were excluded from the analysis. Altogether 3281 vocalic segments were analysed and measured. The PVI values were calculated based on the difference in duration between each pair of vowels in successive syllables, taking the absolute value of the difference and dividing it by the mean duration of the pair. The output is multiplied by 100 as the normalisation produces fractional values. For a thorough explanation of the technique consult Grabe and Low (2002).

2.4. Analysis of pitch

Pitch values were also calculated in Praat, with some of Praat’s values hand-corrected to remove pitch tracker errors. Suspiciously low F0 values, typically a result of creaky voice, were excluded from the analysis. The obtained Hertz measurements were also converted to ERB (Equivalent Rectangular Bandwidth), which is arguably the most appropriate scale for the study of intonation (Daly and Warren 2001). The following formula was used to convert Hertz values to ERB:

- $ERB = 16.7 \log(1 + f / 165.4)$, where f equals frequency in Hertz.

Mean, minimum and maximum pitch, standard deviation and pitch range were all calculated. Pitch range was simply computed as the difference between maximum and minimum pitch values over a passage.

3. Results

3.1. Rhythm

In order to investigate the effect of rhythm, a linear regression model was fit by hand. It showed significant effects of ethnicity ($p < .0001$) and age ($p < .01$). The coefficients are shown in Table 2 and the anova table in Table 3.

Table 2: Coefficient table for model of PVI

Variable	Coef	S.E.	t	P
Intercept	43.25	1.57	27.39	0.000e+00
ethnicity=pakeha	11.47	1.29	8.85	5.420e-13
age	0.12	0.04	2.90	5.002e-03

Table 3: Anova table for model of PVI

Factor	d.f.	Partial SS	MS	F	P
ethnicity	1	2106.0	2106.0	78.46	<.0001
age	1	225.7	225.7	8.41	0.005
REGRESSION	2	2313.4	1156.7	43.09	<.0001
ERROR	69	1852.1	26.8		

3.1.1. Rhythm and ethnicity

The resulting PVI values show that the rhythm of Pakeha English is similar to that of British English, whereas Maori English is even more syllable-timed than Singapore English. The mean PVI for Pakeha speakers was 58.7, and the mean PVI for Maori speakers was a low 47.3. There is a degree of variability within Pakeha and Maori English themselves, with PVI values ranging from 38.3 to 72.1. However, the PVI for Maori English never reaches 60 while the PVI for Pakeha English never goes below 50. A boxplot diagram illustrates these numbers in Figure 1. As mentioned above, ethnicity is highly significant in a linear model of PVI.

3.1.2. Rhythm and age

Older speakers of both Maori and Pakeha English produced significantly higher PVIs than younger speakers, which seems to indicate that New Zealand English as a whole is becoming more syllable-timed. This trend is illustrated in Figure 2, which plots the model predictions for different age groups, with the coefficients set to the level for Maori speakers (left panel) and Pakeha speakers (right panel).

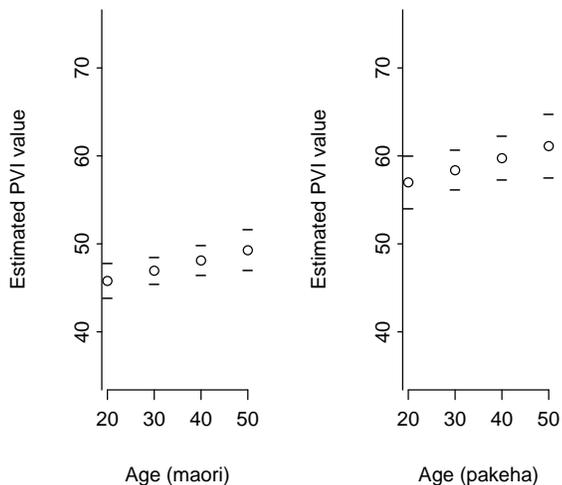


Figure 2: Model predictions for different age groups, with the coefficients set to Maori participants (left panel) and Pakeha participants (right panel)

3.1.3. Rhythm and Maori Integration Index

The MII was not included in the linear model due to collinearity with ethnicity. However, there is a significant correlation between PVI values and Maori Integration Index (Spearman's $\rho = 0.6458$, $p < .0001$). Speakers who are more integrated into Maori society, that is have a higher MII, produced more syllable-timed speech than speakers

with no or low integration. Figure 3 demonstrates this strong correlation.

