Te Reo
the Journal of the Linguistic
Society of New Zealand

Volume 69
Issue 1

Research Article

2026
Pages 74–101

May, 2026

The GOAT vowel in Māori English: An analysis of contextual intraspeaker variation

Fynn Köster
University of Edinburgh

This paper is a peer-reviewed contribution from https://www.nzlingsoc.org/journal/current-issue/

Editor: Victoria Chen

The GOAT vowel in Māori English: An analysis of contextual intraspeaker variation

FYNN KÖSTER
University of Edinburgh

Abstract

This study investigates contextual intraspeaker variation in the realisation of the GOAT vowel in Māori English, focusing on speech produced by New Zealand content creator Broxh across two contrasting interactional settings: a Māori-related woodcarving livestream and a gaming livestream. Drawing on acoustic analysis of 200 tokens, the study examines differences in fronting and monophthongisation using formant measurements and linear regression modelling. The results show a significant effect of context on F_2 values, with more fronted realisations occurring in the Māori-related setting, while no significant contextual effect is found for monophthongisation. GOAT fronting is indicated to function as a context-sensitive sociolinguistic resource, indexing both immediate interactional frames and broader macro-social meanings such as Māoriness and cultural authenticity. Broxh's GOAT vowel does not fully align with established descriptions of either Māori English or Pākehā English but instead reflects the fluid and evolving nature of the New Zealand English vowel system. Overall, the study highlights how fine-grained phonetic variation operates as a socially meaningful resource through which speakers negotiate identity, context, and interaction, and illustrates how macro-social linguistic structures emerge from micro-level stylistic practice.

Keywords

contextual intraspeaker variation, style shifting, indexicality, enregisterment, GOAT vowel, Māori English, New Zealand English

1 Introduction

Māori English (ME) is commonly described as one of two major varieties of English spoken in Aotearoa / New Zealand, alongside the English associated with European-descendent New Zealanders, referred to in te reo Māori as *Pākehā* (cf. Moorfield, n.d.). Early accounts such as Richards (1970) proposed a subdivision of both Māori and Pākehā English into more and less prestigious subvarieties (ME1/ME2 and PE1/PE2), with Pākehā English (PE) 1 occupying the position of the national standard due to its historical proximity to Received Pronunciation (cf. Gordon, 1991; Bayard, 1995). While such models capture broad sociophonetic tendencies, they frame variation primarily in terms of relatively stable, socially stratified categories.

For the purposes of the present study, however, a strictly categorical model of ME is of limited explanatory value. Rather than treating ME as a fixed variety composed of discrete subtypes, it is more useful to conceptualise it as part of a dynamic sociolinguistic continuum. Janet Holmes (2005, p. 93), for instance, proposes a distinction between 'standard' and 'vernacular' ME, not as clearly separable varieties but as reference points along a gradient of

stylistic and social variation. This perspective aligns more closely with approaches that emphasise fluidity and the interactional deployment of linguistic resources.

Such a continuum can be understood as operating along at least two intersecting dimensions: one relating to orientation towards Māori or Pākehā linguistic norms, and another relating to degrees of standardness, prestige, and formality (see Figure 1). Crucially, speakers are not fixed at a single point within this space. Instead, they may shift their position depending on interactional context (cf. Benton, 1991), drawing on different features to index social meanings, identities and stances. This view is further supported by observations that features associated with ME and PE are not exclusive to speakers of their associated ethnicity, nor are speakers restricted to using them (cf. King, 1993, 1999; L. Bauer, 1994; Robertson, 1994; J. Holmes, 1997).

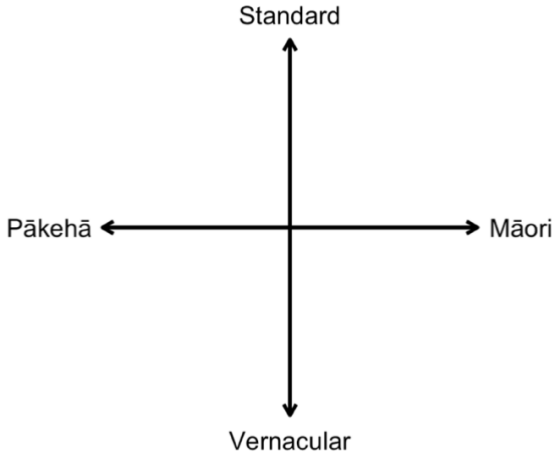

Figure 1. The NZE dialect continuum

Adopting this continuum-based perspective is central to the present study, which focuses not on inter-speaker differences between predefined varieties, but on intraspeaker variation across contexts. In particular, it allows for an analysis of how phonetic features associated with ME—such as the fronting and monophthongisation of the GOAT vowel—may be variably deployed as stylistic resources. Rather than indexing fixed group membership alone, such features can be mobilised to signal alignment with culturally specific practices, interactional settings and social personae.

The following section will present some of the vowel features that have been suggested as characteristic of ME, in particular the variable analysed in this study, the fronted and monophthongised GOAT vowel. The exact operationalisation of the variable will be explained in Section 3, which introduces the speaker, the two contexts that are expected to produce different realisations of the variable, and the concrete methods of data collection. The results of the study will then be presented in Section 4. Lastly, the results will be interpreted through a framework of indexicality (cf. Silverstein, 2003) as well as enregisterment (cf. Agha, 2004) and compared to previous research in Section 5.

2 Māori English Vowel Features

Only a very limited portion of linguistic research on ME focuses on vowels. This is likely due to the difficulties researchers have encountered in their attempts to collect phonological

data on ME. Some of these have been described by Paul Warren and Laurie Bauer (2008, p. 83):

> 'Because of the very nature of Maori English, getting good recordings of this variety in formal settings, in a Pakeha institution (a university) and with Pakeha researchers is difficult. None of the recordings provided here is completely prototypical, even when we have Maori people speaking to each other without Pakeha people present.'

Despite these difficulties, a number of differences between the vowels of ME and PE have been identified through acoustic analysis of conversational and word list speech samples. Among these are a less diphthongal and perhaps slightly closer version of the noticeably diphthongised (cf. Hay et al., 2008) PE FLEECE vowel, which is reflective of te reo /iː/ (cf. Warren & L. Bauer, 2008), and a LOT vowel that is realised as [ɒ̝] (cf. ibid) and thus backer than its PE counterpart, which assumes a position closer to the central [ɞ] than the back [ɔ] in the vowel space drawn up by Laurie Bauer and colleagues (2007). This backward shift could be interpreted as a movement in the direction of the te reo close-mid back vowel /o/ (cf. W. Bauer & Parker, 1993). Lastly, Warren and Bauer (2008) mention claims of a more open variant of the monophthongal NZE NEAR-SQUARE merger in ME.

2.1 The fronting vowel shift

Among the most notable ME vowel features are a less centralised KIT vowel (cf. Bell, 1997, 2000; Warren & L. Bauer, 2008), which may be attributable to the short /i/ vowel of te reo (cf. Ross, 2018), and a GOOSE vowel that is even more fronted (cf. Warren & L. Bauer, 2008; Maclagan et al., 2009) than PE /ʉː/ (cf. L. Bauer et al., 2007), leading to a realisation that Bell (2000) transcribes as [y]. Both of these features could be embedded in a larger vowel shift, as fronted qualities have also been detected for the NURSE vowel, which additionally is more rounded than its PE equivalent (cf. Warren & L. Bauer, 2008), and the DRESS vowel, which—same as the THOUGHT/FORCE vowel (cf. ibid)—is more open compared to PE (cf. Bell, 1997). Moreover, Warren and Bauer (2008) found the START vowel to be fronted in their speech samples of ME despite a generally observed tendency for BATH and START backing in the variety.

2.2 The GOAT vowel

Previous research indicates that this fronting vowel shift also extends to the subject of this study, the GOAT vowel. Fronting of the diphthong's second target was first noted for PE by Watson and colleagues (1998) and later for ME by Paul Warren and Laurie Bauer (2008). While the former describe the PE offset as pointing towards the GOOSE vowel's position in the vowel space, the latter go as far as to say that the second target of ME GOAT is 'matching the GOOSE vowel' (Warren & L. Bauer, 2008, p. 85). This difference in wording indicates that fronting of the second target of GOAT is more pronounced in ME than in PE. However, a conclusive judgement on this cannot be made, as only Watson and colleagues provide vowel plots (see Figure 2) to illustrate their findings, though they do show that GOAT advances into the GOOSE ellipsis. Furthermore, Warren and Bauer (2008, p. 85) add that they are unsure whether offset fronting of GOAT is 'characteristically ME, or just more generally broad NZE.' If second-target GOAT fronting is included as a feature of ME, an appropriate transcription for the offset of ME GOAT would likely occupy a position between the PE GOOSE vowel [ʉ] (cf. L. Bauer et al., 2007) and the ME variant [y] (cf. Bell, 2000).

