Revisiting the Maori English Vowel Space:
Exploring variation in /ɪ/ and /u/ vowel production in Auckland, New Zealand

by

Fawn T. Draucker

Bachelor of Arts, Dartmouth College, 2004

Submitted to the Graduate Faculty of

Arts and Sciences in partial fulfillment

of the requirements for the degree of

Master of Arts

University of Pittsburgh

2009

UNIVERSITY OF PITTSBURGH

SCHOOL OF ARTS AND SCIENCES

This thesis was presented

by

Fawn T. Draucker

It was defended on

June 4th, 2009

and approved by

David R. Mortensen, Assistant Professor, Department of Linguistics

Scott F. Kiesling, Associate Professor, Department of Linguistics

Claude E. Mauk, Lecturer, Department of Linguistics

Thesis Director: David R. Mortensen, Assistant Professor, Department of Linguistics

**REVISITING THE MAORI ENGLISH VOWEL SPACE:
EXPLORING VARIATION IN /ɪ/ AND /u/ VOWEL PRODUCTION IN AUCKLAND, NEW ZEALAND**

Fawn T. Draucker, M.A.

University of Pittsburgh, 2009

This study examines the correlation of proposed features of Maori Vernacular English (MVE) with ethnicity, gender, and Maori language ability. Earlier studies propose "decentralized" /ɪ/ and "extremely fronted" /u/ as features distinguishing MVE speech from a more standard form of New Zealand English (Bell, 1997, 1999). Bell (1997) also suggests that a high, close production of /ɪ/ could be the result of language transfer and would likely be correlated with Maori language ability. In this work, I investigate these claims within a generation of speakers born between 1915-1937. Interviews were used from a group of participants in an oral history project conducted by the Auckland Public Library in 1990, and include background on the participants' lives, including information about their ethnicity and languages used in their homes. Tokens of target vowels, /ɪ/ and /u/, were collected from the speech produced during these interviews, along with tokens of all other English monophthongal vowels. First and second formant measurements were taken from these tokens in Praat and the data were then normalized. Data were tested for correlation with ethnicity, Maori language ability, and gender using linear mixed effects regression and generalized linear modeling. Results showed that high, close productions of /ɪ/ are correlated with English-Maori bilingualism. This correlation is discussed within both a language transfer framework and a community-based sociolinguistic framework, with the proposal of a sound change in progress at different stages in different communities being the preferred interpretation. Results for the /u/ vowel show that extremely fronted production of /u/ could not be correlated with Maori ethnicity, but instead could be identified as a Pakeha female variant. These results are again discussed within a sociolinguistic framework, focusing on the /u/ variable as a possible sound change in progress. Ultimately, it is determined that neither decentralized /ɪ/ or fronted /u/ can be established as identifying features of the MVE dialect for this group of speakers.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

Preface

I would like to acknowledge several people whose work and support have made this study possible. First, I would like to thank Ms. Kate DeCourcy and the Special Collections Department of the Auckland City Libraries for their assistance and extreme generosity in allowing me to use their material for this study. Without Ms. DeCourcy's help and kindness, this study would not have been possible. I would also like to thank my thesis advisor, Dr. David R. Mortensen for his help and encouragement. In addition, I am grateful to my other committee members, Dr. Scott F. Kiesling and Dr. Claude Mauk for their knowledge and assistance. Finally, thank you to my family, friends, and linguistic classmates, particularly Christina Schoux Casey and David R. H. Mahler for their endless support and encouragement.

1.0 Introduction

With its roots in the variation studies that began cropping up in the 1960s, sociophonetics is a field growing in popularity as a means of correlating language and identity (Labov, 2006). The field is particularly useful in identifying the phonetic variants of a dialect and relating these variants to markers of identity in the dialect's speakers, be they tokens of ethnicity, age, gender, local identity, etc. Such studies have become more and more popular in teasing apart dialectal features around the world, particularly in varieties of English (see Labov, 1963, 1966; Trudgill, 1974; Poplack, 1980; and Eckert 2000 for just a few hallmark examples).

The study of New Zealand English (NZE) over the years has led to volumes of work describing its departures from other varieties of English, the history of these changes over time, and attitudes towards this dialect of English (Bell and Holmes, 1990; McArthur, 2002; Gordon et al., 2004; etc.). Despite this large volume of work, there has been relatively little work published on the variety of NZE spoken by those speakers of Maori ethnicity, which will be referred to in this paper as Maori Vernacular English or MVE[1]. This variety is contrasted with 'Pakeha English', which is another term for standard NZE. 'Pakeha' is derived from the Maori term used for white New Zealanders of European descent. While the presence of a 'Maori' English is widely recognized by New Zealand linguists and non-linguists alike, until recently, few studies

[1] In previous studies, this variety has been referred to as 'Maori English' (Stubbe and Holmes 1999), 'Maori English 2' (Richards, 1970), and 'Maori Vernacular English' or MVE (Bell, 1999).

had been able to determine the particular features of an MVE variety (see Bell, 1999 for a discussion of failed studies). Then, in the late 1990s, studies finally began to isolate features of this ‘elusive’ dialect, after a realization by Holmes (1997) that what might distinguish ‘Pakeha’ English and MVE is the relative frequency of use of certain tokens in speech, as opposed to discrete differences. After Holmes’s discovery, significant frequency differences were found for many features, including discourse particle usage (Bell, 1999), consonant cluster reduction (Schreier, 2003), variation in pronunciation of phrase-final /t/ (Docherty et. al, 2006), prosody and code-switching patterns (Stubbe and Holmes, 1999).

This work will build on the previous research on vowel quality studies in NZE. Watson et. al (2000) and Trudgill et. al (1998) have shown significant evidence for a shift over time in NZE short front vowels, particularly in the centralization of the /ɪ/ vowel. Bell (1997), though, found that there is a significant difference between this centralization for Maori and Pakeha speakers. Older Maori speakers were much more likely to use a close front variant of /ɪ/ in addition to the centralized variant while other speakers used primarily the centralized variant. Bell suggested that this lack of centralization was correlated with fluency in the Maori language, as all of the speakers who used this variant were older and fluent in Maori, and pronunciation of front vowels in Maori is much farther forward in the vowel space than in NZE. In a separate study, Bell (1999) also found a fronted variant of the /u/ vowel in MVE. He suggests that this is not likely to be based on interference from the Maori language, as the /u/ in Maori is pronounced very far back in the vowel space.

This study looks to follow up on the findings in Bell’s studies by looking at the variance of /ɪ/ and /u/ in the English speech of Maori and Pakeha speakers from Auckland, New Zealand.

Bell suggests that his findings show pronunciation transfer from the Maori /i/ vowel in the non-central pronunciation of the /ɪ/ vowel, but that transfer from Maori does not account for the front pronunciation of the /u/ vowel in MVE. Bell's hypotheses suggest that the interference from Maori on the variation found in English is atomic – that is, elements of the Maori language cause interference in the system of English pronunciation individually, as opposed to the Maori vowel system as a whole imposing phonological transfer on the entirety of the English vowel system. The study aims to provide evidence for the possibility of atomic transfer, by investigating the correlation between variation in the vowel space and Maori language fluency. By comparing speakers within one generation – some of whom are bilingual in Maori and English, some of whom are not – this study can identify whether Bell's findings were a result of a generational pattern or can be attributed to the result of bilingual transfer. Both bilingual and English monolingual speakers of Maori ethnicity will be compared to monolingual Pakeha speakers to determine if it is indeed Maori-English bilingualism that can be correlated with the differences in MVE, or if English monolingual speakers of Maori ethnicity exhibit these patterns as well. If, as predicted, Bell's results can be replicated, it would suggest that language transfer can affect variation within one language atomically. That is, if /ɪ/ variation can be found for the Maori-English bilingual group of participants, while /u/ variation is found based on groupings of sex and/or ethnicity, regardless of monolingual or bilingual status, this would show that factors influencing variation can have an effect phoneme by phoneme and do not require wholesale systemic changes on the vowel space. In addition, such findings would suggest that this atomic transfer can occur for speakers who have learned two languages simultaneously from a young age.

Hypotheses for this study are then generated from Bell's previous findings. It is predicted that production of the /ɪ/ vowel will vary significantly in correlation to Maori language ability, with Maori speakers producing a higher and more front (i.e. more peripheral) version of the vowel than those participants that do not speak Maori, regardless of their ethnicity. For this target vowel, /ɪ/, the hypothesis that speakers of Maori would have a production of the vowel that is higher and farther forward in the vowel space found partial support. While there was no significant variation in the frontness of /ɪ/ vowel production, the height of the vowel was found to vary significantly. As predicted, the higher, or more peripheral, production of the vowel is correlated with Maori language ability, reaffirming the possibility of bilingual language transfer as suggested by Bell. The results of the analysis are reported in more detail and their implications on the hypothesis discussed in section 4.1, below.

For the /u/ vowel it was predicted that the variation of front/back position of the vowel will not be correlated with Maori language ability, but instead with Maori ethnicity; ethnically Maori speakers are predicted to use the front variant of the /u/ vowel more than Pakeha speakers. This hypothesis for the /u/ vowel was also not fully supported. As predicted, language ability was not found to be a significant factor in variation, suggesting that if language transfer is taking place, it is doing so atomically, affecting only the /ɪ/ vowel. Conversely, variation was found to be significantly correlated with sex, not ethnicity as predicted. An interaction between gender and ethnicity was also found to be significant, but here Pakeha females were found to produce the most front variants of /u/, contrary to the prediction that Maori speakers would use the most fronted variants. These findings conflict with Bell's results and suggest that a front production of

/u/ may not be a feature of the MVE dialect. Again, results are reported in more detail in section 4.2, followed by a discussion of their implications on the hypothesis.

In addressing the research questions above, this paper first considers the history of research on New Zealand English and Maori Vernacular English, as well as previous research on language transfer, in section 2. Section 3 then presents the research questions laid out above in more detail, followed by a discussion of the methodology and statistical analysis used for the study. Section 4 provides the results of the study, along with a discussion of the interpretation of the results in regards to the hypotheses. Finally section 5 presents the conclusions reached from the results of this study and their larger implications on the field of sociophonetic variation.

2.0 Background and Previous Research

This study is not unique in its investigation of correlations between social factors and language use. Many social factors have been identified over the years as potential sources of linguistic variation: geographical region (Labov, et al., 1996), ethnicity (Stubbe & Holmes, 1999; Dubois & Horvath, 2003), age (Tagliamonte & D'Arcy, 2004), gender (Eckert, 1996), and social class (Gal, 1979) to name a few. Studies of phonetic variation tend to focus on social factors such as these, less commonly turning the spotlight on the effects of bilingual transfer within an ethnic group. While there are many studies focusing on the role of transfer in the language acquisition process (Mackey, 1965; Paradis and Navarro, 2003; Sanchez, 2003), it is less common for language transfer itself to be used to explain patterns of variation within a community.