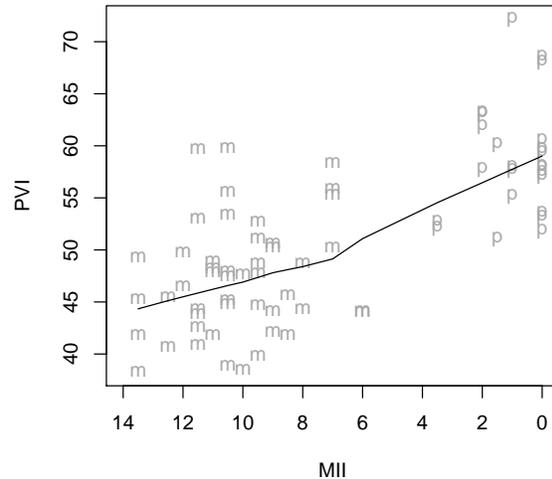


Figure 3: Rhythm vs Maori Integration Index (m = Maori participant, p = Pakeha participant) The line represents a non-parametric scatterplot smoother fit through the data (Cleveland 1979).

It is difficult to separate the effects of MII and ethnicity. None of the Pakeha speakers in this study scored higher on the MII than any Maori participant. MII scores ranged between 6–13.5 for Maori and 0–3.5 for Pakeha. It would of course be interesting to see PVI values for highly integrated Pakeha and see whether the MII is doing more than just distinguishing between the two ethnic groups. My initial hypothesis is that Pakeha with a higher MII score would also be more syllable-timed. This remains a topic for further research.

3.1.4. Rhythm and passage type

We also examined whether the style of the passage affected the rhythm of the speech. For both Maori and Pakeha participants there was a tendency for the reading passages to be more-syllable-timed than the narratives, however this difference only reached the level of significance in case of the Pakeha participants (Wilcoxon paired test, $p < .05$). This is shown in Figure 4.

3.1.5. Rhythm and gender

Gender did not have a significant effect on rhythm. While Maori females tended to be less syllable-timed than Maori males, the reverse is true for Pakeha participants, with Pakeha females being slightly more syllable-timed. Neither of these trends is statistically significant.

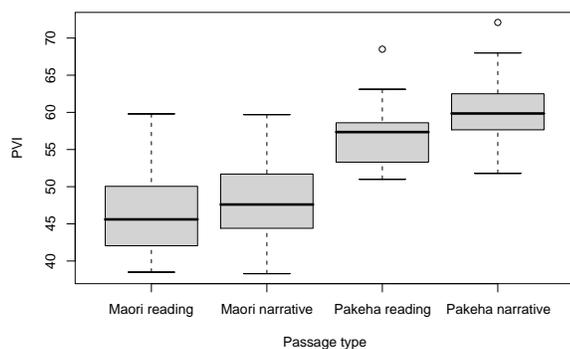


Figure 4: *Rhythm vs Passage Type and Ethnicity*

3.2. Pitch

In another linear regression model we investigated possible differences in mean pitch. Predictably, gender had a highly significant effect on mean pitch ($p < .0001$). However, over and above this gender effect there was also a significant effect of ethnicity ($p < .01$). Maori participants had a significantly higher mean pitch than Pakeha participants. This is most obvious for Maori male participants, whose mean pitch was 128.4 Hz as opposed to their Pakeha counterparts with a mean pitch of 109.5 Hz. A boxplot diagram in Figure 5 displays the male mean pitch values.