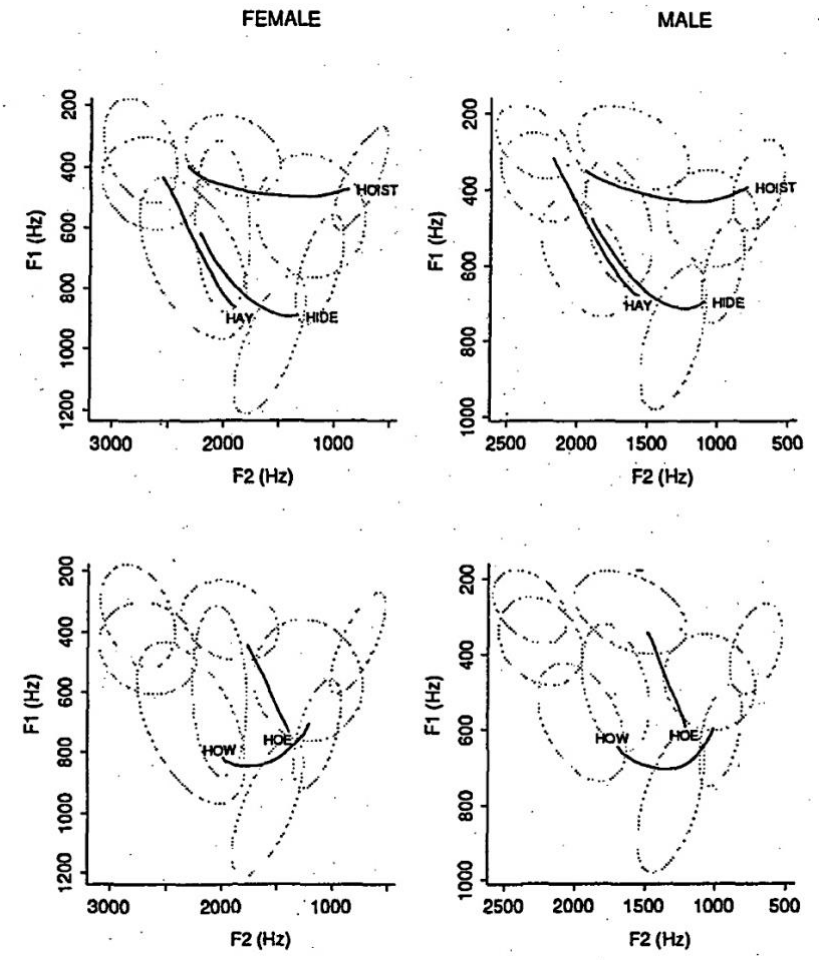

Figure 2. Formant tracks for PE rising diphthongs (GOAT represented here as HOE), superimposed on PE monophthong ellipsis plots (reproduced from Watson et al., 1998)

The fronting shift is presumed to not only affect the offset of the GOAT diphthong. An awareness of fronting of the vowel's onset in NZE has existed at least since the 1880s, as McBurney (1887) likened GOAT to the MOUTH vowel, which at the time may have had a realisation close to [æʊ̯] (cf. Wells, 1982). First-target fronting of GOAT in PE was first recorded formally by Wall (1938), who ascribed the onset the transcriptions [a] and [æ], though this was probably a prescriptivist exaggeration, as later accounts transcribe the onset as [ʌ] (cf. Wells, 1982), [ɐ] (cf. L. Bauer et al., 2007) or [o] (cf. Hay et al., 2008). Maclagan et al. (2008) later made findings which suggest that, in addition to the GOAT vowel being more monophthongal in ME, this fronting shift is more extreme in ME than in PE. If this theory is true, the onset realisations [a] and [æ] could be more appropriately assigned to the ME GOAT vowel. As a whole, ME GOAT could thus be transcribed as [aʉ], [ay], [æʉ] or [æy].

A translation priming experiment conducted by Szakay and colleagues (2012) shows that the onset-fronted and monophthongised GOAT vowel carries particularly strong associations with Māoriness. Among other ME features—namely GOOSE fronting, θ fronting and final-/z/ devoicing—, onset fronting and monophthongisation of GOAT emerged as the one producing the highest priming effect between ME and te reo, indicating that it most clearly signals a perceived link between ME and te reo and thus 'receives the heaviest Māori label' (Szakay et al., 2012, p. 144). Szakay and colleagues (2012, p. 140), further describe this variant as 'the most recent and most innovative variant of ME', almost 'categorically used by ME speakers only.'

More broadly, while some features of ME appear to differ from PE mainly in degree, others—such as a more syllable-timed rhythm and a higher incidence of HRT as well as the question tag 'eh'—have been argued to originate within ME and subsequently diffuse into PE (cf. L. Bauer, 1994; J. Holmes, 1994, 1995, 1997). Within this perspective, ME functions as a driver of linguistic change and 'a source of innovation' (J. Holmes, 1997, p. 97) for NZE. Szakay and colleagues' findings suggest that GOAT may represent a feature at an early stage of this process: despite its strong social salience and close association with Māoriness, it has not yet spread into PE but may do so over time.

3 Methodology

3.1 The speaker

Daytona Te Awarehe Taputu, better known under his online moniker Broxh, is a New Zealand YouTuber and Twitch streamer whose content mainly revolves around *whakairo*, the traditional Māori art of carving. He is of *Ngāi Tuhoe* and *Te Arawa* descent, and his *whakapapa* (genealogy/lineage) includes carvers on both sides of his *whānau* (cf. Red Bull Gaming, 2020; Taputu, n.d.) Born and raised in Te Urewera, the *rohe pōtae* (tribal homeland) of the *Ngāi Tūhoe iwi* (cf. Te Urewera, n.d.), Broxh now lives in Rotorua, the city with the second highest proportion of Māori residents in the country (cf. Statistics New Zealand, 2024). He is bilingual, speaking both te reo, which he describes as his native language (cf. Taputu, 2022), and English.

Even through informal observation, the effect of Broxh's Māori background on his use of English is clearly identifiable in Broxh's through several features of ME. In his livestreams, he generally uses a high incidence of HRT and kinship terms such as *brother* or *bro*. Moreover, a conversation between Broxh and the then-Prime Minister of New Zealand (cf. Taputu, 2020) shows that, in comparison with Jacinda Ardern, Broxh's DRESS vowel is considerably lower and his KIT vowel noticeably less centralised, clearly positioning him closer to the Māori end of the continuum. Broxh can thus quite unambiguously be classified as a speaker of ME.

3.2 The variable

This study aims to investigate whether Broxh's status as a speaker of ME is noticeable in his realisation of the GOAT vowel and whether there are differences in his use of the variable according to the context of the speech act. GOAT was chosen as a variable because, as mentioned in Section 2.2, its fronted and monophthongised realisation is described as 'the most recent and most innovative variant of ME' (Szakay et al., 2012, p. 140), which through its near-categorical use by speakers of ME only is the clearest identifying feature of the variety.

To answer the question as to whether the GOAT variable is embedded in the general pattern of the intraindividual contextual variability that has been identified for ME (cf. Benton, 1991; King, 1993, 1999; L. Bauer, 1994; Robertson, 1994), speech samples were selected from two contexts which differ in their relevance to Māori identity and culture. Carrying 'the heaviest Māori label' (ibid, p. 144), fronted and monophthongised GOAT is the ME feature with the highest potential for variation across these contexts.

The first context is a livestream (cf. Taputu, 2022) which shows Broxh working on a woodcarving piece and presenting his progress to the audience. Due to the rootedness of *whakairo* in Māori culture, it can be expected that the characteristically ME tendencies of fronting and monophthongisation of GOAT are more pronounced in this context. What may add to this effect is Broxh's self-expressed desire (cf. Taputu, n.d.) to share his culture with an audience that is eager to learn about or at least has a base interest in *whakairo* and/or Māori-

related themes in general. To show his involvement in and position himself as an authentic representative of Māori culture, Broxh may thus (consciously or subconsciously) display high rates of ME features such as the fronted and monophthongised GOAT vowel.

The second context is a sponsored livestream (cf. Taputu, 2023) in which Broxh plays and advertises the video game *Diablo 4*. As neither the activity of gaming nor the video game in question have a connection to Broxh's Māori background, it is expected that GOAT fronting and monophthongisation are less marked in this context. Other factors that could contribute to this effect are the official nature of the livestream, which sees Broxh take on the role of advertiser, and a target audience comprised of people with an interest in gaming rather than *whakairo*. Whether consciously or subconsciously, Broxh is aware of this position, as is apparent through his limited use of te reo lexis in comparison with his *whakairo* livestream. Consequently, it can be assumed that, either to avoid ethnic stereotyping (cf. Huygens & Vaughan, 1983; Bayard & Leek, 1992; Robertson, 1994) or simply because linguistic expression of Māori identity is not relevant in this context, this awareness has a weakening effect on the degree fronting and monophthongisation of Broxh's GOAT vowel.

3.3 Data collection

Speech data was obtained from the publicly accessible livestreaming/video platforms Twitch and YouTube. To ensure consistency across tokens and not overstretch the limits of this study, one sample was chosen per context. The two samples were selected to present a clear contextual differentiation without interfering noise such as rain or background music, in a timeframe that renders age grading and changes in language ideology highly unlikely (the *whakairo* sample is from December 2022 and the gaming sample from June 2023). 100 tokens were collected from each sample, resulting in a total of 200 tokens.

Using Praat's FastTrack plugin, values for the second and first formant were extracted from the speech samples at nine measurement points, reaching from 10% to 90% of the token's duration in intervals of 10[1]. Formant values for all measurement points were compared to the spectrogram of the respective token and, if necessary, corrected by hand. All nine measurement points were used to create detailed formant trajectories across the (nearly) full duration of the diphthong. Following Kendall and Fridland's (2021) sociophonetic framework, two of these nine measurement points (20% and 80% of the vowel duration) were selected to evaluate the fronting of onset and offset. The emerging formant values were then utilised to determine the degree of monophthongisation by calculating the Euclidean distance between onset and offset.

To determine whether context has a significant impact on Broxh's realisation of GOAT, a linear regression including context as a fixed effect was performed for each of the dependent variables using R's lme4 plugin. The resulting fixed effects models were then paired with models that do not include context as a fixed effect and compared through R's anova Chi Square function in order to test which model is the best fit for the data set.

The observed contextual variation is interpreted exploratorily through the frameworks of indexicality (cf. Silverstein, 2003) and enregisterment (cf. Agha, 2004). These approaches are used to relate patterns of phonetic variation to potential social meanings and processes of register formation. Rather than aiming to provide a definitive account of Broxh's linguistic behaviour, the analysis seeks to illustrate how the GOAT variable may function as an indexical resource within interaction and as part of a broader process of enregisterment.

[1] See Appendix for a detailed methodological overview, including configuration of formant measurements, calculation of Euclidean distance and composition of linear regressions.

Formant data is largely absent from contemporary studies on NZE vowels, and when it is included, it is often presented in vowel spaces that are normalised according to the totality of speakers and vowels. Though this kind of data is useful when comparing the variable use of different vowels across a clearly delineated group of speakers, it is not a suitable basis of comparison for the present study, whose purpose it is to document intraindividual variation of a singular vowel. Instead, the data will be compared to concrete formant values generated in previous research. As NZE vowel data of this kind is almost entirely exclusive to monophthongs—only Laurie Bauer and Paul Warren (2004) provide a formant trajectory for GOAT (Figure 5)—, the formant values for the onset and offset of Broxh's realisation of the GOAT vowel will be treated as separate entities and viewed in relation to previously measured monophthongal formant values. The goal of this comparison is to anchor Broxh's use of the GOAT vowel in the wider context of NZE.