In order to understand the implications and significance of this study, it is important to review the previous research on New Zealand English as a regional variety distinct from other World Englishes (section 2.1), while section 2.2 will delve into the findings on variation within NZE that have been attributed to social factors such as age, gender, and most importantly, ethnicity. Finally, theories of language transfer and the implications of transfer as a source of dialect variation will be reviewed, as well as looking at the commonalities and differences in the English and Maori vowel inventories (section 2.3). Section 2.4 reviews how the previous research on NZE and language transfer speak to the research questions being asked in this paper.

2.1 New Zealand English and the decline of the Maori language

The history of New Zealand English is intertwined with the history of New Zealand itself. Before English-speaking people arrived, Maori is presumed to have been the primary language spoken on the islands of New Zealand (Kuiper &Bell, 1999). English was not spoken in the area until the end of the 18th century, as British colonization began in the region, and missionaries, settlers, and traders began to make New Zealand their home. While in the early 1800s Maori was still the predominant language, this quickly changed over time with an influx in immigration to New Zealand. With the signing of the Treaty of Waitangi in 1840, British migration to the area became even steadier, and soon it was necessary for the Maori people to learn English in order to communicate in churches, market places, and schools. By the late 1980s, Bell and Holmes estimate that roughly 95 per cent of New Zealanders spoke English, with 90 per cent of those speakers being monolingual (1991). While later waves of Asian immigrants in the early 90s may have diluted the numbers of monolingual speakers, Bell believes that through the late 90s, the proportion of English speakers remained steady at around 95 per cent (Kuiper and Bell, 1999; also see Appendix B for numbers from the 1991 and 1996 censuses). Although the Maori language is still recognized as one of the official languages of New Zealand (the other being English) and despite revitalization efforts, Maori is rarely spoken in public venues, from market places to schools and government meetings.

Kuiper and Bell (1999) report that "as a result of both the recency of the migration and the relatively free movement of settlers throughout New Zealand, geographical dialects (within New Zealand) are not obvious, although small-scale dialect differences do exist". Kuiper and Bell cite these differences being primarily in the use of "regional vocabulary". Much of the focus on studies of NZE then has been not on the variation within New Zealand, but on how NZE compares to other World Englishes.

Bayard's work in 1987 is considered to be some of the first scholarly work on NZE, collecting large samples of speakers from the Otago area, initiating interest in starting databases for study of NZE, particularly in the Wellington and Christchurch areas (Holmes, Bell and Boyce, 1991; Holmes and Bell, 1992; Bauer, 1994; Holmes 1996). Next the Origins of New Zealand English (ONZE) project took flight at the University of Canterbury and continues to this day, with the purpose "to not only document features, patterns and changes in New Zealand English, but to use this information to make wider theoretical statements about language in general" (ONZE, 2009). This project consists of three corpora of New Zealand speakers, one with speakers born between 1851-1910, the second with speakers born between 1890-1930, and the third with speakers born between 1930-1984. Due to the availability of recordings from speakers born over 133 years apart, the ONZE project is able to study the use of English in New Zealand not only synchronically, but diachronically as well, looking at changes in speech over time.

As noted above, in addition to simply describing NZE, most of these projects were aimed at comparing this variety to other dialects of English. Allan and Starks (1999) note that when "discussing a dialect of a language, social or geographical, the usual approach is to discuss the phonology and lexis of the dialect in comparison to some standard… and to note the differences between the specimen dialect and the standard". For their purposes of comparison they identify Received Pronunciation (RP), as the standard form of English, particularly British English. In addition to comparing NZE to a "standard", Allan and Starks look at other Southern Hemisphere Englishes as well, including Australian English (AusE) and South African English (SAfE) in the comparison. While Allan and Starks do identify several areas of consonant variation (see their 1999 paper for further details), the major focus of their study highlights the NZE vowel system. These researchers describe NZE as being “phonologically… almost identical to that of RP” and notes that with the exception of what they identify as the BATH vowel, NZE contains the same set of oppositions as the RP system, that is NZE has only one less vowel phoneme than RP (see Table 1, below, for a list of these vowels). While Allan and Starks find a close similarity in the number of phonemes in the NZE and RP vowel systems, they do note differences in the phonetic

Table 1. Phonetic realizations of vowels in Received Pronunciation, New Zealand English, Australian English, and South African English. (from Allan & Starks, 1999: 58)

			RP	NZE	AusEng	SAfEng
7.	bath	/ɑ:/	[ɑ:]	[ɐ-:][a̝-:]	[a:]	[ɒ:]
9.	nurse	/ɜ:/	[ɜ:]	[œ̈][ø̈]	[ɨ̝:][œ̝:][ø̝:]	[ø:]
10.	fleece	/i:/	[i̝i]	[i̝i][əi]	[əɪ]	[i:]
11.	face	/ei/	[eɪ]	[æe][ɐə]	[ɐɪ]	[ɐe]
12.	price	/ai/	[aɪ]	[ɑ+e][ɒe]	[ɒɪ̝]	[ɑ.ᵊ]
13.	thought	/ɔ:/	[ɔ:]	[o̝][oə][oɐ]	[o:]	[o:]
14.	goat	/ou/	[əu]	[ɐö][ɐ̝ˠ]	[ɐʉ]	[ʌ.ᵊ]
15.	goose	/u:/	[u̝u]	[ʉ̝][əɨ]	[ʊʉ]	[ʉ:]
16.	palm	/ɑ:/	[ɑ:]	[ɐ-:][a̝-:]	[a:]	[ɒ:]
17.	choice	/ɔi/	[ɔi]	[oe]	[oɪ]	[oe]
18.	mouth	/au/	[ɑʊ]	[ä̝ö][ɛɨ]	[æʊ]	[æᵊ]
19.	near	/iə/	[ɪə]	[i̝ɐ][eɐ]	[i̝:]	[e:]
20.	square	/eə/	[ɛə]	[eɐ][i̝ɐ]	[e̝:]	[e:]
21.	start	/ɑ:/	[ɑ:]	[ɐ-:][a̝-:]	[a:]	[ɒ:]
22.	north	/ɔ:/	[ɔ:]	[o̝][oə][oɐ]	[o:]	[o:]
23.	force	/ɔ:/	[ɔ:]	[o̝][oə][oɐ]	[o:]	[o:]
24.	cure	/ʊə/	[ʊə]	[ʉɐ][oə][oɐ]	[ɔ][uə]	[uə][ɔ:][o:]

realization of these vowels. Focusing on the vowels to be analyzed in this study, we look here at their analysis of the /ɪ/ and /u/ vowels.

2.1.1 Central /ɪ/ as an identifiable feature of NZE

The central pronunciation of the /ɪ/ vowel is one of the most commonly noted features of NZE (see Woods, 1999; Easton & Bauer, 2000; Watson et al., 2000; Trudgill et al., 1998; Bell & Holmes, 1992 for just some of the papers citing this feature). In fact, in personal conversation with New Zealanders with no academic training in linguistics, the most common and usually first feature reported to me when asked to describe their dialect was central /ɪ/, often accompanied by the example "People say we say 'fush and chups' (instead of 'fish and chips')". In addition, Trudgill suggests that this vowel centralization is the sound that "stamps" speakers of NZE (as quoted in Moore, 1990). Although the individual studies cited above report a range of pronunciations varying from fully centralized [ə] to a high centralized [ɨ], all of these studies note some degree of central pronunciation of the /ɪ/ vowel.

With central /ɪ/ clearly marked as a feature distinguishing NZE from other dialects, its location in the central area of the vowel space has garnered much attention. While studies disagree about the exact timeline and motivation of centralization, it is agreed that the more canonical close front pronunciation of the vowel was present in the earliest forms of NZE, and that the vowel has since shifted to the center (Watson et al., 2000; Trudgill et al., 1998; Easton & Bauer 2000). Watson et al. argue that the /ɪ/ vowel moved from the canonical front position to a central position to make room for itself in a crowded front vowel space as the other front vowels were raising. They also believe that now that /ɪ/ is clearly distinguishable from these other front vowels, it has ceased to change in recent decades. This description provides an illustration of a classic push chain, in which one vowel crowds the vowel space of another vowel, thus pushing the others into new positions to maintain their contrast. Trudgill (1986) initially argued that the close front positions of the short front vowels were conservative holdovers from RP, and that RP had since lowered its front vowels. This account would suggest that the /ɪ/ vowel centralized to distinguish itself in the vowel space, but that no other vowels had shifted in that process. Trudgill et al. (1998) later argued a compromising approach, where the short front vowels all began in close positions, then as /ɪ/ became centralized, it pulled the other front vowels up into the spot it left open in the vowel spacing, resulting in even closer pronunciations of the other front vowels than found in the initial forms of NZE. Trudgill et al. suggest that this pattern is continuing and that the vowels are still shifting, but most recent acoustic studies support Watson et al.'s conclusion that the central pronunciation of /ɪ/ has become a stable variant of the NZE dialect, and future studies may illuminate the overall pattern and causation of any shift in NZE (Easton & Bauer, 2000; Woods, 1999, Gordon et al., 2004).