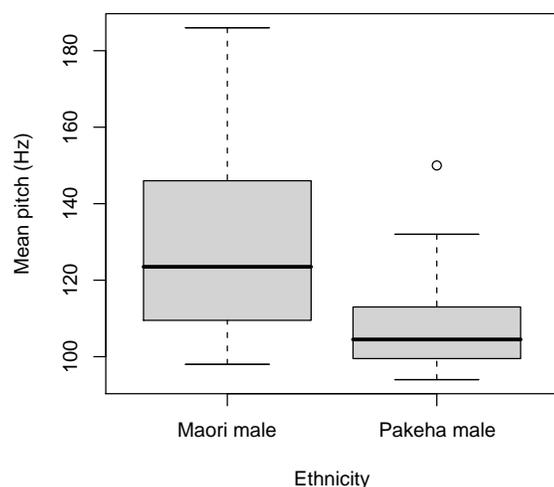


Figure 5: *Difference in mean pitch between Maori and Pakeha males (Wilcoxon-test $p < .001$)*

The linear regression model also indicated that age interacting with ethnicity had a significant effect on mean pitch ($p < .05$). This interaction is shown in Figure 6, which illustrates that Maori mean pitch is getting higher over time

whereas Pakeha mean pitch, if anything, is getting lower.

Although there were highly significant differences in pitch range and the standard deviation of pitch between the sexes (confirming the results of Daly and Warren (2001)), there was no such difference between Maori English and Pakeha English. Conversion of Hertz measurements to ERB did not result in significant differences either.

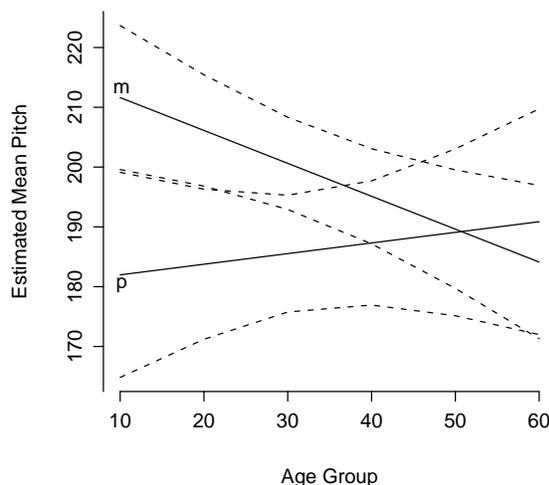


Figure 6: *Model effects showing estimated mean pitch by age group and ethnicity. Dashed lines indicate 95% confidence intervals.*

3.3. Other cues

We also investigated possible differences in speech rate, the number of pauses and the mean length of pauses between the two dialects. None of these showed significant results. Speech rate was calculated as number of vocalic segments per second. Maori participants showed a slightly lower speech rate, with a mean of 4.43, as opposed to the mean of 4.65 for Pakeha speakers. Maori participants also paused slightly more often, with the mean length of these pauses being longer than for Pakeha participants. However, these trends are far from significant.

4. Discussion

4.1. Rhythm

The results of this study clearly show that Maori English is a significantly more syllable-timed dialect than Pakeha English. They also demonstrate that a within-variety difference in rhythmic properties *can* exist as it does within New Zealand English. Table 4 repeats the PVI values shown in Table 1, including the values for Maori English and Pakeha English from this study to demonstrate where these two dialects of New Zealand English fit along the continuum from

syllable-timing to stress-timing. Grabe and Low (2002) report only one value for British English. It would be interesting to see what degree of variability is present among various dialects of British English regarding rhythm. Note that if we were to assign a single PVI value for New Zealand English by calculating the mean value across Maori and Pakeha English, we would get a PVI of 53.0, still lower than that of Singapore English. However, while Pakeha speech may be moving in the direction of syllable-timing, it is still the case that young Pakeha New Zealanders are not significantly more syllable-timed than the British speakers analysed by Grabe and Low (2002).

Table 4: *Rhythm values for some languages (selected data taken from Grabe and Low (2002)) with PVI included for Maori English and Pakeha English*

Language	PVI
Mandarin	27.0
Spanish	29.7
Luxembourg	37.7
Japanese	40.9
French	43.5
Polish	46.6
Rumanian	46.9
Maori English	47.3
Welsh	48.2
Singapore English	52.3
Malay	53.6
British English	57.2
Pakeha English	58.7
German	59.7
Dutch	65.5
Thai	65.8

The results relating to rhythm and age are of great interest as they seem to describe a change in progress toward increased syllable-timing in both Maori English and Pakeha English. Such a change in timing patterns over time has not been documented in New Zealand English before. The fact that languages and language varieties can experience a rhythmic shift is not unknown. Eek and Help (1987), for example, describe Estonian as a syllable-timed language that has undergone a Great Rhythm Shift in its history from a rhythmically more complex type. Crystal (1996) also predicts that more and more English dialects that are less stress-timed are likely to emerge as the language comes into contact with various other languages that are traditionally categorised as syllable-timed. The question arises whether we can tell *when* these New Zealand dialects - and specifically Maori English - started to become more syllable-timed. With the help of the ONZE corpus (Gordon, Hay, and Maclagen *fc*) it might be possible to answer this question in the future by analysing the speech of people born early on in the last century.