4 Results

Through its depiction of the formant trajectories over the course of nine measurement points throughout the vowel, Figure 3 offers a visual juxtaposition of the two contexts. Though the differences seem subtle at first glance, the disparities identified by the raw formant values in Table 1 are clearly visible in the plots. The curves for F_1 are almost identical, except for a somewhat more pronounced arch from 10% to 40% of the vowel's duration, leading to a higher OF1[2] value and thus more open vowel quality at the 20% mark, and a slightly steeper downward slope from a marginally higher midpoint, resulting in a lower WF1 value and consequently more closed vowel quality at the 80% mark of the gaming curve. The F_2 curves are very similar to one another as well, both starting with an almost linear upward slope that flattens out at the 60 to 70% mark before slightly falling from 80 to 90% of the vowel duration. However, the *whakairo* curve in its totality is settled considerably higher on the y-axis and demonstrates a more pronounced arch towards the end of the vowel than the gaming curve, leading to a consistently higher F_2 frequency and hence a fronter quality across the full duration of the vowel.

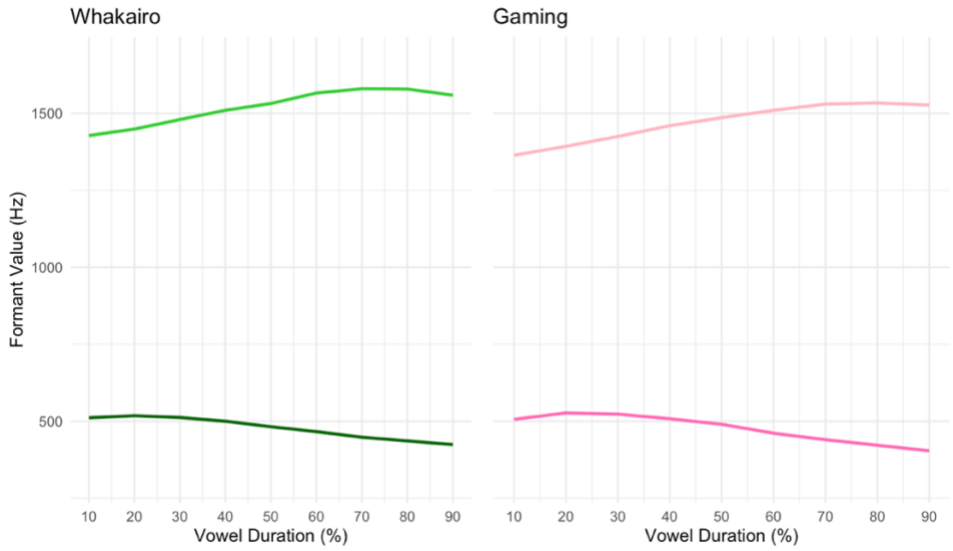

Figure 3. Mean formant trajectory of F_1 (dark green, dark pink) and F_2 (light green, light pink) of GOAT according to context

[2] The letters 'O' for onset and 'W' for offset were derived from the ARPAbet (cf. Shoup, 1980) identifier 'OW' for GOAT.

When depicted in a vowel space showing the diphthongs' trajectories from the first (20%) to the second (80%) measurement point (Figure 4), the contrast between Broxh's realisations of GOAT in the two different contexts becomes even more apparent. Most recognisable is, again, the more fronted position—signified by the higher F_2 values—of both nucleus and glide in the *whakairo* context. Additionally, while the two arrows describe an almost parallel trajectory from onset to offset, with formant values that are in similar cross-contextual relation to each other at starting and end point, the lower Euclidean distance between first and second target is clearly discernible in the *whakairo* arrow's shorter trajectory, moving from a more closed starting point to a more open end point.

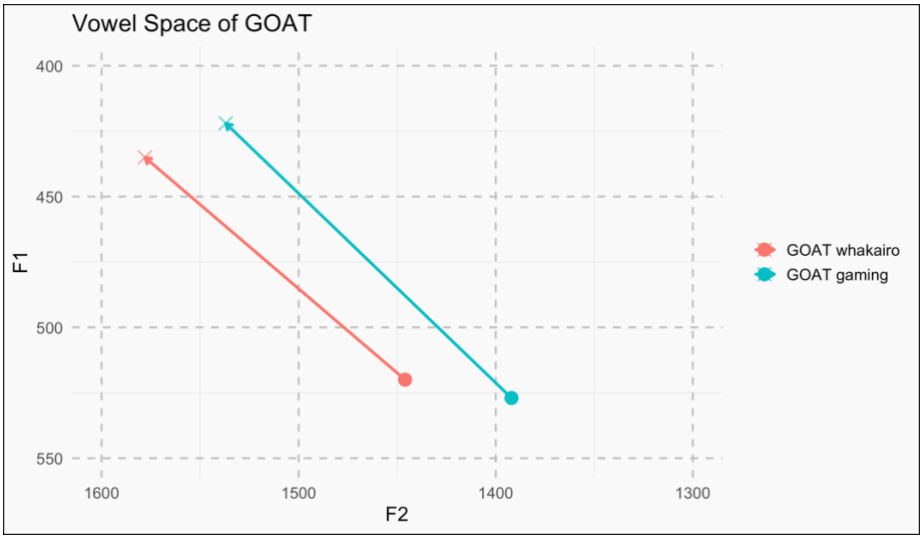

Figure 4. Mean formant tracks of GOAT within the vowel space according to context

The raw formant data (Table 1) shows higher F_2 values for both the onset and offset of the GOAT vowel in the *whakairo* context compared to the gaming context. While the same holds true for the glide's F_1, the first formant frequency of the nucleus is higher in the gaming context than when Broxh engages in *whakairo*. Similarly, the Euclidean distance between onset and offset is larger in the gaming context, signifying diphthongal quality.

Table 1. Mean formant values (in Hz) and Euclidean distance for GOAT according to context

Register	OF1	OF2	WF1	WF2	Euclidean distance
GOAT whakairo	520	1446	435	1578	214,55
GOAT gaming	527	1392	422	1537	231,99

The statistical analysis (see Appendix Tables A1–A5 for a detailed overview of the relevant fixed effects models) reveals that the gaming context has a significant effect on Broxh's F_2 values for onset (** p-value of 0.004876) and offset (** p-value of 0.007622) of GOAT, reducing OF2 by 48 Hz and WF2 by 56 Hz compared to the *whakairo* context. Context did not have a significant effect on Euclidean distance or the offset's F_1 value and only a minimally significant impact on the onset's F_1 (. p-value of 0.0644). For the formant values, these results fall in line with the previous literature, which identifies fronting of both onset and offset of GOAT as potential features of ME but does not link GOAT's vowel height to Māoriness. The context's lack of significance for the variable's Euclidian distance, however, runs contrary to the prediction that the GOAT vowel's monophthongisation, which has been named as a potential

feature of ME, would be significantly more pronounced in the *whakairo* context. The model comparison demonstrates that, with a lower residual sum of squares, the models which include context as a fixed effect emerged as significantly more suitable to predict the F_2 variability of both onset (** p-value of 0.004374) and offset (** p-value of 0.00697) than non-context models. A consistent pattern for the influence of surrounding phonological environments across the dependent variables could not be identified. This is perhaps due to the fact that onset formants are affected more profoundly by preceding sounds, whereas offset formants are affected more directly by following environments.

5 Discussion

5.1 Contextual variation of GOAT

Overall, the data shows significant differences between the *whakairo* and the gaming context in two of the three variables for which such effects were expected. The significantly higher values for OF2 and WF2 represent fronter realisations of both onset and offset in the *whakairo* context. This variation across contexts that differ in their relevance to Māori culture indicates that Broxh is, at least subconsciously, aware of a connection between GOAT fronting and Māoriness. Therefore it can be assumed that, drawing from Silverstein's (2003) framework of indexical order, Broxh's use of the GOAT variable does not only exhibit first-order indexicality but has also become available for style shifting, thus functioning as a sociolinguistic marker in the Labovian (1972) sense and a second-order indexical in Silverstein's terms. As Silverstein describes first-order (n-th order) and higher-order (n+1st order) indexicality as dialectically related properties that can be active at the same time and interact with one another, each is integral to understanding Broxh's variation of GOAT and will be examined in the following.

First-order indexicality is grounded in the micro-social dimension and consists of two operations: presupposition, i.e. appropriateness to the relevant context, and entailment, i.e. effectiveness/creativity in the relevant context (cf. Silverstein, 2003). As a *whakairo* artist, Broxh is of course aware of the art form's rootedness in Māori culture. This being his presupposition, Broxh may make use of GOAT fronting and its connection to Māoriness (cf. Szakay et al., 2012) in the explicitly Māori-related *whakairo* context. Simultaneously, through use of the GOAT variable in this way, Broxh may take up an epistemic stance (cf. Kiesling, 2011) that positions himself as an authentic representative of Māori culture and an expert on *whakairo*. He communicates his knowledge via an interpersonal stance (cf. ibid) that is welcoming and appreciative towards an audience that does not necessarily have direct ties to Māori culture but is interested and eager to learn. These stances can be understood as effects of indexical entailment through which Broxh centres the interactive situation on Māori themes and shapes the nature of his interaction with the audience.

Due to the sponsored gaming livestream's official nature and lack of relevance to Māori culture, Broxh may presuppose a more formal and ethno-locally neutral quality for this context and, aiming for contextual appropriateness, adjust his use of the GOAT variable accordingly, leading to an overall less strongly fronted realisation, which entails a less culturally specific interactional situation. This way, Broxh may, on the one hand, occupy the slightly more professional epistemic stance of advertiser and, on the other hand, the ethnically neutral epistemic stance of gamer and internet personality. Interpersonally, Broxh may take up a stance that sees him present the video game *Diablo 4* to a more general audience with an interest in gaming rather than Māori culture.

Presupposition and entailment are interconnected phenomena, mediated through what Silverstein (2003, p. 196) terms 'metapragmatic function', rendering 'potentially

presupposable context more transparent' and consequently more accessible to entailment. Broxh employs metapragmatic functions in both their explicit and their implicit form. He frequently engages in explicit metapragmatic discourse to explain Māori themes, *whakairo*-specific terminology and nuances of te reo vocabulary, which increases accessibility to his out-group audience. Other features of ME which, based on informal observation, cooccur with GOAT fronting in Broxh's speech—namely a lowered DRESS vowel, a peripheralised KIT vowel as well as a high incidence of HRT and kinship terms like *brother* or *bro* (see Section 3.1)—implicitly facilitate interpretation of the presupposable context.