Table 2 illustrates the variation in phonetic realizations of the /ɪ/ vowel and other short vowels in RP, NZE, AusE, and SAfE. As one can see, both NZE and SAfE are shown to exhibit a more central pronunciation of this vowel as compared to the RP pronunciation, while AusE exhibits a more fronted, tense variant of the vowel. The pronunciations of the short front vowels in NZE exhibit a pattern of centralization and raising as compared from the forms of these vowels that were believed to have been in the speech of the earliest settlers from England. As

Table 2. Short vowel realizations in RP, NZE, AusE, and SAfE
(from Allan & Starks, 1999: 73)

		RP	NZE	AusEng	SAfEng
kit	/ɪ/	[ɪ]	[ë]/[ə]	[i̞]	[ə]/[ɪ]
dress	/ɛ/	[ɛ]	[e̝]/[ë̝]/[ɪ]	[e̝]	[e]
trap	/æ/	[æ]	[ɛ̝]/[ɛ̝]	[ɛ̝]	[ɛ]
lot	/ɒ/	[ɒ]	[ɒ̝⁺]	[ɔ]	[ɔ]
strut	/ʌ/	[ɐ]	[ɐ]	[ɐ]	[ɐ]
foot	/ʊ/	[ʊ]	[ö̝]/[ʏ̝̈]	[ʊ]	[u]

noted above, Watson et al. and Trudgill et al. believe that the /ɪ/ vowel has moved towards the center of the vowel space (both down and back from its original position), while the /ɛ/ vowel

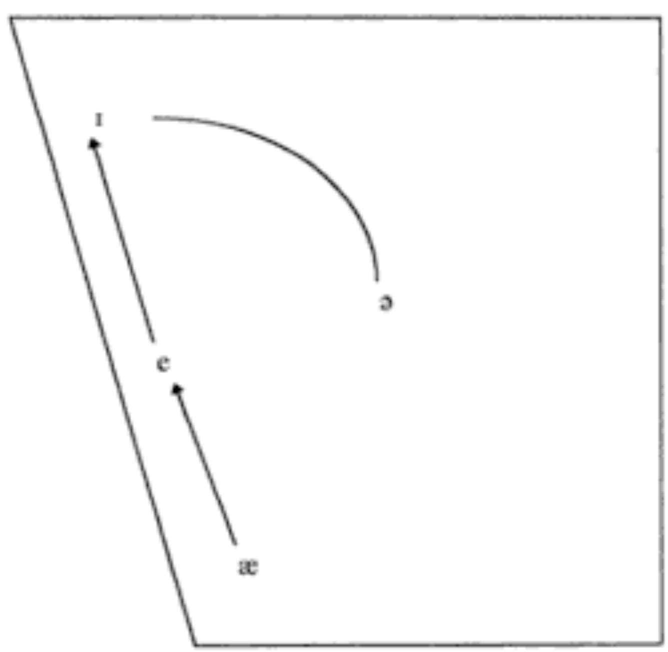


Figure 1. Patterns of front vowel shift in NZE (from Allan & Starks, 1999: 74)

has raised to the position normally occupied by the /ɪ/ vowel, and in turn the /æ/ vowel has raised to the /ɛ/ position (Figure 1, below, illustrates this). Although Watson et al. and Trudgill et al. argue over the exact positioning of the vowels in the speech of the earliest British settlers, both agree that the /ɪ/ vowel has shifted from a close, front pronunciation to a central position in the vowel space in NZE. The evidence of this shift has led to the central variant in NZE being named as "centralized /ɪ/", which refers to the belief that this vowel has "centralized" from its initial position at the front of the vowel space.

2.1.2 /u/ fronting in NZE

While some characteristic features of NZE, such as /ɪ/ centralization and the apparent merging of *ear* and *air* diphthongs (Batterham, 1999; Holmes & Bell, 1992; Gordon & Maclagan, 1990), are commonly studied and talked about, not only in linguistic circles but in common discussion of the dialect, other features are present but are not at the same level of interest and awareness. One such feature is the presence of fronted pronunciation of the /u/ variant in NZE. Many of the vowel studies mentioned above report results illustrating /u/ fronting, but while they dedicate multiple pages of discussion to /ɪ/ centralization, /u/ fronting often receives little more than a paragraph (Allan & Starks, 1999; Easton & Bauer, 2000; Watson et al., 2000; Woods, 1999). In Gordon et al. (2004), there are eleven pages dedicated to variation in /ɪ/ pronunciation, yet barely two pages of discussion of the /u/ vowel. Most current NZE speakers, when asked casually, do not report being aware of /u/ fronting and do not consider it to be a characteristic marker of New Zealand speech.

One possible reason for this lack of interest in and awareness of /u/ fronting in NZE is that it is exhibited in many dialects of English around the world, therefore not making it a distinctive feature of NZE. Allan & Starks (1999) show similar productions in Popular London English, Cockney English, AusE and SAfE (see Table 3, below), and similar patterns have been found in Southern dialects of American English (Fought, 1999). Wells (1982) describes conservative RP as having an /u/ that is fully backed in the vowel space, yet describes modern RP as having a "somewhat centralized" variant of the vowel. This claim suggests that while NZE was likely innovative in fronting the /u/ vowel, as RP at the time of colonization contained the backed version of the /u/, fronting and centralization were changes that took place in many dialects around the world, making it less notable when comparing NZE to other dialects of English.

Table 3. Long vowel and diphthong realizations in several varieties of English (from Allan & Starks, 1999: 72)

Vowel	RP	Popular London	Cockney	NZE	AusE	SAfE
fleece	[iː]	[i̞i]	[əi]	[j̞i][əi]	[əɪ]	[iː]
face	[eɪ]	[ʌɪ]	[aɪ]	[æe][ɐə]	[ɐɪ]	[ɐe]
price	[aɪ]	[ɑɪ]	[ɒɪ]	[ɑ+e][ɒe]	[ɒ̞ɪ]	[ɑ.ᵊ]
choice	[ɔɪ]	[ɔ̞ɪ]	[oɪ]	[oe]	[oɪ]	[oe]
goat	[əʊ]	[ʌʊ]	[a-ʊ]	[ɐö][ɐ̞ˠ]	[ɐʉ]	[ʌ.ᵊ]
mouth	[ɑʊ]	[æʊ]	[æː]	[ä̞ö][ɛɨ]	[æʊ]	[æᵊ]
goose	[uː]	[ʊʉ]	[əʉ ~ ʉː]	[ʉ̞][əi]	[ʊʉ]	[ʉː]

While not as much attention has been paid to the /u/ vowel as other targets of interest in NZE, there does seem to be consensus that the vowel is most consistently produced as a centralized close rounded vowel, represented as [ʉ] (Allan & Starks, 1999; Easton & Bauer, 2000; Watson et al., 2000; Woods, 1999; Gordon et al., 2004).

2.2 Maori Vernacular English

While much work has been done to describe the ways that NZE is differentiated from other varieties of English, it has proved more difficult to pin down variation within the New Zealand dialect. Bell describes the search for a Maori dialect of English as follows:

> Among the most intriguing and elusive issues in the study of New Zealand English is that of the nature – and even the existence – of Maori English. New Zealanders have always tended to feel there is a distinctive Maori variety of English. Pakeha New Zealanders claim they can tell Maori people from the way they talk. Some Maori also remark that their English is commented on by other New Zealanders as recognizably spoken by a Maori rather than a Pakeha…
>
> However New Zealand linguists have found Maori English elusive. They have been looking for it since at least the 1960s. By 1990 they had almost given up on specifying any clear conclusive differences between Maori and Pakeha English.
>
> (1999: 221)

Bell's description covers the early era of the search for the particular features that would distinguish a uniquely Maori variety of English from the Pakeha dialect. While these early studies searched for morphosyntactic and pragmatic differences in Maori English speech, they failed to find exceptional features that could set a Maori English variety apart (as cited in Bell, 1999: Barham, 1965; Benton, 1966; McCallum, 1978). Then, in the 1990s, researchers discovered that it was not a qualitative difference separating Maori and Pakeha English – it was a quantitative one (Bell, 1999). Maori speakers were not using unique phonetic, morphosyntactic, or pragmatic features, but they were using features of NZE at different rates than Pakeha speakers.

This discovery led to an influx of information on the Maori dialect (henceforth referred to as ‘Maori Vernacular English’ or ‘MVE’). Pragmatic differences were identified in MVE, such as much higher rates of the use of the particle ‘eh’ at the end of statements to form a question, similar to the process highlighted frequently in Canadian English (MVE studies: Holmes, Bell & Boyce, 1991; Meyerhoff, 1994; Stubbe & Holmes, 1999; Canadian study: Gibson, 1976). Morphosyntactic features of MVE also appeared, one example being higher rates of ‘have’ dropping, especially in phrases like ‘have gotta’ or ‘had better’ (Jacob, 1991). Finally, phonetic variation within NZE was illuminated, with studies showing variation in both consonant (Holmes 1995; Robertson, 1994, 1996) and vowel production (Bell, 1997, 1999).

2.2.1 Non-central /ɪ/ in Maori Vernacular English

Of particular interest to this study are Bell’s findings on variation in vowel production in Maori and Pakeha speech. As noted above, /ɪ/ centralization is one of the most distinctive features of NZE, therefore variation in production of this vowel became quickly apparent to Bell in his 1997 study. While he did find that most New Zealanders in a corpus from Porirua produced at least 60% of their tokens as [ə] and most other tokens as [ɨ], some speakers stood out as producing an average of 40% of their tokens as front pronunciations of either [i] or [ɪ]. All of these speakers with a high average of front close tokens were older Maori people, and all were still fluent in Maori. Older Maori participants who were not fluent in the Maori language produced only 10%

of their tokens as close front realizations of the vowel, a rate close to that of younger Maori people (also not fluent in Maori) and Pakeha speakers. These findings prompted Bell to posit that it was interference from the Maori language producing the high rate of front pronunciations for the Older Maori people that were fluent in Maori. This hypothesis carries with it the assumption that the vowel is being decentralized by the Maori speakers; that is, the vowel had been centralized in general NZE speech, including the Maori population of speakers, and was now being moved back to the front of the vowel space through interference from Maori.

In a follow-up study in 1999, Bell looked at differences in production between a Pakeha man who was a monolingual English speaker and a Maori man who spoke English natively and had become a fluent L2 speaker of Maori. Bell found here that the Maori man produced close front tokens of the /ɪ/ variant at double the rate of the Pakeha man, although both rates were much lower than the Older Maori speakers in the first study (14 per cent - 7 per cent in the 1999 study as compared to 40 per cent - 10 per cent in the 1997 study). Bell notes that while this rate of 14 per cent is much lower than the rates of the older Maori speakers, it is still significantly higher than the young Maori speakers in the 1997 study (8 per cent), and may mark a "revival of the ethnically marked feature", with this Maori man "maintaining and enhancing a pronunciation which most of his peers… have all but lost" (1999: 242). Whether or not this revival should be attributed to Maori language interference or another source is left unclear by the author.

2.2.2. /u/ fronting in Maori Vernacular English

While /u/ fronting has not received much attention as a variant in discussions of NZE, it did catch Bell's attention in studies of MVE. In his 1999 study, Bell found that both participants were likely to produce the /u/ variant in a close centralized position – [ʉ] – but the Maori participant had a pronunciation that was even farther forward, producing 38 per cent of his tokens with a close front rounded realization – [y]. In comparison the Pakeha participant produced only 17 per cent of his tokens in the close front position, less than half as many as the Maori man.

In a study of seventy-five speakers evenly divided by gender, age, and ethnicity, and including a class distinction, Easton and Bauer (2000) found that Maori speakers were more likely to produce a higher F2 than Pakeha speakers, i.e. a more front realization of the vowel, supporting the findings for Bell's two speakers (1999). They also suggest that differences in the age and class of the participants suggest a shift over time to a more front production of the vowel, a trend that they believe is still in progress (see Easton & Bauer, 2000: 111 for full discussion).

