ADVENTURES IN *MITA*-READING: EXAMINING STRESS 'RULES' AND PERCEPTION OF PROSODIC PROMINENCE IN THE MĀORI LANGUAGE

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ABSTRACT

This paper presents the results of a perception study investigating the location of prosodic prominence in the Māori language. 40 Māori-familiar participants listened to Māori sentences from speakers of three age groups with birthdates spanning over 100 years. In light of older speakers' comments that the language has changed, the participants' perception of syllabic prominence on a phrase-by-phrase basis was compared to existing 'stress rules' established for the language in the 1960s. Alignment results show that often the perceived prominences do match the predicted stress locations, but there is also a tendency for extra perceived prominence in some positions, as well as mismatch (including apparently absent stresses). A difference is observed between results for historical speakers, present-day older speakers and present-day young speakers, providing initial support for the older speakers' perception that the sound of Māori has changed.

Keywords: Māori language, perception, prominence, prosody, stress

1. INTRODUCTION

This paper presents results from an ongoing study exploring the location of prosodic prominence in the Māori language. In a previous study, it was shown that listeners, both Māori-proficient and non-Māori-proficient, could identify prominences consistently when presented with English and Māori sentences taken from read passages [13]. This goes further and tests Māori sentences taken from continuous speech. It examines listener perception of prominence and alignment of this perceived prominence with existing stress rules, and looks for evidence of any change in this alignment over time.

2. BACKGROUND

2.1. Māori language

Māori is the indigenous language of New Zealand. It has been in contact with and influenced by English for around 200 years, resulting in qualitative and quantitative changes (see e.g. [9]), which may include the location of word stress ([14]). Māori has 10 consonants: /p t k m n ŋ f h w r/. The 5-vowel system has a 2-way phonemic length distinction, but this is being lost in all pairs except /a - aː/ ([9]).

Older Māori speakers (or 'elders') are, anecdotally, sensitive to a change in what they call the *mita* of their language, something they find hard to explain. The word itself is possibly related to the English 'meter', but the concept is more complex than that. Sometimes described as the 'sound' or 'accent' of a language, it seems to encompass a range of elements, from regional lexical and phonetic variation to prosodic features [10]. There is existing description of Māori prosody ([2, 3, 5, 8, 11]), but no in-depth acoustic prosodic analysis. This study was designed to begin to investigate the possible prosodic elements of *mita*, using perception of syllabic prominence in Māori.

2.2. Māori stress 'rules' and syntactic phrases

The investigation of Māori stress rules has yielded various results [2, 3, 8], with the commonly used analysis that of Bruce Biggs (1921-2000) [3]. Stress appears on word and phrase levels, with phonological phrases essentially inextricable from syntactic ones [2, 8]. There are a number of ways to describe Māori syntactic phrase structure, but the most useful for the present discussion of stress is the one used by Biggs: a phrase is a unit with up to three parts. An obligatory nucleus contains one or more content words (e.g. N + Adj), and optional peripheries either side hold function words [3]. An example is in (1) below.

(1) Māori phrase structure, with example.

[(preposed periphery)		**nucleus**	**(postposed periphery)]**
ki	*te*	*whare*	*nei*
to	the-SG	house	LOC:close to speaker

'to this house'

Stress rules refer to both the mora (μ), in the form (C)V, and the syllable (σ). Māori syllables may take any form permitted by (C)V(V(V)), so may be anything up to trimoraic (e.g. *kaai+nga* 'home': 2σ; 3μ+1μ). Monomoraic syllables are light; all others are heavy. In monomorphemic words, 'word stress' (WS) is assigned according to a syllable weight

hierarchy [2], where *heavy* > *light* and *long V* > *diphthong* > *short V*.

The highest available syllable type within 4μ from the end of the word bears **WS** (e.g. *koi**raa*** 'and so'). Where all σ within the 4μ are the same weight, **WS** is on the first of these equal-weight syllables (e.g. ***ka**nohi* 'face'). This is also true of some long vowels or diphthongs created across morpheme boundaries. Prefixed words and reduplications create special circumstances.

All phrases have one 'phrase stress' (PS), the location of which depends on whether or not the phrase is sentence-final. In final phrases, the PS is expected to be the WS of the last content word. In non-final phrases, PS is expected on the penultimate mora of the phrase, which may differ from the content word WS position. In the phrase at (1), **WS** and PS are expected as follows:

[*ki te **wha**re nei*] (non-final)
[*ki te **wha**re nei*] (final)

Biggs' rules were formulated in the mid-20th century, and are based on the Māori of speakers from that generation and before. If the sound of today's Māori has changed, then it makes sense to compare these rules against examples of both historic and modern speech.

2.3. Prominence and prosody

This investigation of Māori proceeds from the idea that rhythm may be described as 'a regular recurrence of beats' [7], and rhythm in *language* manifests itself in perceived prominences: units (of whatever type) that are somehow more salient than others. The acoustic/phonetic feature or features which cause prominence are known to be different across and within languages [1], and may include duration, pitch, intensity and vowel quality, among others. In addition to this, the organization of prominences is tied to the concept of a prosodic hierarchy as outlined in various works and summarized in [12], moving from the utterance or intonational phrase level, down through various phonological/intermediate phrase levels, to the syllable or mora.