While first-order indexicality is grounded in the micro-social context, where linguistic forms index aspects of the immediate interactional situation, higher-order indexicality links these linguistic forms to macro-social meanings (cf. Silverstein, 2003). It is important, however, to note that both orders are operative within interaction: higher-order indexical meanings are invoked in situational language use, even as they point beyond it. In the macro-social dimension, recurrent micro-social indexical relations become stabilised through processes of conventionalisation and/or institutionalisation, giving rise to value ascriptions, ideological essentialisations, and categorical social differentiations (cf. ibid). These macro-social meanings are in turn presupposed and reproduced in subsequent micro-social interactions, resulting in a dialectical relationship between micro-level usage and macro-level structure.

Building on this framework, Agha (2004) conceptualises enregisterment as the sociohistorical process through which such indexical meanings become socially recognised and typified as a register. Registers thus comprise not only sets of linguistic features but also the associated social personae, activities and value- as well as ideology-laden interpretations that emerge through ongoing metapragmatic processes. Ultimately, registers can further consolidate into standardised varieties, as attested for the prestige variety RP by Agha (2003) and for the vernacular variety 'Pittsburghese' by Johnstone and colleagues (2006).

Viewed through the lens of the frameworks outlined above, Broxh's more fronted realisation of GOAT in the Māori-related context does not merely index the Māori activity of *whakairo* but also points to broader macro-social meanings, including Broxh's Māori identity and his alignment with Māori social personae and cultural practices. Importantly, these higher-order meanings are not external to interaction but are actively invoked within it: by employing more marked GOAT fronting in the *whakairo* context, Broxh both presupposes and entails a Māori-relevant frame, thereby linking micro-social usage to macro-social categories.

Through recurrent use across similar contexts, such indexical relations may become stabilised in the macro-social dimension. The association between increased GOAT fronting and Māoriness may thus give rise to value ascriptions (e.g. authenticity, cultural appropriateness), ideological essentialisations (e.g. the notion that GOAT fronting is inherently Māori) and categorical social distinctions (e.g. Māori vs Pākehā speech). These macro-social meanings are then fed back into interaction, where they are presupposed and reproduced in subsequent uses of the variable.

In Agha's (2004) terms, this process can be understood as enregisterment. The patterned co-occurrence of GOAT fronting with other proposed features of ME, as well as its significantly more pronounced realisation in Māori-related contexts, may contribute to the emergence and/or stabilisation of a socially recognisable register associated with Māori cultural practices such as *whakairo*. This register, which we have come to know as ME, encompasses not only linguistic features but also the social personae (e.g. Māori cultural practitioner), activities (e.g. teaching or performing *whakairo*), and value-laden interpretations (e.g. authenticity, expertise, cultural legitimacy) that are indexed through language use. Metapragmatic processes—both implicit,

in the form of co-occurring linguistic features, and explicit, in the form of discourse about Māori culture—play a crucial role in shaping and reinforcing these associations.

While the enregisterment of ME remains an ongoing process, the observed variation in GOAT suggests that such a register is at least partially stabilised and available as a stylistic resource. In the longer term, continued circulation and institutional embedding of these features—for instance through digital media, cultural practice, and community norms—may contribute to their further consolidation, potentially leading to more clearly delineated varieties within the NZE continuum. In this way, Broxh's intraspeaker variation provides insight into the micro-level processes through which macro-social linguistic structures emerge and are maintained.

Broxh's contextual variation of the GOAT vowel can further be illuminated through Gumperz' (1968) distinction between dialectal and superposed variability. Dialectal variability refers to relatively stable correlations between linguistic features and social groups, whereas superposed variability captures context-dependent shifts within a speaker's repertoire. Gumperz notes that variation of this kind can, in fact, even be culturally expected.

In the present case, GOAT fronting may be understood as part of the dialectal variability of ME, insofar as it differentiates Māori from Pākehā speech and thus indexes group membership at a broader social level. At the same time, Broxh's systematic alternation between more and less fronted realisations of GOAT across the two contexts exemplifies superposed variability, as the same speaker draws on different variants in response to interactional demands. This provides evidence for Benton's (1991) suggestion that NZE speakers may be able to shift along both axes of the variety's dialect continuum depending on the social context (see Section 1). Accordingly, Broxh's variation of GOAT can be interpreted as movement along the NZE dialect spectrum, whereby phonetic choices reflect shifting alignments with Māori- and Pākehā-oriented norms depending on context. As some features of ME are suggested to have reached stereotypical status in the Labovian (1972) sense by rising to the awareness of the general speech group of NZE (cf. Huygens & Vaughan, 1983; Bayard & Leek, 1992; Robertson, 1994; Szakay, 2007), contextual variation could very well be a culturally informed necessity for speakers of ME. Style shifting for Broxh may therefore not only be motivated by the aforementioned contextual norms but also by the avoidance of ethnic stereotyping (cf. K. Holmes et al., 2001; Te Hiwi, 2008; Houkamau et al., 2017) and negative valorisation (cf. Agha, 2004).

The two types of variability described by Gumperz (1968) are not independent: the availability of GOAT fronting as a stylistic resource in superposed variability presupposes its prior establishment as a dialectal feature. In this sense, Gumperz' framework complements Silverstein's (2003) account of indexical order, with dialectal variability corresponding broadly to first-order indexical correlations, and superposed variability reflecting higher-order, metapragmatically informed stylistic deployment.

5.2 Comparison to previously collected formant data

While Section 5.1 demonstrated that GOAT fronting functions as a context-sensitive sociolinguistic resource in Broxh's speech, the comparison with previously collected formant data allows us to situate this stylistic variation within the broader phonetic landscape of NZE. Crucially, this comparison reveals a divergence between the variable's indexical behaviour and its structural positioning in the vowel system.

As the contextual difference in Euclidean distance was not significant, the indexical patterns identified in Section 5.1 cannot be extended to the monophthongisation of GOAT. In

other words, while fronting participates in the kind of higher-order indexical processes described above, monophthongisation does not appear to be available to Broxh as a resource for context-sensitive style shifting.

However, when comparing Broxh's mean formant trajectories of GOAT (Figure 3) to those reported by Laurie Bauer and Paul Warren (2004) for Pākehā speakers (Figure 5), a different picture emerges at the structural level: their data shows a considerably steeper F_2 rise (ca. 1600 Hz to 1900 Hz) and a more pronounced F_1 movement (ca. 600 Hz to 400 Hz), resulting in a much larger Euclidean distance (ca. 360.56) than in either of Broxh's contexts (*whakairo*: 214.55, gaming: 231.99). This indicates that, irrespective of contextual modulation, Broxh's GOAT vowel is overall more monophthongal than that of the Pākehā speakers in Bauer and Warren's study.

Broxh's formant values reveal a weaker fronting pattern overall than those reported by Bauer and Warren. At first glance, this appears to challenge the assumption—implicit in Section 5.1—that GOAT fronting is more advanced in ME and thus available as a salient index of Māoriness. However, this apparent contradiction dissolves when considering the distinction between absolute phonetic realisation and relative, intraspeaker variation. While Broxh's GOAT realisation may not occupy the most fronted region of the NZE vowel space, it nevertheless exhibits systematic contextual shifts that are sufficient to index social meaning. In this sense, what matters for indexicality is not extremeness, but contrast within the speaker's own repertoire.

Moreover, methodological differences complicate a direct comparison. Bauer and Warren's dataset includes both male and female speakers—the latter of whom, due to physiological differences such as vocal tract length, tend to produce higher formant frequencies (cf. Simpson, 2009)—and is based on tightly controlled word-list data. By contrast, the present study analyses spontaneous speech from a single male speaker across varying phonological environments. These factors likely contribute to the lower overall F_2 values observed for Broxh and caution against interpreting the difference as purely dialectal.

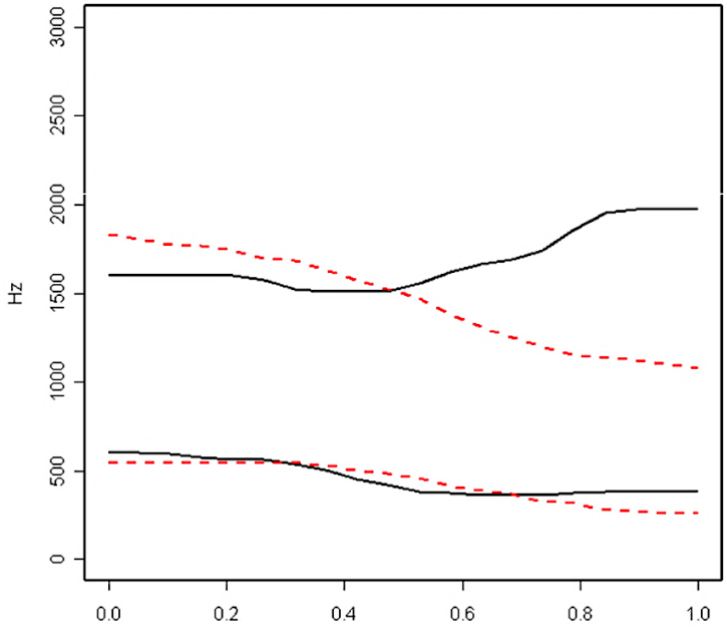

Figure 5. Formant trajectories for Wellington and Hamilton Pākehā speakers' realisations of GOAT (solid lines) and MOUTH (dotted lines) (reproduced from L. Bauer and Warren, 2004)

A more fine-grained comparison is possible with the formant dataset compiled by Anita Easton and Laurie Bauer (2000), as it is differentiated by ethnicity, age and sex. While Broxh's onset F_2 values in either context (*whakairo*: 1446 Hz, gaming: 1392 Hz) do not quite reach the frequencies on the higher end of the NZE START spectrum[3] (Table 2), they do align closely with those reported for male Māori speakers' realisations of START (Table 3), supporting an interpretation of Broxh's GOAT onset as relatively fronted within an NZE framework. Importantly, this alignment reinforces the analysis in Section 5.1: even if Broxh's GOAT vowel is not maximally fronted in absolute terms, it occupies a phonetic space that is recognisably associated with Māori-oriented speech and can therefore support indexical interpretation.