Bell's (1999) analysis of these results attempts to provide an explanation for more extreme /u/ fronting in Maori speech. Bell notes that while /ɪ/ centralization can likely be attributed to, or at least correlated with, fluency in the Maori language, pronunciation of the corresponding /u/ vowel in Maori is at the back of the vowel space (Bauer 1993), and therefore /u/ fronting cannot be described as assimilating to a Maori pronunciation. Bell posits that /u/ fronting "lacks an obvious antecedent", but does note that a form of hypercorrection may be in play, and that in attuning to the fronted variant in NZE, speakers of Maori ethnicity may have 'overshot' the realization that they were hearing and begun producing the variant even farther forward in the vowel space.

It is unclear from the current studies whether or not this fronting is correlated with Maori language fluency. Bell's study provides data for only one Maori participant, who is an L2 speaker of Maori, but distances himself from an explanation based on correlation with Maori language fluency. Bauer (1993) notes that younger, L2 speakers of Maori have begun fronting the /u/ vowel in their Maori speech, suggesting here that their English pronunciation is being transferred into their Maori pronunciation and not the other way around. Easton and Bauer's (2000) results do not help us reach a conclusion on this issue, as their report does not include information on the language background of their participants, and based on trends of decreased numbers of Maori language speakers, it should not be assumed that their Maori participants are speakers of the language.

2.3 The role of transfer in language production

Most research on language transfer today is conducted with the goal of investigating the effects of a speaker's native language, L1, on their production and perception of a second language, L2. It is commonly accepted among researchers today that knowledge of an L1 can lead to interference or transfer of features from that language into an L2 learned later in life (Odlin, 1989; Major 2008), although the effects of transfer for simultaneous bilinguals is less clear. The features that can be the focus of language transfer range from morphosyntactic to phonological to pragmatic, and can vary in degree from affecting pronunciation of certain like sounds to incorporating grammatical patterns from the L1 into the L2.

Early on, language transfer was believed to work like a filter, where the L2 was acquired through a perception that was filtered by linguistic knowledge inherent in the L1 (Trubetzkoy, 1939). This process was later termed language "interference", painting the L1 as something that was interfering with the acquistion of an L2 (Weinreich, 1953). Contrastive Analysis (CA) theories cropped up in the 1950s and 60s, with the claims that language transfer could explain, and therefore predict, all errors in L2 acquisition (Stockwell & Bowen, 1965). While there are both strong and weak versions of this theory, its powers of prediction were called into question, as many errors could be accounted for by language transfer, but the theories made too many predictions that were not found to occur and could not explain why certain features were interfered with while others were not (see Major, 2008 for further discussion). Although most versions of the CA theory were rejected, the idea of language transfer continued on. Today many competing theories exist on what features can be affected by transfer, what conditions must exist for transfer to take place, and to what extent L2 acquisition is dependent on L1 (again see Major, 2008 for details on these theories). The discussion here will turn to studies that address the role of language transfer on phonetic production and phonological patterns.

One area of language transfer that people tend to be aware of, even outside of the academic world, is the existence of interference in pronunciation of a second language. Speakers are generally aware of accents that sound "foreign", i.e. show signs of transfer from a different L1 language. There is a debate in the world of language research on how deep this transfer goes: is it simply on the surface, in a speaker's production, or is there a deeper transfer of a phonological system? Major presents this debate as follows:

> It seems that phoneticians and phonologists forever have been at odds with each other over what is a legitimate level of investigation. Phoneticians generally favor more surface phenomena, while phonologists generally favor more abstract phenomena. These differences in points of views have carried over into research in (second language acquisition). What is transferred? Is it surface phenomena or abstract features and principles? Is stylistic variation in the L1 part of abstract competence or is it merely a matter of performance? Is L1 variation transferred to the L2?
> (2008: 68-9)

Major suggests that this debate is unlikely to be solved any time soon, with both sides providing evidence that they believe supports their argument. While the current study does not aim to settle this debate, analysis will be done primarily on a surface level of investigation, on the phonetic productions of the speakers. Phonemic implications for the vowel systems will be discussed, but the impact of the findings on more abstract phenomena will be left to the reader's interpretation.

As discussed thus far, most studies of language transfer focus on the impact of L1 features on L2 acquisition, but what about transfer in bilinguals who learned both languages from a very young age, as we find in this study? While there are relatively few studies on this question, research has shown that the effects of interference do not appear to be as strong in simultaneous bilinguals as in those who acquire an L2 later in life, although some effects can still be present in early acquisition (Bosch & Sebastian-Galles, 2003; Burns, Werker, & McVie, 2003; Sundara, Polka, & Baum, 2006; Sundara & Polka, 2008). The first three of these studies found a U-shaped curve in children's ability to distinguish phonetic contrasts. In studies on vowel distinction (Bosch & Sebastian-Galles, 2003) and voice onset time (Burns, Werker, & McVie, 2003; Sundara, Polka, & Baum, 2006), researchers found that at roughly 6-8 months old, children being raised in monolingual and bilingual environments showed little to no language-specific distinction in perception of contrasts. In later stages of acquisition (starting as early as 10 months and lasting as late as 4 years of age), these studies showed that bilingual children showed interference in discriminating contrasts that were only present in one of their input languages or were different between the two languages. They performed consistently worse on discrimination tasks than monolingual children of the same age. All of these studies found mixed results for bilingual children in later stages of acquisition (12-48 months), with some of the bilingual children performing as well as monolingual children, while others performed at much lower rates. These studies noted that bilingual adults with normal language ability reported no problems with the contrasts that were tested, although this evidence is self-reported and not tested in a controlled study.

According to Sundara & Polka (2008), theirs is the only study to look at the effects of language transfer on perception in adults learning two languages simultaneously from birth. In a study of perceptual contrasts, the L2 learners in their study exhibited signs of interference as expected, while the simultaneous bilinguals performed as well as, if not better than, the monolingual speakers containing the target contrast. These studies suggest that there are differentiated representations for each language in the linguistic representation for simultaneous bilingual speakers. While these studies address perception and not production, as this study will consider, the separation of the representation of each languages phonemic contrasts for bilingual speakers suggests that speakers will have been able to form these inventories from their input without interference from the other language by the time they have reached full linguistic competence. Contrary to Bell's hypotheses on transfer of /ɪ/ decentralization from Maori to English, these studies suggest that we should not expect to find interference between languages learned simultaneously by a bilingual speaker.

2.3.1 Maori and English vowel systems

In order to understand any potential transfer from Maori to English, it is importantly to note the differences and similarities in the Maori and English vowel systems. Maori contains five short vowels, /i/, /e/, /a/, /o/, and /u/, and their long counterparts. There is some debate on whether the long vowels are part of the phonemic inventory or are a concatenation of two like short vowels (Bauer, 1993), although that debate should not bear on this study. NZE contains six lax vowels (see Table 2 in section 2.1.1 for a list of these vowels) and 7 tense vowels, which includes ‘long’ vowels and diphthongs (listed in Table 3, section 2.1.2). Tense vowels in English are often more peripheral than lax vowels, that is closer to the edges of the vowel space; long vowels in Maori are also usually considered to have a slightly more peripheral pronunciation than their short counterparts. In Maori, a differentiation in vowel length is not seen as corresponding to a tense/lax distinction, while in English tense vowels are generally produced with a longer duration than lax vowels in addition to a difference in vowel quality. The /i/ vowel in Maori would likely be the closest counterpart of the /ɪ/ vowel in English, while the /u/ or /u:/ vowel in Maori would be comparable to the /u/ vowel in English.

As noted above, Bell suggests a type of atomic transfer from Maori features to the English language: that is, he suggests that fluency in Maori has an effect on the pronunciation of the /ɪ/ vowel in English, specifically in decentralized realizations of the vowel which become more like the pronunciation of the Maori counterpart /i/. This interference is atomic in that it affects only the pronunciation of one particular vowel. While the varied pronunciation of this vowel may lead to later shifts in the pronunciation of other English vowels, only pronunciation of the /ɪ/ vowel can be directly linked to assimilation to the corresponding Maori vowel. If the interference were systematic, that is if the entire Maori vowel space had an effect on the corresponding vowels in English, we would expect to find the /u/ vowel assimilating to the Maori pronunciation as well, resulting in a backed production of the vowel. Instead, earlier studies have found an extremely front pronunciation of the English /u/ by ethnically Maori participants, and so far no concrete correlation with Maori language fluency has been established. Rather we see that the fronted English production may be correlated with a change in L2 pronunciation of the Maori /u/, again suggesting evidence for atomic, not systemic, language transfer.

2.4 Research questions

The previous research on both NZE and language transfer speak directly to the research questions being asked in this paper. The first research question of this study, pertaining to the variation of the /ɪ/ vowel, asks whether or not a close, front pronunciation of the vowel can be correlated with Maori language fluency, and not just Maori ethnicity. As a corollary to this question, this paper also questions the possibility that this variation could be a result of bilingual language transfer, specifically transfer from one element of Maori, the /i/ vowel, to one element of the English vowel space, the /ɪ/ vowel. If correlation with Maori language fluency is found, it will suggest that the close, front variant of the /ɪ/ vowel is not a feature of MVE itself, but a result of bilingualism in Maori and English.

Another question that has arisen from the previous research, which acts as the second research question of this study, is whether or not an extremely front pronunciation of the /u/ vowel can be correlated with Maori ethnicity, and not with Maori/English bilingualism. This question again seeks to provide insight on the possibility that language transfer can occur atomically, i.e. that only the /ɪ/ vowel will be affected by transfer, not the /u/ vowel. This second question also seeks to establish the front variant of the /u/ vowel as a possible characteristic of MVE, as proposed by Bell.

3.0 Research Questions and Methodology

This study aims to investigate the correlation of close, front /ɪ/ and front /u/ in MVE with language ability and the social identity factors of gender and ethnicity. Specifically, the study will test Bell's hypotheses that /ɪ/ decentralization is correlated with fluency in the Maori language, while extreme /u/ fronting is correlated with membership in the Maori ethnic group. Findings on the presence or absence of these correlations will be discussed in regards to implications for sociolinguistic and language transfer theory. In addition to these goals, this study will also add to the currently small body of work describing patterns of variation in the Auckland region[2].

3.1 Research methodology

This research was conducted using speech collected from nineteen interviews of residents of the Auckland region of New Zealand (see Appendix A for a map of the region). These interviews were initially collected for the purpose of an oral history project investigating various aspects of life in the Auckland area, and were used for this study with permission of the Auckland City Library. The interviews were used to gather information on aspects of social identity and language background of the participants, as well as speech samples for vowel analysis.