If the Māori concept of *mita* does involve prosodic phenomena, it will be necessary to determine what features are involved in the creation of prominence in the language, and in what manner the prominences are organized. If the relevant features have changed in some way, and this is causing the elders to make comments about change, then acoustic analysis should be partly directed by prominence perception. This experiment was designed with the intention of providing areas of focus for an acoustic study. Such a study has since begun, but constraints of space do not allow its description within the present paper.

3. METHODOLOGY

3.1. Materials

The MAONZE (Māori and New Zealand English) Database [6, 9, 13, 14] includes recordings of read and continuous speech in both Māori and English from speaker groups with birthdates spanning about 100 years. The present study uses recordings of Māori L1 males from three of these groups: 'historical' elders (HE, born ca.1880); present-day elders (PE, born ca.1920~1940), and young speakers (PY, born ca.1970~1990). To put this in context, the HE group were two generations Biggs' senior; the PE group slightly younger than he was. The PY group would have considered him an elder.

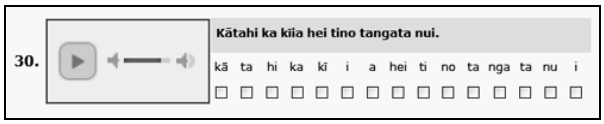
The experiment materials comprised 32 recordings of Māori sentences, taken from interviews with several different speakers in the database: five HE, and four each of PE and PY. Two buffer sentences were included at the beginning and end of the perception test, for practice and to avoid the 'last-task' effect. Besides these, there were ten complete sentences from each of the three groups. Sentence selection criteria included clarity of recording, length, and content. There were usually 3-5 phrases per sentence.

3.2. Delivery

Participants accessed the experiment via a web survey interface. They were asked to give some basic information, including age, gender and language experience, and were then presented with the sentences. Each sentence was laid out on the screen with normal punctuation, then syllabified underneath according to Māori syllabification rules (see e.g. [4]). For each syllable, there was a checkbox (Fig. 1).

Participants were asked to play the recording of each sentence using the button provided, and to check the boxes for syllables that 'stood out' to them. This wording is deliberately non-technical in order to avoid leading the participants. Recordings could be played as many times as a participant wished, but could not be paused or restarted partway through.

Figure 1: Screenshot of the online survey interface.



This mode of delivery, tested successfully in a previous study [13], is used for speed, portability and, its participant-friendly nature. The 'own-pace', checkbox method helps circumvent performance anxiety or coordination issues that can arise in exercises such as tapping, and some participants have reported finding it fun.

3.3. Participants

The experiment is ongoing and currently includes 68 participants obtained through networks. Here, we present results from a subset of 40 participants only. It is acknowledged that in prosodic perception studies such as this, native speaker participation is crucial. However, the Māori language presents two obstacles in this regard. Firstly, finding L1 speakers is difficult. Secondly, all speakers of New Zealand Māori (L1 or otherwise) are also exposed to English on an extensive, daily basis, and any 'native' prosodic cues to which they are sensitive may be influenced by that.

For this reason, in the present study the choice was made to analyse the results from participants with exposure to Māori (excluding those with none). Such exposure is a natural part of NZ residency of any significant duration. While not all participants were current NZ residents, self-rating of Māori proficiency ranged from 'very good' or 'above average' (14/40) to 'words & phrases' (26/40). All participants rated their English proficiency highly. There were 30 females and 10 males, aged 16 to 65+. Ethnically, non-Māori made up 30/40, including NZ European, other European/American, and Asian. 10/40 classified themselves as Māori.

3.4. Analysis

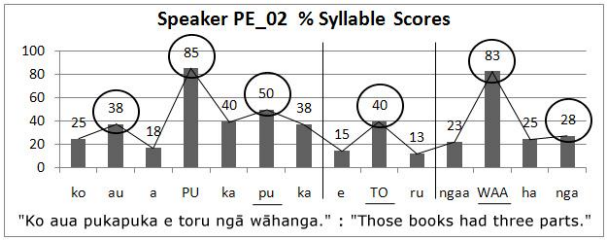
For each syllable, the number of 'votes' from the participants was tallied and a percentage score was calculated based on that total over 40. Charts were created for each sentence using these scores. The sentences were split into phrases according to the Māori phrase structure rules explained above, and expected WS and PS, according to Biggs' rules, were marked on the charts. Then, the perceived prominences (pps) for each phrase were identified. A syllable was considered a pp here if the chart showed a peak relative to adjacent syllables: drawing a line at a given score would have been arbitrary. Fig. 2 is an example chart. Vertical lines are phrase boundaries; capitals mark WS; underlines mark PS; circles mark pps/peaks.

All sentences in the study (except the two buffer sentences) were examined, phrase by phrase, to see how the pps aligned with predicted stress positions. Each phrase was put in one of three categories:

- 'match' (pps occurred exactly where expected);
- 'match+extra' (all pps were as expected, but with one/more additional prominent syllable/s);
- 'mismatch' (pps did not match one/some/any expected positions: they were either missing or in an unexpected position).