Table 2. START formants over time in RP, Australian English and NZE (reproduced from Easton and Bauer, 2000)

Table 12. The START vowel

	F1	F2	F3
RP1 male (Wells 1963)	677	1083	2540
RP2 female (Deterding 1997)	779	1181	–
RP2 male (Deterding 1997)	687	1077	–
RP3 female (Deterding 1997)	910	1316	2841
RP3 male (Deterding 1997)	646	1155	2490
AusE1 male (Bernard 1989)	740	1360	2475
AusE2 female (Watson *et al.* 1998)	1049	1499	–
AusE2 male (Watson *et al.* 1998)	731	1275	–
Northland male Pakeha (Hall 1976)	789	1590	2577
Northland male Maori (Hall 1976)	830	1443	2480
Auckland male (Hall 1976)	783	1478	–
Christchurch female (Maclagan 1982)	920	1520	–
Christchurch male (Maclagan 1982)	800	1480	–
Otago female (Watson *et al.* 1998)	985	1583	–
Otago male (Watson *et al.* 1998)	789	1315	–

[3] As mentioned in Section 3.3, concrete formant values for NZE GOAT were not provided by prior studies. Instead, the formant values of Broxh's GOAT onset and offset are compared to those of the closest corresponding monophthongs.

Table 3. Formant values for START realisations of Māori and Pākehā speakers from Porirua (reproduced from Easton and Bauer, 2000, using data from the 1989 Wellington Dialect Survey)

Table 11. The START vowel

			Working class						Middle class		
			Pakeha			Maori			Pakeha		
			Mean Hz	SD	*n*	Mean Hz	SD	*n*	Mean Hz	SD	*n*
Women	Young	F1	832	105	6	1008	121	5	847	240	4
		F2	1553	440	4	1677	140	5	1529	94	5
		F3	2834	347	5	2879	196	4	2773	252	5
	Middle aged	F1	923	250	4	883	128	6	891	56	4
		F2	1673	161	4	1535	198	6	1660	149	5
		F3	2941	133	3	2747	164	5	2747	170	5
	Old	F1	755	39	5	869	87	5	930	140	5
		F2	1677	79	5	1608	69	5	1686	72	5
		F3	2912	187	5	2764	231	5	2938	146	5
Men	Young	F1	730	57	5	771	156	4	–	–	–
		F2	1512	78	5	1401	42	4	–	–	–
		F3	2651	241	5	2695	146	4	–	–	–
	Middle aged	F1	756	171	5	724	71	6	–	–	–
		F2	1379	210	4	1492	159	6	–	–	–
		F3	2434	189	5	2434	137	6	–	–	–
	Old	F1	721	59	5	727	90	4	–	–	–
		F2	1512	94	5	1390	128	4	–	–	–
		F3	2495	251	5	2579	125	3	–	–	–

A similar pattern emerges for the offset, which, following Paul Warren and Laurie Bauer's (2008, p. 85) description of ME GOAT's second target as 'matching the GOOSE vowel', is compared here to GOOSE F_2 values compiled by Easton and Bauer (2000). While Broxh's glide F_2 values (1578 Hz for *whakairo*, 1537 Hz for gaming) do not fully reach the high frequencies generally associated with NZE GOOSE (Table 4), they approximate those reported for young male Māori speakers (Table 5). This suggests that Broxh's realisation of GOAT participates in wider NZE sound change trajectories, but does so in a way that is neither fully aligned with Pākehā norms nor entirely reducible to established descriptions of ME. Instead, Broxh's GOAT vowel occupies an intermediate and dynamic position, consistent with the continuum-based model (cf. Benton, 1991) outlined in Section 1.

Table 4. GOOSE formants over time in RP, Australian English and NZE (reproduced from Easton and Bauer, 2000)

Table 20. The GOOSE vowel

	F1	F2	F3
RP1 male (Wells 1963)	309	939	2320
RP2 female (Deterding 1997)	339	1396	–
RP2 male (Deterding 1997)	302	1131	–
RP3 female (Deterding 1997)	328	1437	2674
RP3 male (Deterding 1997)	316	1191	2408
AusE1 male (Bernard 1989)	350	1615	2370
AusE2 female (Watson *et al.* 1998)	447	2030	–
AusE2 male (Watson *et al.* 1998)	373	1686	–
Northland male Pakeha (Hall 1976)	417	1897	2493
Northland male Maori (Hall 1976)	417	1389	2354
Auckland male (Hall 1976)	339	1778	–
Christchurch female (Maclagan 1982)	420	1600	–
Christchurch male (Maclagan 1982)	410	1600	–
Otago female (Watson *et al.* 1998)	365	1926	–
Otago male (Watson *et al.* 1998)	287	1605	–

Taken together, these comparisons reinforce a key insight from Section 5.1: phonetic variables need not exhibit categorical or extreme realisations to function indexically. Broxh's GOAT vowel demonstrates that relatively subtle phonetic differences—well within the range of NZE variation—can nonetheless be mobilised to signal shifts in stance, identity, and interactional alignment. The discrepancy between his moderate overall fronting and its clear contextual modulation thus underscores the importance of distinguishing between a variable's phonetic embedding and its indexical potential.

In this sense, the findings of this section complement the indexical and enregisterment-based analysis developed earlier. While the comparison with previous data situates Broxh's speech within the structural dynamics of NZE, his intraspeaker variation illustrates how these structures are actively taken up, reinterpreted, and reproduced in interaction.

Table 5. Formant values for GOOSE realisations of Māori and Pākehā speakers from Porirua (reproduced from Easton and Bauer, 2000, using data from the 1989 Wellington Dialect Survey)

Table 19. The GOOSE vowel

			Working class						Middle class		
			Pakeha			Maori			Pakeha		
			Mean Hz	SD	*n*	Mean Hz	SD	*n*	Mean Hz	SD	*n*
Women	Young	F1	412	53	6	408	39	5	399	57	5
		F2	1528	191	6	1912	160	5	1747	245	5
		F3	2521	156	6	2616	155	5	2760	247	4
	Middle aged	F1	402	109	4	413	81	6	399	36	5
		F2	1640	189	4	1854	186	6	1790	180	5
		F3	2549	324	3	2644	195	6	2486	202	5
	Old	F1	434	106	5	408	59	5	347	87	5
		F2	1903	99	5	1634	299	5	1599	391	5
		F3	2538	167	5	2662	242	4	2543	90	4
Men	Young	F1	434	79	4	321	24	5	–	–	–
		F2	1369	56	4	1573	229	5	–	–	–
		F3	2303	71	4	2151	135	4	–	–	–
	Middle aged	F1	347	–	5	340	33	6	–	–	–
		F2	1651	137	5	1724	145	6	–	–	–
		F3	2303	264	5	2289	53	6	–	–	–
	Old	F1	365	73	5	358	42	4	–	–	–
		F2	1677	100	5	1445	350	4	–	–	–
		F3	2251	172	5	2314	196	4	–	–	–

6 Conclusion

This study set out to investigate whether the realisation of the GOAT vowel exhibits intraindividual contextual variation within a speaker of ME and how such variation can be interpreted within a broader sociolinguistic framework. The results provide clear evidence that Broxh's production of GOAT is sensitive to interactional context, with significantly more fronted realisations occurring in the Māori-related *whakairo* setting than in the gaming context. While no significant contextual effect was found for monophthongisation, the overall comparison with previously collected formant data suggests that Broxh's GOAT vowel remains relatively monophthongal in both contexts.

In general, the comparison with previously reported formant values suggests that Broxh's realisation of GOAT does not fully align with established descriptions of either ME or PE but instead reflects the fluid and dynamic nature of the NZE vowel system. While its relatively moderate degree of fronting challenges categorical assumptions about ME, its consistent contextual modulation demonstrates that even subtle phonetic variation can function as a socially meaningful resource. This highlights that indexicality and enregisterment operate not only through extreme realisations but also through fine-grained, systematic shifts that signal alignment with different social meanings.

From a theoretical perspective, the study's findings support an analysis of GOAT variation as an instance of indexical practice in the sense of Silverstein (2003). At the level of first-order indexicality, Broxh's variable use of GOAT reflects sensitivity to the immediate interactional context. At the level of second-order indexicality, Broxh's more pronounced GOAT fronting in the *whakairo* context indexes broader social meanings such as Māoriness, cultural authenticity,

and alignment with Māori social personae. It needs to be noted that these meanings are not external to interaction but actively invoked and negotiated within it, as Broxh draws on phonetic variation to position himself differently across contexts.

The patterns observed in this study illustrate the dynamic interplay between micro-social usage and macro-social structure. Recurrent associations between GOAT fronting and Māori-related contexts contribute to the stabilisation of value-laden meanings, which in turn feed back into interaction as presupposed norms. In line with Agha's (2004) notion of enregisterment, GOAT fronting can thus be understood as part of a broader sociohistorical process through which linguistic features become socially recognised as elements of a Māori-related register. This register is constituted not only by the linguistic features themselves but also by the social personae, practices, and ideological values they index.

Furthermore, the data demonstrates how such indexical meanings are operationalised interactionally through what Gumperz (1968) terms superposed variability, enabling speakers to shift stylistically within their repertoire. In conjunction with Benton's (1991) suggested model of style shifting along the NZE continuum, Broxh's variation of GOAT can be interpreted as movement along a sociolinguistic spectrum, whereby phonetic choices reflect shifting alignments with Māori- and Pākehā-oriented norms depending on context.

Overall, this study highlights the value of analysing intraspeaker variation as a window into larger sociolinguistic processes. By focusing on a single speaker, it demonstrates how macro-social structures such as registers, identities, and ideologies are not merely reflected in language use but are actively produced and reproduced through situational interaction. At the same time, the study is limited by its reliance on a single speaker and a relatively small dataset, as well as by the lack of directly comparable contemporary formant data for NZE diphthongs. Future research could expand on this study's findings by incorporating a larger sample of speakers and exploring additional variables.

In sum, Broxh's contextual variation of the GOAT vowel provides compelling evidence that phonetic variation in ME functions as a socially meaningful resource, through which speakers navigate identity, context, and interaction in a stratified and dynamic linguistic landscape.