[2] Due to the availability of extensive corpora in Wellington, Christchurch, and Poirirua, much of the research on MVE documents the dialects from these areas, leaving the Auckland dialect largely understudied.

Tokens of all English monophthongal vowels were gleaned from the speech samples, with particular interest in the /ɪ/ and /u/ vowels. All vowels were measured in Praat and plotted using the Plotnik software, to determine the vowel space of each speaker and the relative location of the target vowels within the vowel space. Vowel measurements were normalized and analyzed for correlation with social identity and language factors using linear mixed effects regression models.

The following sections include a more detailed description of the research design and methodology, while section 3.2 reviews the hypotheses predicted for the results of the research.

3.1.1 Participants and interview format

As noted above, the data for this study comes from interviews collected in an oral history project in Auckland, New Zealand for the Auckland City Library in 1990. Participants were recruited through neighborhood canvassing and recruitment through neighborhood networks (i.e. asking participants to provide information on other potential participants in the neighborhood). The information collected on each participant includes interviews from one to three hours in length, as well as an interviewee information form. All interviews were conducted by one of two female researchers from the Auckland area. The interviews include general questions about the participants' life in Auckland and their experiences there and were originally collected to provide the library with oral documentation on the history of the Auckland region. The information forms specifically address questions of the participants' date and place of birth, familial history, marital history, employment history, and educational history. The forms were either filled out by the participants themselves or by the interviewer upon directly asking the participants to respond to the questions on the information form. Most of the participants in the oral history project were born before 1940, although several of the speakers were born as late as 1970.

Twenty-nine interviews were chosen in a preliminary selection from the larger collection, with only interviewees who were born and raised in Auckland or the surrounding area being selected. Of these twenty-nine interviews, nineteen were chosen for inclusion in this study, in an effort to have equal representation from the Pakeha and Maori ethnicities, as well as balance for gender. All interviewees chosen for this study were born between 1915-1937, in an effort to ensure that age is not a factor of variation in this study. Of the nineteen interviewees selected, ten are of Pakeha ethnicity and nine Maori. Inclusion in the Maori ethnic group is based on self-reporting of Maori ancestry and/or belonging to a Maori *iwi*, or 'tribe'. Pakeha ethnicity was determined by self-reported English, Irish, or Scottish ancestry[3]. All Pakeha participants were at least second generation New Zealanders. Participants were also selected to represent gender as equally as possible (based on availability): five Pakeha men, five Pakeha women, five Maori men, and four Maori women.

Of the Maori participants selected, three of the men and two of the women are simultaneous bilinguals in Maori and English. The other four Maori participants are English monolingual. All Pakeha participants are English monolingual. Language ability was assessed based on self-reporting by the participants when asked about their language background during the interviews. While Maori language ability was not tested, all of the bilingual participants reported learning Maori in the home as children and say that while they use it less frequently in the home at the time of the interviews, they do still use the language with other Maori speakers,

[3] This determination of Pakeha ethnicity was not based on an effort to exclude immigrants from other European regions, but was merely a result of the sample. Of the twenty-nine interviews chosen, twenty of those participants were not Maori; of those twenty, one was a first-generation Greek immigrant who was excluded because English was not his native language. All other Pakeha participants were English, Irish, or Scottish.

primarily at the *marae* (Maori meeting houses). One of the five Maori speakers ultimately had to be left out of the final analysis due to background noise in the interview causing unreliable measurements of the vowels, resulting in an equal number (4) of bilingual and English monolingual Maori participants in the analysis (see Appendix C for demographic information on the speakers used in the final analysis).

3.1.2 Vowel analysis

To test the correlation of vowel production and identity factors, eight to fifteen tokens each of the /ɪ/ and /u/ vowels were collected, based on availability in the interview. These target vowels were chosen as subjects of investigation due to their previous identification as variables of significant variation differentiating the MVE dialect from the Pakeha dialect (Bell, 1997, 1999). In addition, five tokens each of the other English monophthongal vowels (/i/, /ɛ/, /æ/, /ɒ/, /ʊ/, and /ə/) were collected in order to construct a vowel space for each speaker for comparison of the relative location of the target vowels within the vowel space. Tokens were primarily taken from obstruent-vowel-obstruent positions, although some sonorant-vowel-obstruent positions were used to ensure a minimum number of tokens was reached. Post-sonorant vowels were only collected as tokens where there was no strong visible effect on the formant structure based on coarticulation with the preceding sonorant. (Appendix D provides summary information about the phonetic environments of the tokens used in this study, as well as a complete list of environments, organized by vowel.)

After the vowel tokens were collected, a Praat script was run to extract measurements of the first and second vowel formant (F1 and F2, respectively) at several different points in the vowel, including midpoint, first third, and last third, as well as the mean value for the vowel. Due to some expected measurement errors resulting from using an automatic script, outliers and randomly selected vowels were checked (and corrected if necessary) using manual measurements in Praat at the midpoint, first third, and last third of the vowel.

Because this study is not looking to test the effects of coarticulation with surrounding segments, the vowel midpoint was selected as the ideal measurement for analysis. However, in order to be sure that vowel variation was not being significantly affected by phonetic environment, measurements at the first and last third of the vowel were tested against the midpoint and mean values using a repeated-measures ANOVA in the R statistical package. Results from the ANOVA showed that the method of measurement (method = midpoint, first third, last third, and mean) was not a significant factor of variation, and therefore it will be assumed it is not necessary to account for coarticulation with the preceding and following segment in further analysis. Midpoint measurements (including the manual corrections) were then used for analysis of correlation with social and language ability factors.

After selecting the midpoint measurements for further analysis, these measurements were normalized using the Labov ANAE method[4] to remove differences between speakers resulting from variation in the fundamental frequencies of their speech. The group log-mean (g-value = 6.81181) was extracted from Plotnik, and normalization was done in R using this value.

[4] Several methods of normalization were investigated on the NORM website (Thomas & Kendall, 2007-2009). Ultimately, Labov's method was chosen due to its production of outputs that could still be plotted using the Plotnik software. The Labov ANAE method is a modification of the Neary method, using a log-mean method of normalization based on a group log-mean as opposed to individual speaker means. Because this method of normalization is speaker-extrinsic, it allows for a scaling of the original Hertz values, while other methods give non-Hertz-like values, which are not able to be plotted using Plotnik.

3.1.3 Statistical models : midpoint values

In order to investigate the correlations, the data was modeled using both the normalized midpoint values and rates of non-centralized /ɪ/ and front /u/. The midpoint values were analyzed using a linear mixed effects regression (lmer), with the F1 and F2 values for each of the target vowels acting as the dependent variables, resulting in four independent models: F1 of /ɪ/, F2 of /ɪ/, F1 of /u/, and F2 of /u/. The sex, ethnicity, and language ability of the participants acted as binary independent variables in these models. The models controlled for the random effects of speaker and word from which the token was extracted. In models in which language ability was determined to be a significant factor within the Maori participants, a collapsed category for ethnicity and language ability was introduced to allow bilingual and monolingual Maoris to be compared to Pakeha participants, which only have one level for language ability (monolingual). This category contained three levels of distinction: bilingual of Maori ethnicity, English monolingual Maori, and English monolingual Pakeha. These models were used to determine which of the independent variables were significantly correlated with mean production differences in vowel quality for this group of speakers.

3.1.4 Statistical models : rates of non-central /ɪ/ and front /u/

As noted in section 2.2 above, it is often the rates of certain features, not their mere existence, which differentiates MVE from Pakeha English. To ensure that these rates were not being missed by analyzing only the production F1 and F2 values, the rates of non-central /ɪ/ and front /u/ were also analyzed. These rates were determined by constructing plots of the speakers' vowel space in

Plotnik (based on the normalized midpoint values) and identifying the center of the vowel space. In addition, the positioning of each vowel token was determined in regards to its location in the vowel space relative to the [i], [ej] and [a] vowels, as per methodology used in Fought (1999). As Fought notes, using ratios, as opposed to raw Hz measurements, allows for cross-speaker comparisons by accounting for the size of each individual speakers vowel space. For the vowel /ɪ/, tokens were determined to be either 'front', and assigned an application value of 1, or 'central', and assigned a non-application value of 0. 'Front' tokens were those in the more canonical [ɪ] or [i] position in the vowel space, determined by positioning in the front 1/3 of the vowel space. 'Central' tokens (both [ɨ] and [ə]) were those falling in the middle third of the vowel space. Fronting of /u/ was determined on an application versus non-application basis as well: tokens in the back 1/3 of the vowel space, [u], and tokens in the central 1/3, [ʉ], were considered not to be extremely fronted and assigned a value of 0, while tokens in the front 1/3 of the vowel space, [y], were considered to be fronted and assigned a value of 1. See Appendix E for spectrograms illustrating representative tokens of each category of the two target vowels.

After assigning these values, rates of non-central /ɪ/ and front /u/ were correlated with sex, ethnicity and language ability in generalized linear models. An ANOVA using the Chi square test was used to analyze these models. Again, a combined ethnic/ language ability category was used when language ability was found to be a factor in order to compare the two groups of Maori participants to the Pakeha participants.

3.2 Hypotheses

Based on the findings and suggestions of previous MVE vowel studies (Bell 1997, 1999), it is predicted that use of the close, front variant of /ɪ/ will be correlated with Maori language ability and not simply Maori ethnicity. If Bell's suggestions were correct, in that the Maori language is having a transfer effect on the English /ɪ/ vowel, we should find that higher rates of non-central /ɪ/ occur with Maori/English bilingual Maori participants than with English monolingual Maori participants (who should have rates closer to those of the Pakeha participants). For the /u/ variable, it is predicted that a correlation of the use of an extremely front pronunciation with Maori ethnicity will be found to be significant, and that correlation with Maori language ability will not be a differentiating factor within the Maori group.

4.0 Results and Discussion

4.1 Non-central /ɪ/: Results and discussion

It was predicted that non-central /ɪ/ will be correlated with Maori language ability; therefore, in the linear mixed effects models using the F1 and F2 values for analysis, we expect lower F1 values and higher F2 values for participants with a Maori language background. In the generalized linear model looking at rates of non-central /ɪ/ production, we expect higher rates of the application value for speakers of Maori than monolingual English speakers. The hypotheses were not found to be fully accurate, but did find some support. Looking at the formant measurements of the vowels, F1 values for were found to be significantly lower within the group of Maori participants based on language ability, resulting in a less central vowel production in the speech of these participants. F2 values showed no significant variation based on correlation with the factors in this study. Looking at rates of non-central production, significant variation was again found only within the group of Maori participants, where sex and language ability provided a significant interaction. These results are reported and discussed in more detail below.

