Introduction
All long vowels in Te Reo Māori have decreased in duration over time, becoming more similar to the short counterparts (King et al. 2011). However, some have changed less than others; in particular, the [æː] – [a] opposition has maintained a substantial difference in duration, as shown in the below figure based on King et al. 2011.

Hypotheses
Weak: The functional load of the [æː] – [a] opposition is much greater than that of other long/short vowel oppositions.
Strong: The extent to which all long/short vowel pairs are durationally contrastive (i.e. have different durations) is positively correlated with the extent to which they are functionally contrastive.

Materials and methods
Vowel duration data:
Obtained from the MAONZE corpus (King et al. 2011).
Differences in duration of oppositional long and short vowels found using mean gender-specific durations for each vowel.
Roughly normalised to allow pooling of gender-specific data and combined in a weighted average: an overall measure of vowel distinctiveness.

Functional load data:
Based on the Māori Broadcast Corpus (Boyce 2006); proper nouns and words occurring once removed.
22 different measurements of functional load (Surendran 2003; Wedel, Jackson, and Kaplan forthcoming), based on:
• Minimal contrasts, phonological environments, and entropy.
• Type and token frequencies.
• Word and segment levels.

Results
Left panel: In 21 of the 22 measurements, the functional load of the [æː] – [a] opposition was substantially greater than that of any other oppositions.
Measurement 14, which used the number of minimally contrastive words weighted by their token frequencies to measure functional load, was the only measurement not to display this result. However, this was expected, as this measurement is not representative of competition effects and is heavily skewed by high-frequency words.
Right panel:
For these 21 measurements, there was a statistically significant (α = 0.05) positive correlation between functional load and difference in duration.
However, when the [æː] – [a] opposition was removed from consideration, only measurement 13 maintained a statistically significant correlation. The correlations with measurements 9, 15, and 19 became negative, but visual inspection suggests this is due to distortion from [eː] – [ɪ].

Conclusions
The weak hypothesis was borne out: the high functional load of the [æː] – [a] opposition is a plausible factor in its great durational contrast.
The significant correlation between present-day durational contrast of vowel oppositions and the change of this contrast over time (Pearson’s r = -0.964, p < 0.01) suggests the weak hypothesis may be relevant for diachronic change.
The strong hypothesis was tentatively supported: there appears to be a tendency for long/short vowels in oppositions with greater functional load to have greater differences in duration. However, more data (e.g. cross-linguistic) and/or more sophisticated statistical analysis are necessary to clarify this relationship.

References

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