7 Acknowledgements

I would like to thank my MSc supervisors at the University of Edinburgh, Claire Cowie and Jeremy Steffman, for their guidance, thoughtful feedback and continuous support throughout and beyond the development of the dissertation this article is based on. Their expertise in sociolinguistics and phonetic methodology, respectively, have been instrumental in shaping both the direction and the quality of this work.

I would also like to thank Stefano Coretta, who helped me expand my statistical and programming skills.

Finally, I would like to thank Daytona Te Awarehe Taputu, a.k.a. Broxh, for his contributions to the preservation of Māori culture and language through a combination of valuing traditions and embracing new avenues, and for sharing its beauty with myself and others who would otherwise scarcely have the chance to experience it.

References

Agha, A. (2003). The social life of cultural value. *Language and Communication*, *23*(3–4), 231–273. https://doi.org/10.1016/S0271-5309(03)00012-0

Agha, A. (2004). Registers of language. In A. Duranti (Ed.), *A companion to linguistic anthropology* (pp. 23–45). Blackwell.

Bauer, L. (1994). English in New Zealand. In R. Burchfield (Ed.), *The Cambridge history of the English language* (Vol. 5, pp. 382–429). Cambridge University Press.

Bauer, L., & Warren, P. (2004). Curing the goat's mouth. In S. Cassidy, F. Cox, R. Mannell, & S. Palethorpe (Eds.), *Proceedings of the 10th Australian International Conference on Speech Science & Technology* (pp. 215–220). Australian Speech Science and Technology Association. http://emu.sourceforge.net/

Bauer, L., Warren, P., Bardsley, D., Kennedy, M., & Major, G. (2007). Illustrations of the IPA: New Zealand English. *Journal of the International Phonetic Association*, *37*(1), 97–102.

Bauer, W., & Parker, W. (1993). *Māori*. Routledge.

Bayard, D., & Leek, R. (1992, August). *Voices, attitudes, and accents: Gender and ethnicity effects in Auckland and Dunedin* [Conference presentation]. Third New Zealand Language and Society Conference, Auckland, New Zealand.

Bell, A. (1997). The phonetics of fish and chips in New Zealand: Marking national and ethnic identities. *English World-Wide*, *18*(2), 243–270.

Bell, A. (2000). Māori and Pakeha English: A case study. In A. Bell & K. Kuiper (Eds.), *New Zealand English* (pp. 221–248). John Benjamins.

Benton, R. A. (1991). Māori English: A New Zealand myth? In J. Cheshire (Ed.), *English around the world* (pp. 187–199). Cambridge University Press.

Easton, A., & Bauer, L. (2000). An acoustic study of the vowels of New Zealand English. *Australian Journal of Linguistics*, *20*(2), 93–117. https://doi.org/10.1080/07268600020006021

Gumperz, J. (1968). The speech community. In D. L. Sills (Ed.), *International encyclopedia of the social sciences* (Vol. 9, pp. 381–386). Macmillan and Free Press.

Hay, J., Gordon, E., & Maclagan, M. (2008). *New Zealand English*. Edinburgh University Press.

Holmes, J. (1994). New Zealand flappers: An analysis of T voicing in New Zealand English. *English World-Wide*, *15*, 195–224.

Holmes, J. (1995). Glottal stops in New Zealand English: An analysis of variants of word-final /t/. *Linguistics*, *33*, 433–463.

Holmes, J. (1997). Māori and Pakeha English: Some New Zealand social dialect data. *Language in Society*, *26*(1), 65–101. https://doi.org/10.1017/s0047404500019412

Holmes, J. (2005). Using Māori English in New Zealand. *International Journal of the Sociology of Language*, *172*, 91–115. https://doi.org/10.1515/ijsl.2005.2005.172.91

Holmes, K., Murachver, T., & Bayard, D. (2001). Accent, Appearance and Ethnic Stereotypes in New Zealand. *New Zealand Journal of Psychology*, *30*(2). https://psycnet.apa.org/record/2002-10959-005

Houkamau, C. A., Stronge, S., & Sibley, C. G. (2017). The prevalence and impact of racism toward Indigenous Māori in New Zealand. *International Perspectives in Psychology: Research, Practice, Consultation*, *6*(2), 61–80. https://doi.org/10.1037/ipp0000070

Huygens, I., & Vaughan, G. M. (1983). Language attitudes, ethnicity and social class in New Zealand. *Journal of Multilingual and Multicultural Development*, *4*(2–3), 207–223. https://doi.org/10.1080/01434632.1983.9994112

Johnstone, B., Andrus, J., & Danielson, A. E. (2006). Mobility, indexicality, and the enregisterment of "Pittsburghese." *Journal of English Linguistics*, *34*(2), 77–104. https://doi.org/10.1177/0075424206290692

Kendall, T., & Fridland, V. (2021). *Sociophonetics*. Cambridge University Press. https://doi.org/10.1017/9781316809709

Kiesling, S. F. (2011). *Linguistic variation and change*. Edinburgh University Press.
King, J. (1993). Māori English. A phonological study. *New Zealand English Newsletter*, *7*, 33–47.
King, J. (1999). Talking Bro: Māori English in the university setting. *Te Reo*, *42*, 20–38.
Labov, W. (1972). *Sociolinguistic patterns*. University of Pennsylvania Press.
Maclagan, M., King, J., & Szakay, A. (2008, November 17–18). *Māori English: Perceptual features* [Conference presentation]. 11th New Zealand Language and Society Conference, Dunedin, New Zealand.
Maclagan, M., Watson, C. I., Harlow, R., King, J., & Keegan, P. (2009). /u/ fronting and /t/ aspiration in Māori and New Zealand English. *Language Variation and Change*, *21*, 175–192. https://doi.org/10.1017/S095439450999007X
McBurney, S. (1887). Colonial pronunciation. *Christchurch Press. Reproduced in Turner (1967)*.
Moorfield, J. C. (n.d.). *Te Aka Māori Dictionary*. https://www.maoridictionary.co.nz/
Red Bull Gaming. (2020). *Meet wholesome Broxh_ the streaming carver | Uncovered* [Video]. Youtube. https://www.youtube.com/watch?v=oCrN10ybCBA
Richards, J. C. (1970). The language factor in Māori schooling. In J. Ewing & Shallcrass J. (Eds.), *Introduction to Māori education* (pp. 122–132). New Zealand Universities Press.
Robertson, S. (1994). *Identifying Māori English: A study of ethnic identification, attitudes, and phonetic features* (Unpublished master's thesis). Victoria University of Wellington.
Ross, B. C. (2018). *An acoustic analysis of New Zealand English vowels in Auckland*. Victoria University of Wellington.
Shoup, J. E. (1980). Phonological aspects of speech recognition. In *Trends in Speech Recognition* (pp. 125–138). Prentice Hall.
Silverstein, M. (2003). Indexical order and the dialectics of sociolinguistic life. *Language and Communication*, *23*(3–4), 193–229. https://doi.org/10.1016/S0271-5309(03)00013-2
Simpson, A. P. (2009). Phonetic differences between male and female speech. *Language and Linguistics Compass*, *3*(2), 621–640. https://doi.org/10.1111/J.1749-818X.2009.00125.X
Statistics New Zealand / Tatauranga Aotearoa. (2024). *2023 Census national and subnational usually resident population counts and dwelling counts*.
Szakay, A. (2007). *Identifying Māori English and Pākehā English from suprasegmental cues: A study based on speech resynthesis* [Master's thesis, University of Canterbury]. UC Research Repository. http://hdl.handle.net/10092/975
Szakay, A., Babel, M., & King, J. (2012). *Sociophonetic markers facilitate translation priming: Māori English GOAT - a different kind of animal* (18.2; Selected Papers from NWAV 40). http://repository.upenn.edu/pwpl/vol18/iss2/16
Taputu, D. T. A. (n.d.). *About broxh.* Twitch. https://www.twitch.tv/broxh_/about
Taputu, D. T. A. (2020, September 7). *Broxh gets a visit from Auntie Jacinda Ardern* [Video]. YouTube. https://www.youtube.com/watch?v=yViVVRpZoEw&t=732s
Taputu, D. T. A. (2022, December 28). *i know it has been a while my bad* [Video]. YouTube. https://www.youtube.com/watch?v=bDPegzpD6_o&t=508s
Taputu, D. T. A. (2023). *Highlight: !Drops & 2 Gifted Sub Mount . !Diablo4 #AD #twitchdrops* [Video]. Twitch. https://www.twitch.tv/videos/1839606644?filter=highlights&sort=time
Te Hiwi, E. (2008). Disrupted Spaces: Racism and the lived experience of Māori identity formation. In M. Levy, L. W. Nikora, B. Masters-Awatere, M. R. Rua, & W. Waitoki

(Eds.), *Claiming spaces: Proceedings of the 2007 National Māori and Pacific Psychologies Symposium* (pp. 271–280). Māori and Psychology Research Unit.
Te Urewera. (n.d.). Ngāi Tūhoe Iwi. https://www.ngaituhoe.iwi.nz/te-urewera
Turner, G. W. (1967). Samuel McBurney's newspaper article on colonial pronunciation. *Journal of the Australasian Universities Modern Language Association*, *0*(27), 81–85.
Wall, A. (1938). *New Zealand English: How it should be spoken*. Whitcombe and Tombs.
Warren, P., & Bauer, L. (2008). Māori English: phonology. In K. Burridge & B. Kortmann (Eds.), *Varieties of English 3: The Pacific and Australasia* (pp. 77–88). De Gruyter Mouton.
Watson, C. I., Harrington, J., & Evans, Z. (1998). An acoustic comparison between New Zealand and Australian English vowels. *Australian Journal of Linguistics*, *18*(2), 185–207. https://doi.org/10.1080/07268609808599567
Watson, C. I., MacLagan, M. A., King, J., Harlow, R., & Keegan, P. J. (2016). Sound change in Māori and the influence of New Zealand English. *Journal of the International Phonetic Association*, *46*(2), 185–218. https://doi.org/10.1017/S0025100316000025
Wells, J. C. (1982). *Accents of English. Vol. 3: Beyond the British Isles*. Cambridge University Press.

Appendix

Te reo Māori glossary (based on Moorfield (n.d.))

Iwi – (noun) extended kinship group, tribe, nation, people, nationality, race - often refers to a large group of people descended from a common ancestor and associated with a distinct territory.

Kohanga reo – (noun) Māori language preschool.