4.1.1 Variation in F1 and F2 values for /ɪ/

Results. In the linear mixed effects model containing all participants, neither F1 nor F2 values were found to vary significantly for the factors of sex, ethnicity, or language ability[5]. A report of these results can be seen in Tables 4 and 5 below. Table 4 shows the results of a linear mixed effects regression for the midpoint F1 of /ɪ/ vowel tokens. No factors were found to correlate with significant variance of F1 production, as indicated by t-values with an absolute value lower than 2. Table 5 presents similar results for the midpoint F2 values of /ɪ/. Again, all factors have a t-value with an absolute value less than 2, showing that none of the identity factors are significant in explaining any variance in the F2 values with the group of all speakers.

Table 4. Results from linear mixed effects regression for F1 values of /ɪ/ revealing no significant factors within group of all speakers

	Estimate	Std. Error	t value
(Intercept)	483.718	10.507	46.04
Maori – yes	-16.337	17.196	-0.95
Sex – M	-4.168	12.396	-0.34
Speaks Maori – yes	-27.735	18.962	-1.46

[5] As noted in Baayen (2008), with models that have an n >100, the absolute value of the t-value needs to be 2 or higher to show significance. Therefore, the p-values will only be provided for factors with a t-value close to or greater than 2.

Table 5. Results from linear mixed effects regression for F2 values of /ɪ/ revealing no significant factors within group of all speakers

	Estimate	Std. Error	t value
(Intercept)	1924.98	29.78	64.65
Maori – yes	-48.60	33.54	-1.45
Sex – M	-25.83	24.15	-1.07
Speaks Maori - yes	-24.17	36.98	-0.65

Because the language background is only applicable within the group of speakers of Maori ethnicity (recall that all Pakeha speakers are English monolinguals), language ability was tested for significance within a Maori only population. Here, language ability was found to be a significant factor for F1 only. Table 6 provides these results.

Table 6. Results from linear mixed effects regression for F1 values of /ɪ/ revealing Maori language ability as significant within the group of Maori speakers

	Estimate	Std. Error	t value	p value
(Intercept)	452.0743	5.6935	79.42	
Sex – M	5.9576	4.6492	1.28	
Speaks Maori - y	12.6228	4.5370	2.78	0.00636**
Sex(M):Speaks(y)	0.4536	4.6694	0.10	

In Table 6, the category of language background (Speaks Maori) is revealed to be a significant factor in explaining the variance in F1 production (or vowel height) of the /ɪ/ vowel. These results confirm the hypothesis that Maori language ability is a significant factor in /ɪ/ production within the Maori population of participants. Bilingual Maori participants, monolingual Maori participants, and Pakeha participants were compared directly in a third mixed effects regression and this factor grouping was found not to be significant for the set of all participants.

Discussion. From the results above, one can see that Maori language background does result in a significant difference in height for /ɪ/ vowel production within the group of ethnically Maori speakers. Figure 2 below shows the mean difference and variation in F1 for monolingual and

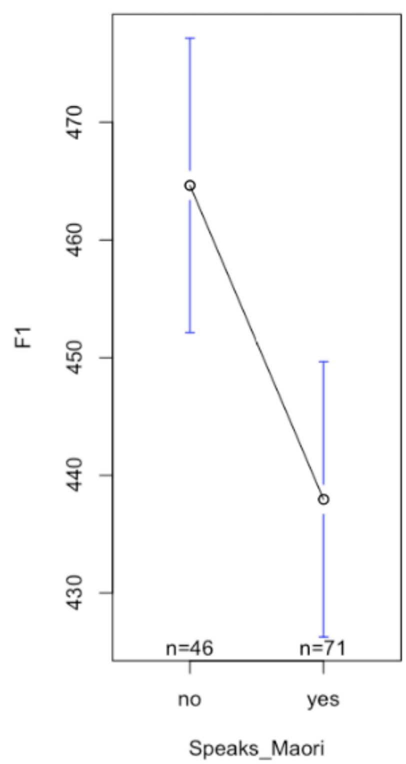


Figure 2. Mean difference and variation for F1 values (in Hz), comparing ethnically Maori participants that are English monolingual to English-Maori bilingual Maori participants

bilingual Maori participants, respectively. This figure shows the mean F1 production values for each group (as indicated by a circle at the midpoint of the blue bars) as well as the range of variance for each group (the blue bars themselves). The results clearly indicate that monolingual Maori participants demonstrate consistently higher F1 values. In fact no overlap in variance can be seen with the bilingual group of Maori speakers. As noted above, higher F1 translates into a vowel that is respectively lower, or more central, in the vowel space. As predicted, the bilingual participants have an /ɪ/ vowel that is higher in the vowel space, or less central. While variation in F2, the front-back component of the vowel, could not be predicted by social or language factors of the speakers, the relative height of the vowel was higher for bilingual Maori participants, with these participants exhibiting a more canonical [ɪ] or [ɨ] pronunciation.

Figures 3 and 4 below give a comparison of /ɪ/ production for a bilingual Maori participant and a monolingual Maori participant, respectively. These figures, made in the Plotnik program, use a light green circle labeled with the letter 'i' to represent the /ɪ/ vowel. As can be seen, the bilingual participant (Figure 3) has a concentration of vowels in the 400-500Hz range, with only a few lower tokens. The monolingual participant (Figure 4) produces most /ɪ/ vowels near 500Hz, with many tokens lower than this, but only a few tokens higher, and none at or above 400Hz. It is also interesting to note that the mean production of the /ɪ/ vowel for the bilingual participant is higher in the vowel space than for the /i/ vowel. English /i/ is usually higher in the vowel space than /ɪ/, as in the monolingual speakers vowel space. If Bell is correct in hypothesizing that it is transfer from the Maori language that is causing the correlation between Maori language ability and decentralized /ɪ/, it is interesting that this did not also transfer to the English /i/ vowel. While these results support the hypothesis of atomic transfer,

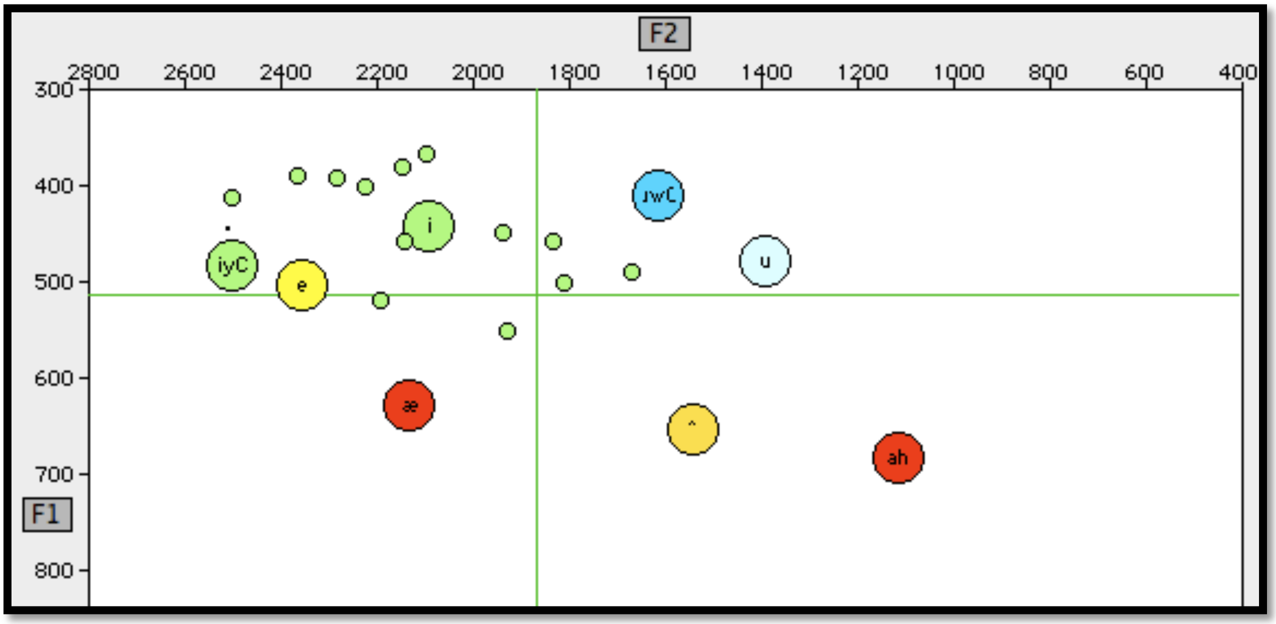


Figure 3. Mean vowel productions for an ethnically Maori participant who is bilingual in Maori and English. Smaller dots represent tokens of /ɪ/.

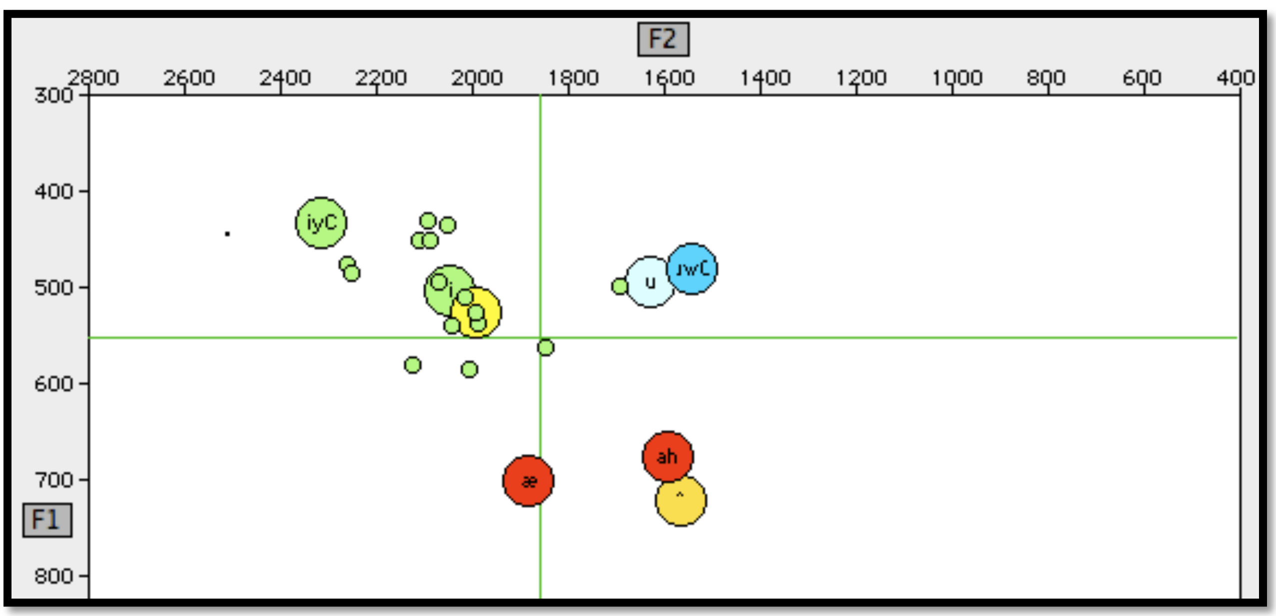


Figure 4. Mean vowel productions for an ethnically Maori participant who is monolingual in English. Smaller dots represent tokens of /ɪ/.

that is, interference on an element by element basis, the question remains as to why the /ɪ/ vowel would be a product of transfer and not another high front vowel. One possible explanation for this is that speakers are more attuned to the non-canonical pronunciation of the /ɪ/ vowel, due to its highly popular status as a feature of NZE. Maori language interference may spread to this vowel more readily than the /i/ vowel as speakers are noticing a 'strange' production of the /ɪ/ vowel and correcting it or even hypercorrecting with a transfer from their pronunciation in the Maori language. The need for association between Maori and English may not be as necessary for the /i/ vowel, which shows less variation and certainly does not garner the same awareness that /ɪ/ variation garners. Because /i/ was not a target vowel for this study, there is not enough data to investigate this hypothesis, but future research could provide insight here. Further discussion will be taken up in section 4.3 below, after looking at the rest of the results of the study.