It has been demonstrated in numerous sociolinguistic studies that speakers use a more standardised variety of their language when reading a passage than when speaking spontaneously (e.g. Labov 1972). Based on this, it would be expected that the PVI values would be higher for reading passages than for narratives. In fact, the opposite trend emerged from the present data. Pakeha participants produced significantly more syllable-timed speech for the reading passages. One explanation might be that being stress-timed is no longer necessarily associated with the standardised variety. However, it is also possible that a lower PVI is just an inherent characteristic of this particular reading passage (see Appendix).

4.2. Pitch

Differences between women and men have received the greatest amount of attention in the literature on pitch, as Biemans (2000) points out. Gender differences relating to pitch can obviously be linked to differences in physiology, the build of the larynx and the vocal folds. The present study showed that on top of the unsurprising gender effect, there was also a significant effect of ethnicity on mean pitch. Maori participants had a significantly higher mean pitch, which was most obvious for male speakers. This difference between the two male groups cannot be explained by anatomy. Rather, it has to be socially constructed and as such indicating ethnicity-related speaker identity.

Studies in the past have shown that pitch can be influenced by culture. Majewski, Hollien, and Zalewski (1972) showed that the pitch of Polish men was lower than the pitch of American men, and Loveday (1981) described differences between Japanese and British use of pitch. Biemans (2000) draws from several studies on pitch to show average values for both males and females and gives a range between 100–125Hz for men. This indicates just how high the mean pitch of Maori males at 128.4Hz is, actually falling outside the male range given in her study.

This difference in the use of pitch between Maori and Pakeha males seems to be a recent phenomenon. As Figure 6 has shown, the ethnicity effect is interacting with age. Maori mean pitch is getting higher over time, whereas Pakeha pitch is lowering, resulting in a significant difference between young Maori and Pakeha speakers. The results of Walker (2006) also indicated that male pitch in New Zealand English might be lowering over time. Her subjects did not include Maori participants, so the results from her study can be taken to confirm that Pakeha male pitch might indeed be lowering.

Gussenhoven (2002) claims that high pitch is socially associated with submissiveness, politeness, vulnerability and femininity, while low pitched voices suggest authority, assertiveness, masculinity. It is possible that young Pakeha men feel the need to use lower pitch to show more mas-

culinity and authority, while for young Maori males these traits are not as important. We could speculate that their use of higher pitch might signal solidarity, cheekiness and humour. The reasons behind this change are speculative but what is certain is that these two dialects within New Zealand English are becoming increasingly distinct, at least with respect to pitch.

5. Conclusion

The results shown above strongly support previous reports that Maori English is more syllable-timed than Pakeha English. Furthermore, they seem to indicate a change toward increased syllable-timing in the dialect as a whole. The results relating to pitch demonstrate that rhythm is not the only prosodic factor which serves as a marker of ethnicity in New Zealand English. Taken together, these results strongly indicate an increasing separation between Maori English and Pakeha English, which might be tied up with identity issues in current New Zealand society. In follow-up work we are now investigating the degree to which listeners can use these prosodic differences to facilitate dialect identification. Our aim is to gain insight into the contribution of different linguistic cues to the perception of an accent, from segments to prosody.

6. Acknowledgements

This research has been partially funded by a University of Canterbury Master's Scholarship. I would like to thank all the speakers who participated in this research. I would also like to express my sincere appreciation to my supervisor, Dr Jen Hay for her ongoing support and all her help with statistical data analysis.

Appendix

Reading passage

“And now of course six years have already passed. I have never told this story before. The friends who saw me again on my return were very happy to see me alive. I seemed sad but I said to them: ‘It’s exhaustion’. Now I have got over my loss a little, which is to say not entirely. But at least I know that he returned safely to his planet because I couldn’t find his body in the morning.”

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