Ngāi Tuhoe – (personal noun) tribal group of the Bay of Plenty in the Kutarere-Ruātoki-Waimana-Waikaremoana area.

Pākehā – (noun) New Zealander of European descent - probably originally applied to English-speaking Europeans living in Aotearoa/New Zealand. According to Mohi Tūrei, an acknowledged expert in Ngāti Porou tribal lore, the term is a shortened form of *pakepakehā*, which was a Māori rendition of a word or words remembered from a chant used in a very early visit by foreign sailors for raising their anchor. Others claim that *pakepakehā* was another name for *tūrehu* or *patupairehe.* Despite the claims of some non-Māori speakers, the term does not normally have negative connotations.

Rohe pōtae – (noun) tribal territory, tribal homelands.

Whakapapa – (noun) genealogy, genealogical table, lineage, descent - reciting *whakapapa* was, and is, an important skill and reflected the importance of genealogies in Māori society in terms of leadership, land and fishing rights, kinship and status. It is central to all Māori institutions. There are different terms for the types of *whakapapa* and the different ways of reciting them including: *tāhū* (recite a direct line of ancestry through only the senior line); *whakamoe* (recite a genealogy including males and their spouses); *taotahi* (recite genealogy in a single line of descent); *hikohiko* (recite genealogy in a selective way by not following a single line of descent); *ure tārewa* (male line of descent through the first-born male in each generation).

Whānau – (noun) extended family, family group, a familiar term of address to a number of people - the primary economic unit of traditional Māori society. In the modern context the term is sometimes used to include friends who may not have any kinship ties to other members.

Whanaungatanga – (noun) relationship, kinship, sense of family connection - a relationship through shared experiences and working together which provides people with a sense of belonging. It develops as a result of kinship rights and obligations, which also serve to strengthen each member of the kin group. It also extends to others to whom one develops a close familial, friendship or reciprocal relationship.

Te Arawa – (personal name) people descended from the crew of this canoe from Hawaiki who form a group of tribes in the Rotorua-Maketū area.

Toi whakairo – (noun) art of carving.

Methodological details

As Broxh is a tall male speaker, Praat's analysis frequency was set to 4500–6500 Hz. The number of steps was adjusted to 20 and the number of coefficients to 10.

For their purpose of cross-dialectic comparison of different vowels (both monophthongs and diphthongs), Kendall and Fridland indiscriminately set the formant measurement points at 1/3 and 2/3 of the token's duration. Since, however, the goal of this study is intraindividual comparison of a singular diphthong, 20% and 80% of the vowel duration were selected as primary measurement points. This choice was made to ensure that formant values were captured for both targets of the diphthong, as the offglide is not always situated exactly at the midpoint of the vowel.

The Euclidean distance between onset and offset was calculated using the following formula (cf. Fabricius, 2007; Watson et al., 2016; Kendall & Fridland, 2021; operationalised specifically for diphthongal onset-offset comparison by Haddican et al., 2013; Cardoso 2015):

$$ED(onset - offset) = \sqrt{(F1_2 - F1_1)^2 + (F2_2 - F2_1)^2}$$

Linear regressions were conducted using R's lme4 plugin. Initially, a linear mixed effects model that included the factor 'Word' as a random factor was created for each of the five dependent variables OF1, OF2, WF1, WF2 and Euclidean distance. However, as the model returned no significant random effect variation for 'Word' and none of the other factors recorded for the tokens were suitable random effects, a fixed effects model was chosen instead. In addition to the context, the categories of preceding and following phonological environment were included as fixed effects to correct for a potential colouring of the vowel as described by Kendall & Fridland (2021, p. 42). The full formula, using OF1 as an example, thus looked like this:

lm((OF1 ~Register + PrecPhon + FolPhon), data = goat_simplified)

Each of the fixed effects models was paired with a model that did not include context as a fixed effect. These model pairs were then compared using R's anova Chi Square function to determine which of the two is a better fit for the data (see Appendix Tables A5 and A7). Using OF2 as an example, the formula looked like this:

anova(OF2_mdl, OF2_mdl_comparison, test = 'Chisq')

Analysis of whānau and GOLD

Kendall and Fridland (2021, p. 42) describe liquids and nasals as 'compromising' phonological environments that '"color" the quality of the vowel.' In an ideal scenario, all tokens preceded and/or followed by such compromising phonemes, which also include other vowels, would be excluded from the analysis, leaving only 'neutral' tokens surrounded by (voiced) obstruents. However, tokens that met these ideal criteria proved very difficult to find, and a full process of exclusion would have drastically reduced the number of overall tokens of this study. The present study therefore followed Paul Warren and Laurie Bauer (2008), who specifically note a distinct vowel quality for ME GOAT when followed by /l/, in analysing such tokens separately under the GOLD category. To correct for other potential interferences, the preceding and following phonological environment was recorded for each token and included as fixed effects in linear regression models.

During the process of identifying the tokens and marking the vowel boundaries in Praat, it was noticed that Broxh's pronunciation of the final vowel /au/ in the te reo word *whānau* sounds very close to his GOAT vowel. This similarity is in line with Watson and colleagues' (2016) suggestion of a merger within young bilingual speakers of the te reo diphthongs /ou/, whose closest English correspondent is GOAT, and /au/. Watson and colleagues ascribe this merger to a series of connected vowel shifts, initiated by the fronting of te reo /u/, which highly correlates for both male and female speakers with the fronting of NZE GOOSE (see also Maclagan et al., 2009) and exclusively for male speakers with the fronting of the second target of GOAT. The fronting of /u/ then led to the fronting of the second targets of both /au/ and /ou/, which, in turn, caused the fronting and eventual merging of the diphthongs' first targets. To test whether this perceived similarity will manifest in the data, *whānau* will be included in the analysis as a separate category.

Appendix Figure A1 shows that *whānau* behaves very similarly to GOAT. Starting at almost the same offset point as GOAT in the gaming context (the two variables have, in fact, the same mean OF1 value and differ only slightly in their OF2), the *whānau* arrow stretches out between the two GOAT arrows, eventually culminating in an offset that has a lower F_1 frequency and a higher F_2 frequency than GOAT in either context, relating to a more closed and fronted quality. Through this trajectory, the *whānau* arrow reaches a greater length than its GOAT counterparts, hence exhibiting a larger Euclidean distance.

The arrow for GOLD, however, describes an almost opposite trajectory, moving from a starting point that, through its higher F_1 and substantially lower F_2, is more open and backer than all other variables to a glide point whose F_1 value and thus vowel height is comparable to GOAT in the gaming context and *whānau*. The offset's F_2 frequency, on the other hand, is even lower than that of its own onset, rendering the end point of GOLD even backer and even more distant from its GOAT and *whānau* counterparts. Despite having the longest trajectory in the vowel space, the Euclidean distance of GOLD is, as displayed in Appendix Table A9, lower than that of *whānau*. In the case of GOAT and *whānau*, arrow length functioned as an indicator for Euclidean distance because the internal formant relations between the three trajectories were similar enough. This inference cannot be made for GOLD, whose arrow length is mostly based on its comparatively large gap between OF1 (547 Hz) and WF1 (420 Hz) but is counteracted in terms of Euclidean distance by its comparatively small difference between OF2 (947 Hz) and WF2 (845 Hz).

The raw formant values (Appendix Table A9) and mean diphthong trajectory (Appendix Figure A1) of *whānau* confirm the initial informal observation that Broxh's realisation of the final vowel in this te reo word is of a very similar quality to that of his GOAT vowel. While

Broxh's *whānau* glide is slightly fronter and closer than that of either GOAT context, his realisation of the nucleus of the /au/ diphthong in *whānau* is only marginally fronter than and exactly as open as that of his realisation of the /ou/ correspondent GOAT in the gaming context. This similarity could provide tentative evidence for a merger of the te reo vowels /au/ and /ou/, as suggested by Watson and colleagues (2016).

The stark difference in F_2 frequency between Broxh's realisations of GOAT and GOLD is in line with Paul Warren and Laurie Bauer's (2008) observation of distinct vowel qualities for the two variables and validates the decision to analyse the latter separately. While both variables can primarily be categorised as closing diphthongs, GOAT has an additional fronting quality in Broxh's speech whereas GOLD can secondarily be described as a backing diphthong.

Appendix figures and tables

Table A1. Linear fixed effects model for F_1 of the GOAT onset

OF1					
term	**estimate**	**std.error**	**statistic**	**p.value**	
(Intercept)	483.300	35.386	13.658	<2e-16	***
Contextgaming	18.054	9.705	1.860	0.0644	.
PrecPhoncoronal	-20.167	31.318	-0.644	0.5204	
PrecPhondiphthong	-30.595	41.889	-0.730	0.4661	
PrecPhonfront (semi)vowel	-95.222	48.285	-1.972	0.0501	.
PrecPhonlabial	21.858	40.889	0.535	0.5936	
PrecPhonliquid	14.305	32.129	0.445	0.6567	
PrecPhonnasal	31.083	32.462	0.958	0.3396	
PrecPhonpause	22.155	53.514	0.414	0.6794	
PrecPhonvelar/glottal	-17.038	31.813	-0.536	0.5929	
FolPhoncoronal	34.411	19.426	1.771	0.0782	.
FolPhondiphthong	47.406	36.719	1.291	0.1983	
FolPhonfront (semi)vowel	20.954	20.258	1.034	0.3023	
FolPhonlabial	49.892	22.254	2.242	0.0262	*
FolPhonnasal	56.870	21.855	2.602	0.0100	*
FolPhonpause	47.587	20.002	2.379	0.0184	*
FolPhonvelar/glottal	-15.175	28.813	-0.527	0.5991	
			2.675	0.0008	
r.squared	**adj.r.squared**	**sigma**	**df**	**df.residual**	**nobs**
0.1896	0.1187	64.5	16	183	200
Signif. codes:	'***' 0.001	'**' 0.01	'*' 0.05	'.' 0.1	' ' 1