4.1.2 Variation in 'front' versus 'central' /ɪ/ rates

Results. Rates of front, or non-central, /ɪ/ were tested in a binomial generalized linear model to see if the significant factors would change or remain the same when comparing the rates to the production values. When all participants were considered, none of the factors (sex, ethnicity, and language ability) emerged as significant in predicting rates of front /ɪ/. This result mirrors the results for all participants in the models using F1 and F2 reported above in Figures 1 and 2. Factors were regrouped to test the three-level ethnicity and language grouping. In this model, the group of monolingual Maori participants was found to be significantly different from bilingual Maori participants, but the Pakeha group did not prove to be significant. Also the interaction of sex and the ethnicity/language group was found to be significant, but only comparing the monolingual Maori group to the bilingual group.

Because the findings in the previous model accounted only for the differences between the monolingual and bilingual Maori groups, a model looking within the group of participants of Maori ethnicity only was considered. In this model, both remaining factors, sex and language ability, emerged as significant. An interaction between these two factors proved significant as well, as can be seen in Table 7 below. The p-values in this table show that sex, language ability, and an interaction of these two factors are all explanatory factors correlated with the variance in the rate of front /ɪ/ production.

Table 7. Results from a binomial generalized linear model for rates of front /ɪ/ for Maori participants.

	Estimate	Std. Error	z value	p value
(Intercept)	-1.8718	0.7596	-2.464	
Sex – M	2.2513	0.8405	2.678	0.00740**
Speaks Maori – y	1.7287	0.8488	2.037	0.04169*
Sex(M):Speaks(y)	-2.6190	0.9781	-2.678	0.00742**

Discussion. As found in section 4.1.2 above, Maori language ability again proved to be a significant factor within the group of ethnically Maori participants. Figure 5 below illustrates rates of front /ɪ/ by sex and language ability. In the right hand portion of the figure, under the ‘y’ heading for Speaks_Maori, it can be seen by the roughly equivalent size of the boxes that bilingual Maori participants have roughly even numbers of central and front tokens, with females producing slightly more front tokens than males. Sex becomes a noticeable factor in the group of monolingual participants however (on the left side of the graph), with monolingual females producing very few front tokens, as noted by the much smaller count box in the application (1) column, while monolingual males produce the highest percentage of front tokens.

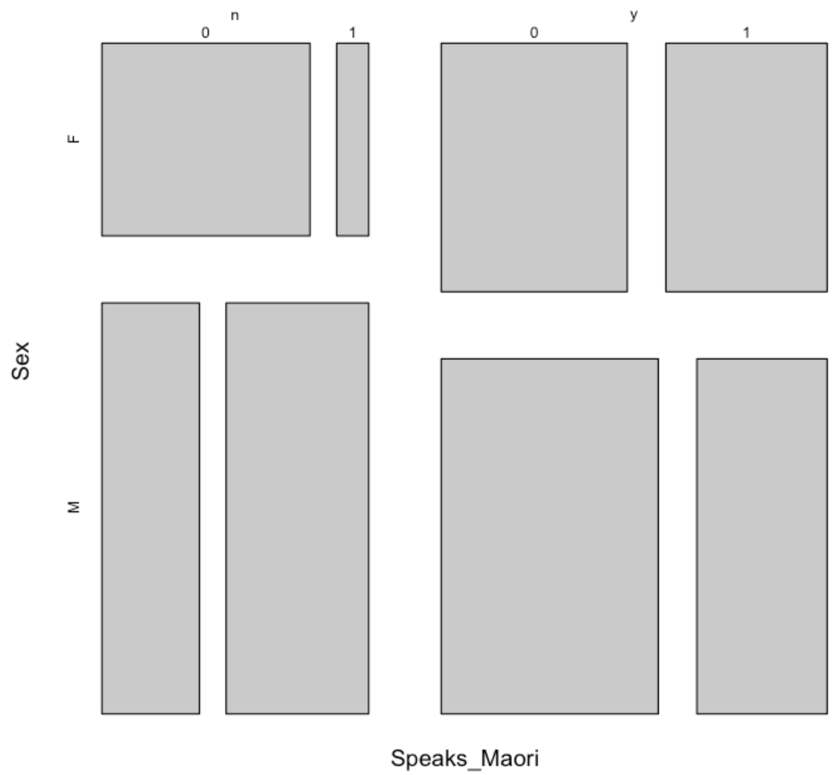


Figure 5. Rates of central (0) versus front /ɪ/ (1) by sex and language ability

The implications of these patterns are interesting. Because this study is done with only one generation of speakers, we cannot ascertain that any of the patterns are sound changes in progress. Despite this, it has often been noted that women lead in sound changes, both from above the level of awareness by conforming to the most socially accepted form of the variant, as well as from below the level of awareness by taking up an incoming variant (Labov, 2001). These patterns are thus interesting because it is the monolingual females that show the lowest rates of front /ɪ/, the same pattern found in Pakeha speakers in this study and the younger generations of Maori and Pakeha speakers in Bell's study (1997). The bilingual Maori participants all reported being actively involved in the Maori community and in activities taking place at their *marae* or 'meeting houses'. While the monolingual participants also reported being involved in the Maori community, many of them also reported that they did not feel that the Maori culture was particularly strong in their homes and one of them even reported that her parents were barely involved in the Maori community at all. This lack of involvement could suggest that the monolingual Maori women were seeking their linguistic identity by conforming to the innovative patterns of Pakeha speakers instead, while monolingual Maori males continued the patterns of using the front variant of /ɪ/ much like the bilingual Maori participants. The monolingual female speakers could be seen as fitting the patterns previously identified by Labov, leading the change for the Maori community whether the sound change was above or below the level of awareness. If the central variant of /ɪ/ was below the level of awareness for this community, these speakers might simply be seen as taking up an incoming variant new to their speech community; if the central variant is above the level of awareness, the speakers can be seen as leading the change in the Maori community by using what they might see as a 'prestige' or 'Pakeha' variant.

It is also interesting to note that variation in /ɪ/ production could not be predicted solely by ethnic group, whether considering mean production values or rates of centralization. It seems then that front /ɪ/, at least within this population, may not be a feature of MVE per se, but a feature of speech by English-Maori bilingual participants. Bell (1997) predicted this might be the case as only the older speakers in his study, all of whom were bilingual in Maori and English, were the most likely to have a front production of /ɪ/. It was unclear in Bell's study if the front variant of /ɪ/ was a result of generational variation or variation correlated with language ability. In this study, all speakers are from one generation, and the variation still appears and is correlated with language ability, suggesting that Bell's results were likely also based on a Maori language background. Discussion of possible factors condition variation in this variable and relation to variance for the /u/ variable is continued in section 4.3 below.

4.2 /u/ fronting: Results and discussion

Recall the hypotheses for /u/ predicted that extremely fronted /u/ will correlate with Maori ethnicity. We therefore expect to find higher F2s for Maori participants as compared to Pakeha participants; no difference was predicted for F1 values. Rates of fronting for Maori participants were also predicted to be higher for Maori than Pakeha speakers. Importantly, it was also predicted that Maori language ability would *not* be a significant factor in /u/ fronting, both for F2 values and rates of fronting. While the hypothesis that Maori language ability would not be a significant factor was supported, ethnicity by itself was not found to correlate with more fronted /u/, rejecting the first hypothesis. Although ethnicity and language ability did not prove to be significant factors, sex emerged as a significant factor correlated with rates of /u/ fronting, and an interaction of sex and ethnicity proved to be moderately significant for variation in the F1 and F2 values. Results are reported and discussed in more detail below.

4.2.1 Variation in F1 and F2 values for /u/

Results. The linear mixed effects models for F1 and F2 values revealed no significant factors individually conditioning variation for the set of data containing all speakers. While sex and ethnicity showed no significance as predictors of variance for /u/, a model including interactions revealed that interaction of sex and ethnicity was at or near significance for both F1 and F2, while language ability remained insignificant. Tables 8 and 9 below show these results. Note that language ability did not prove to be significant, even when interactions with other factors were considered.

Table 8. Results from linear mixed effects regression for F1 values of /u/ for all participants revealing a weak interaction between sex and ethnicity

	Estimate	Std. Error	t value	p value
(Intercept)	419.835	8.982	46.74	
Maori – yes	9.424	10.342	0.91	
Sex – M	3.045	8.297	0.37	
Speaks Maori-yes	0.934	11.656	0.08	
Sex(M):Maori(yes)	-19.968	10.295	-1.94	0.0545
Sex(M): Speaks Maori(yes)	4.669	11.425	0.41	

Table 9. Results from linear mixed effects regression for F2 values of /u/ for all participants revealing an interaction between sex and ethnicity

	Estimate	Std. Error	t value	p value
(Intercept)	1777.90	55.47	32.05	
Maori – yes	108.79	66.05	1.65	
Sex – M	10.69	53.06	0.20	
Speaks Maori - yes	13.18	73.93	0.18	
Sex(M):Maori(yes)	154.92	65.87	2.35	0.0202
Sex(M):Speaks Maori(yes)	-61.12	73.09	-0.84	

Effects of language ability were again tested within the group of Maori participants only, and once again it did not emerge as a significant factor. A grouping of factors testing the interaction between ethnicity and language ability was also tested, again revealing no significance to the grouping.