The number of phrases in each category was divided by the total number of phrases to produce further percentage scores, both overall and separately for each of the three speaker groups. The mismatches and extra pps were then examined for possible explanations. As this was only the first stage of the ongoing project, no acoustic analysis was included at the time.

Figure 2: Sentence analysis chart for a PE group speaker.



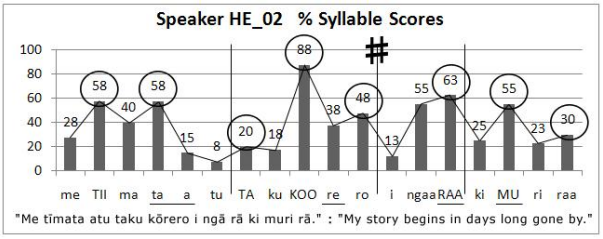
4. RESULTS & DISCUSSION

Under the score-based alignment analysis, perceived prominences do often match the stress positions predicted by Biggs' rules. Table 1 shows the overall results, along with the results by speaker group (HE, PE, PY).

Table 1: Results from the alignment score analysis.

Category	Overall	HE	PE	PY
Match	77 (52%)	21 (48%)	25 (55%)	31 (53%)
Match+Extra	20 (14%)	8 (18%)	7 (16%)	5 (9%)
Mismatch	50 (34%)	15 (34%)	13 (29%)	22 (38%)
Total phrases.	**147**	**44**	**45**	**58**

Figure 3: Examples of extra pps in an HE speaker.



The results from the 'match' category suggest, at face value, that the PE and PY speakers are slightly more likely to fit the expected stress pattern than the HE group, which is unexpected, since the pattern was formulated with reference to the language of the HE generation, or the one directly after. However, if we add in the phrases in the 'match+extra' category, the match scores are not very different. The HE speakers have more 'extra' pps, but closer examination also reveals over twice as many noticeable pauses in their speech, created by either silence or extended duration, as in either of the other groups. An example can be seen in Fig. 3, where neither the *ro* in *kōrero* ('story') before the pause (#) nor *rā* (emphatic marker) in the final phrase are expected stress locations, yet prominence is perceived there. In the

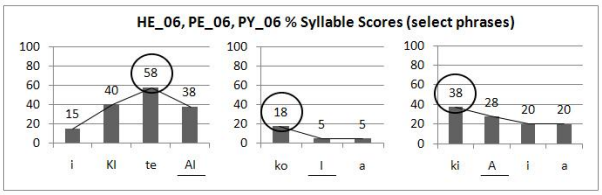
first case, there is increased vocalic duration as well as silence. Many of the extra HE pps might be explained by position in this way: sentence-initial, sentence-final, and pre-pausal are all positions known to increase perceived prominence.

Apart from the use of interjections such as *nā* ('now then'), extra pps in the other speaker groups are less readily explainable; this is unsurprising without the aid of acoustic analysis.

Most of the mismatches come from unexpected positions for pps, rather than total absence. In these results, the mismatch results across all groups are quite similar, with perhaps slightly more from the young speakers. However, the charts show that three of the absent pps from the PY speakers could be explained by an adjacent super-prominent syllable (i.e. one with 70-80% participant agreement). If those instances are removed, the mismatch score for the PY group is much closer to those of the other two groups. Other mismatches are, again, less explainable without acoustic analysis, but there appears to be influence from syllable weight, pause, and an interesting 'magnetic onset' effect, described below.

Participants in this exercise often mark as prominent the syllable *before* an expected prominence, when the expected syllable has no onset but the preceding syllable does. This occurs even where the expected syllable is heavy (μ=2+), and across word boundaries. It was also observed in all three speaker vintages (Fig. 4).

Figure 4: 'Shift' of pps towards syllable with onset.



In *i kite ai* ('which [I] saw'), WS and PS are expected on *ai*, but the pp is on *te*. The same effect can be seen on *ko* in *ko ia* ('[that is] it/the thing') and *ki* in *ki a ia* ('to him/her').

The relatively higher match and lower mismatch scores for the PE speakers are interesting, given that it is this group who comment on change in the language, and do so with reference to younger people's speech. The PE group may be more conservative or rule-conscious than the PY group.

5. DIRECTIONS

The next step in this study is, of course, the acoustic investigation. The results as they appear here clearly highlight the necessity of a multi-faceted analysis, but they also show the usefulness of a preliminary study like this in directing such further investigation. Features marked for examination include duration, which is unquestionably relevant in Māori phonology; F0, as H* is expected to match PS (see e.g. [8]); and spectral emphasis, as there are indications of extra high-frequency energy in the older speakers. It appears that all may be relevant cues for the participants. A further goal is to gain more participants with very high Māori proficiency, particularly older ones. In the meantime, from this comparison of perceived prominence with expected stress, we can see that Biggs' rules remain generally accurate in predicting perceived prominence locations. Furthermore, there is some support for the comments from elders that something about the sound of Māori has changed.

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