Table A2. Linear fixed effects model for F_2 of the GOAT onset

OF2					
term	**estimate**	**std.error**	**statistic**	**p.value**	
(Intercept)	1406.365	61.710	22.790	< 2e-16	***
Contextgaming	-48.233	16.925	-2.850	0.004876	**
PrecPhoncoronal	38.124	54.616	0.698	0.486046	
PrecPhondiphthong	203.675	73.051	2.788	0.005861	**
PrecPhonfront (semi)vowel	317.639	84.205	3.772	0.000218	***
PrecPhonlabial	-31.245	71.308	-0.438	0.661782	
PrecPhonliquid	-28.072	56.030	-0.501	0.616967	
PrecPhonnasal	66.308	56.612	1.171	0.243011	
PrecPhonpause	157.043	93.325	1.683	0.094128	.
PrecPhonvelar/glottal	195.459	55.480	3.523	0.000539	***
FolPhoncoronal	-57.492	33.877	-1.697	0.091384	.
FolPhondiphthong	-69.932	64.035	-1.092	0.276234	
FolPhonfront (semi)vowel	28.345	35.328	0.802	0.423396	
FolPhonlabial	-83.794	38.809	-2.159	0.032142	*
FolPhonnasal	-62.256	38.113	-1.633	0.104091	
FolPhonpause	-5.826	34.882	-0.167	0.867528	
FolPhonvelar/glottal	-54.508	50.247	-1.085	0.279438	
			9.333	< 2.2e-16	
r.squared	**adj.r.squared**	**sigma**	**df**	**df.residual**	**nobs**
0.4493	0.4012	112.5	16	183	200

Table A3. Linear fixed effects model for F_1 of the GOAT offset

WF1					
term	**estimate**	**std.error**	**statistic**	**p.value**	
(Intercept)	458.297	39.195	11.693	<2e-16	***
Contextgaming	-5.959	10.750	-0.554	0.5800	
PrecPhoncoronal	-7.612	34.690	-0.219	0.8266	
PrecPhondiphthong	2.195	46.399	0.047	0.9623	
PrecPhonfront (semi)vowel	-44.494	53.483	-0.832	0.4065	
PrecPhonlabial	-12.146	45.292	-0.268	0.7889	
PrecPhonliquid	-2.968	35.588	-0.083	0.9336	
PrecPhonnasal	24.613	35.958	0.685	0.4945	
PrecPhonpause	-8.968	59.276	-0.151	0.8799	
PrecPhonvelar/glottal	1.048	35.238	0.030	0.9763	
FolPhoncoronal	-45.180	21.517	-2.100	0.0371	*
FolPhondiphthong	2.746	40.673	0.068	0.9462	
FolPhonfront (semi)vowel	-7.343	22.439	-0.327	0.7438	
FolPhonlabial	-28.092	24.650	-1.140	0.2559	
FolPhonnasal	27.538	24.208	1.138	0.2568	
FolPhonpause	-53.091	22.156	-2.396	0.0176	*
FolPhonvelar/glottal	-74.370	31.915	-2.330	0.0209	*
			2.668	0.0008	
r.squared	**adj.r.squared**	**sigma**	**df**	**df.residual**	**nobs**
0.1891	0.1182	71.4	16	183	200

Table A4. Linear fixed effects model for F_2 of the GOAT offset

WF2					
term	**estimate**	**std.error**	**statistic**	**p.value**	
(Intercept)	1561.02	75.05	20.799	< 2e-16	***
Contextgaming	-55.54	20.58	-2.698	0.007622	**
PrecPhoncoronal	-113.23	66.42	-1.705	0.089973	.
PrecPhondiphthong	-126.12	88.84	-1.419	0.157455	
PrecPhonfront (semi)vowel	-56.97	102.41	-0.556	0.578683	
PrecPhonlabial	-201.98	86.73	-2.329	0.020951	*
PrecPhonliquid	-163.41	68.14	-2.398	0.017492	*
PrecPhonnasal	-143.03	68.85	-2.077	0.039169	*
PrecPhonpause	24.56	113.50	0.216	0.828953	
PrecPhonvelar/glottal	-115.32	67.47	-1.709	0.089134	.
FolPhoncoronal	154.15	41.20	3.741	0.000245	***
FolPhondiphthong	80.92	77.88	1.039	0.300184	
FolPhonfront (semi)vowel	224.33	42.97	5.221	4.80E-07	***
FolPhonlabial	79.08	47.20	1.675	0.095564	.
FolPhonnasal	73.93	46.35	1.595	0.112438	
FolPhonpause	226.61	42.42	5.342	2.71E-07	***
FolPhonvelar/glottal	188.96	61.11	3.092	0.002299	**
			4.346	3.389E-07	
r.squared	**adj.r.squared**	**sigma**	**df**	**df.residual**	**nobs**
0.275	0.212	136.8	16	183	200

Table A5. Linear fixed effects model for the Euclidean distance of GOAT

Euclidean distance					
term	**estimate**	**std.error**	**statistic**	**p.value**	
(Intercept)	304.078	61.728	4.926	1.87E-06	***
Contextgaming	7.533	16.930	0.445	0.656879	
PrecPhoncoronal	-125.711	54.632	-2.301	0.022516	*
PrecPhondiphthong	-172.335	73.072	-2.358	0.019408	*
PrecPhonfront (semi)vowe	-274.219	84.229	-3.256	0.001348	**
PrecPhonlabial	-114.989	71.329	-1.612	0.108663	
PrecPhonliquid	-84.732	56.047	-1.512	0.132307	
PrecPhonnasal	-149.686	56.628	-2.643	0.008923	**
PrecPhonpause	-70.778	93.352	-0.758	0.449315	
PrecPhonvelar/glottal	-191.860	55.496	-3.457	0.000679	***
FolPhoncoronal	56.030	33.887	1.653	0.099957	.
FolPhondiphthong	-6.521	64.054	-0.102	0.919019	
FolPhonfront (semi)vowel	65.745	35.338	1.860	0.064426	.
FolPhonlabial	13.498	38.821	0.348	0.728462	
FolPhonnasal	12.907	38.124	0.339	0.735329	
FolPhonpause	95.951	34.892	2.750	0.006560	**
FolPhonvelar/glottal	59.823	50.262	1.190	0.235497	
			3.258	5.54E-05	
r.squared	**adj.r.squared**	**sigma**	**df**	**df.residual**	**nobs**
0.2217	0.1537	112.5	16	183	200

Table A6. Model comparison for GOAT OF2

OF2						
Model 1: OF2 ~ Register + PrecPhon + FolPhon						
Model 2: OF2 ~ 1 + PrecPhon + FolPhon						
Model	**Res.Df**	**RSS**	**Df**	**Sum of Sq**	**Pr(>Chi)**	
1	183	2314328				
2	184	2417039	-1	-102710.9	0.004374	**

Table A7. Model comparison for GOAT WF2

WF2						
Model 1: WF2 ~ Register + PrecPhon + FolPhon						
Model 2: WF2 ~ 1 + PrecPhon + FolPhon						
Model	**Res.Df**	**RSS**	**Df**	**Sum of Sq**	**Pr(>Chi)**	
1	183	3423276				
2	184	3559471	-1	-136195.2	0.00697	**

Table A8. Formant values for STRUT realisations of Māori and Pākehā speakers from Porirua (reproduced from Easton and Bauer, 2000, using data from the 1989 Wellington Dialect Survey)

Table 9. The STRUT vowel

			Working class						Middle class		
			Pakeha			Maori			Pakeha		
			Mean Hz	SD	*n*	Mean Hz	SD	*n*	Mean Hz	SD	*n*
Women	Young	F1	811	67	3	999	156	3	982	289	5
		F2	1448	165	3	1717	75	4	1495	181	5
		F3	2564	301	3	2749	74	4	2727	214	4
	Middle aged	F1	923	168	4	1008	259	5	825	142	4
		F2	1811	448	3	1504	290	5	1347	321	4
		F3	2901	144	4	2842	186	5	2391	185	2
	Old	F1	854	133	3	880	143	4	877	84	5
		F2	1630	93	2	1673	189	4	1703	57	5
		F3	2724	196	3	2684	264	4	2662	185	4
Men	Young	F1	608	–	1	738	131	3	–	–	–
		F2	1434	–	1	1318	66	3	–	–	–
		F3	2129	–	1	2477	157	3	–	–	–
	Middle aged	F1	747	72	5	731	84	6	–	–	–
		F2	1347	96	5	1514	232	6	–	–	–
		F3	2312	72	5	2477	137	6	–	–	–
	Old	F1	749	42	4	680	50	3	–	–	–
		F2	1390	87	3	1332	25	3	–	–	–
		F3	2379	135	4	2506	223	3	–	–	–

Table A9. Mean formant values (in Hz) and Euclidean distance for GOAT, *whānau* and GOLD

Register	OF1	OF2	WF1	WF2	Euclidean distance
GOAT whakairo	520	1446	435	1578	214.55
GOAT gaming	527	1392	422	1537	231.99
whānau	527	1396	416	1589	277.57
GOLD	547	947	420	845	235.30

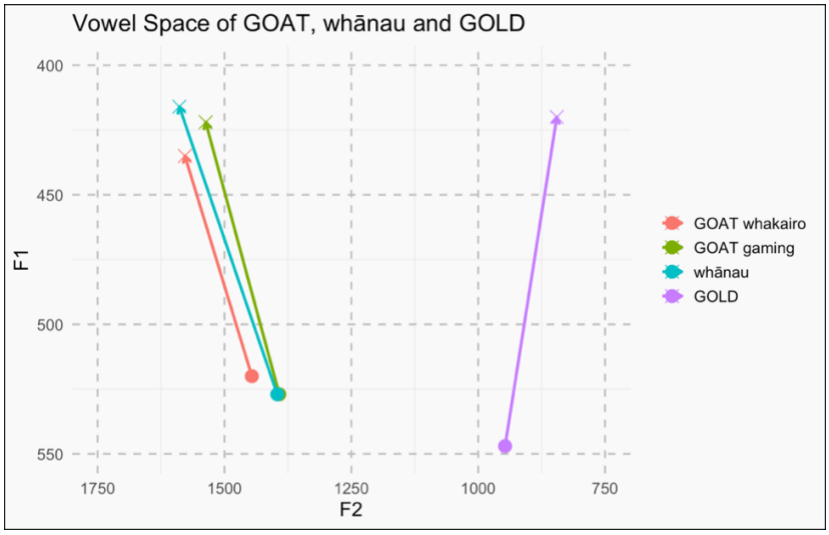

Figure A1. Mean formant tracks within the vowel space for GOAT, *whānau* and GOLD