Discussion. The results above show that while Maori ethnicity itself does not significantly correlate with variation in /u/ fronting, an interaction of sex and ethnicity is significant. As we see in Table 9, F2, the front-back component of the vowel, shows a high significance for this interaction ($p=0.020$), while Table 8 reveals that a sex-ethnicity interaction is just above the 0.05 level of significance ($p=0.054$) in explaining the variance of F1. As noted above, in discussion of /u/ fronting we are most concerned with the F2 values of the vowel; therefore, as the correlation of F1 with this interaction is not quite at the level of significance and does not relate to the fronting of the vowel, F1 results will be set aside for the purposes of this discussion.

Turning to the F2 results, Figure 6 below shows that Maori and Pakeha males have relatively close productions, while ethnicity becomes a factor within the female grouping. The distribution on the right-hand side of the figure shows that the average production of Maori males F2s is only slightly higher on average than that of Pakeha males. The left-hand side, however, shows that Pakeha females consistently produce higher F2 values than Maori females. Recall that these higher F2 values mean a more fronted production of the vowel. Within the female group, then, we find the opposite of what we predicted in the hypothesis: it is the Pakeha group of females that are producing the extremely fronted variants of /u/, realized as [y], while Maori females are producing the most backed variants of the vowel, most often realized as [u].

These results are surprising, in that they do not replicate Bell's findings, although his 1999 study investigating /u/ fronting looked at the speech of only two participants, one Maori male and one Pakeha male. Because there are no females in his study (and a quite low number of speakers), it seems that generalizations could not be made from his data to apply to a larger population including female speakers. While we do not find much difference here between the male groups, we do find a slightly higher average for Maori men, as Bell did. The interesting finding is then the pattern produced by the women in this study. How can we explain this deviation from the expected results? Labov's (2001) "gender paradox" may again offer some explanation here. As noted above, women tend to lead sound change above the level of awareness by conforming to the most socially prestigious variant. As discussed in section 2.1.2 above, however, /u/ fronting does not appear to be a variable above the level of awareness of the speakers of the community; that is, the average speaker from New Zealand is not likely to note fronted /u/ as a feature of NZE or to identify it in their speech. Therefore it is unlikely that these women can be leading a change from above the level of awareness. Looking at the variable, then, as a possible change from below, women are likely to lead the change by *not* conforming to the standard pronunciation, but leading the change with an incoming variant. If the variable were a

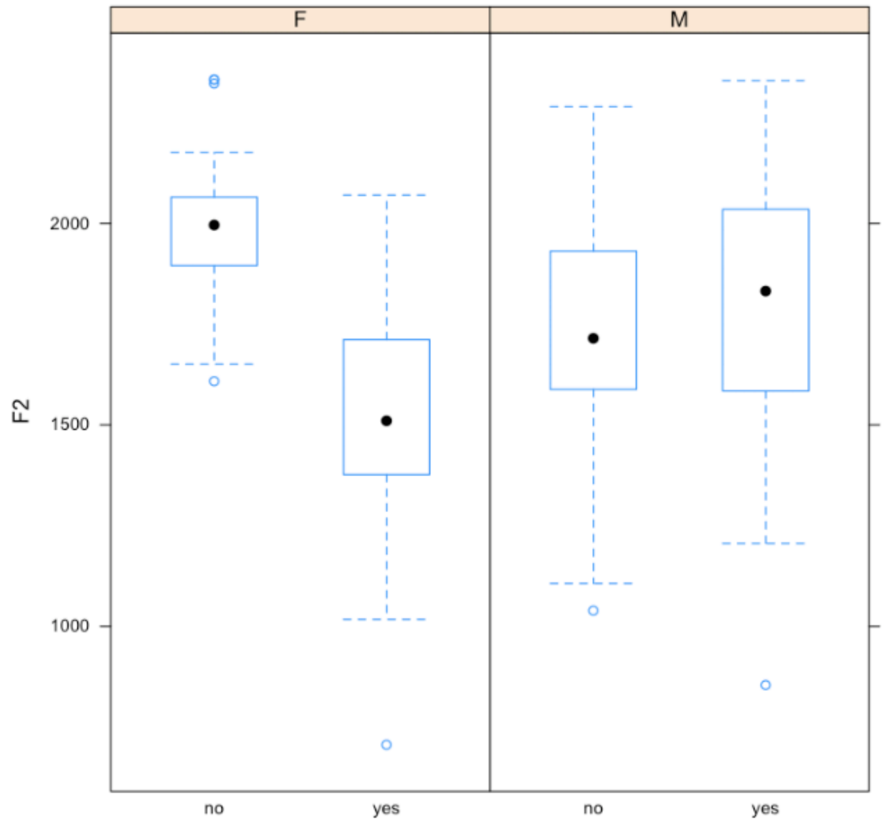


Figure 6. Mean productions of F2 for /u/ grouped by sex and ethnicity (no=Pakeha, yes=Maori)

stable linguistic variable, we would expect to find women to be the more conservative group, conforming to the standard. Clearly that is not the case here for the Pakeha females. While we again cannot confirm only from this study that /u/ fronting is a change happening over time due to having data from only one generation, it is a possibility to consider that /u/ pronunciation could be change in progress at this time within the Pakeha community that has not yet been picked up by the Maori community. It would then be expected that the Pakeha women would lead this change by going away from the standard pronunciation, which is what is seen here, with extreme fronting by the Pakeha women. If the variable is still a stable one in the Maori community, we would expect the Maori women to be conservative by conforming to the standard, backed /u/, which is again what we see in these results. Although we do not have data from other generations in this study, previous research suggests that the /u/ vowel was backed at the time of colonization of New Zealand and that New Zealanders were then innovative in fronting the vowel (Wells, 1982; see Section 2.1.2 of this paper for further discussion). This observation would then support the hypothesis that we are seeing a change in progress in this generation of speakers, with the Pakeha females beginning to lead the change to a fronted variant, while the Maori females continue to observe the backed /u/ pronunciation.

4.2.2 Variation in /u/ fronting rates

Results. Although no individual factors emerged as significant for F1 and F2 variation, a binomial generalized linear model was used to test the factors against rates of centralization. Here, ethnicity and language ability remained insignificant, but sex emerged as a significant factor. No interactions proved to be significant. These results are reported in Table 10, below.

Language ability and sex were tested as significant factors within the group of Maori participants only. Language ability continued to prove insignificant, while sex remained significant. Because sex was also a significant factor in the model accounting for all of the data (instead of the Maori only portion of the data), only the results from the larger model are reported. Again, a model with a combined three-level category for ethnicity and language ability (bilingual Maori, monolingual Maori, and Pakeha) was tested and provided only sex as a significant factor.

Table 10. Results from binomial generalized linear model for rates of /u/ fronting for all speakers

	Estimate	Std. Error	z value	p value
(Intercept)	0.5108	0.3651	1.399	
Maori – yes	-17.0769	979.6101	-0.017	
Sex – M	-2.5033	0.5681	-4.406	1.05 e-05 ***
Speaks Maori –yes	15.9783	979.6102	0.016	
Sex(M):Maori(yes)	18.6639	979.6103	0.019	
Sex(M):Speaks Maori(yes)	-16.2660	979.6105	-0.017	

Discussion. In finding sex as a significant factor of variation in rates of /u/ fronting, it is necessary to look at the distribution of fronted tokens by sex. Figure 7 below illustrates these patterns. Recall that the application value, 1, represents tokens that are in the front of the vowel space, roughly equivalent to a [y] pronunciation, while productions in the middle or back of the vowel space, [ʉ] and [u], have been coded as 0. Here we see that women show a nearly equal rate of fronting and non-fronting, with slightly fewer fronted tokens. Men on the other hand exhibit a very low rate of fronting, with most of their tokens in the middle or back of the vowel space. While looking at the mean production values showed that sex was only a significant factor as an effect of its interaction with ethnicity, results for rate of /u/ fronting find sex to be significant on its own, and in fact not as an interaction with ethnicity. The conflict between these results suggest that Maori women should have roughly similar rates of fronting as Pakeha females, but that their non-fronted tokens are likely at the back of the vowel space, while Pakeha women are more likely to exhibit non-fronted tokens as central high vowels. Figures 8 and 9

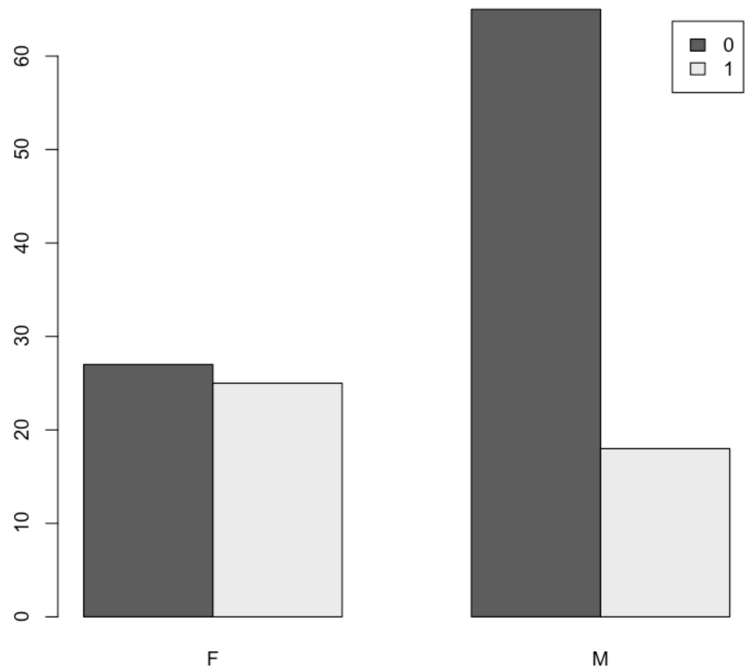


Figure 7. Counts of non-fronted (0) versus fronted (1) tokens of /u/ by gender

show this to be the case. In these figures, again made using the Plotnik program, the /u/ vowel is represented with a bright blue circle, labeled with 'uwC'. As exhibited in Figure 8, the vowel space of a Pakeha female, we see most of the tokens in the front of the vowel space, with the non-fronted tokens in the middle of the vowel space. Figure 9, however, shows that in this Maori female's vowel space, while several tokens of /u/ are fronted, the non-fronted tokens range from the middle to the far back of the vowel space.

Although the rates of fronting are certainly not identical for these two speakers, they both exhibit both fronted and non-fronted tokens. As can be seen in the distributions of the /u/ vowel in Figure 7 above, men are much less likely to produce fronted tokens, with most of their tokens in the middle of the vowel space. Like the F1 and F2 values, the rates of fronting tell us that for

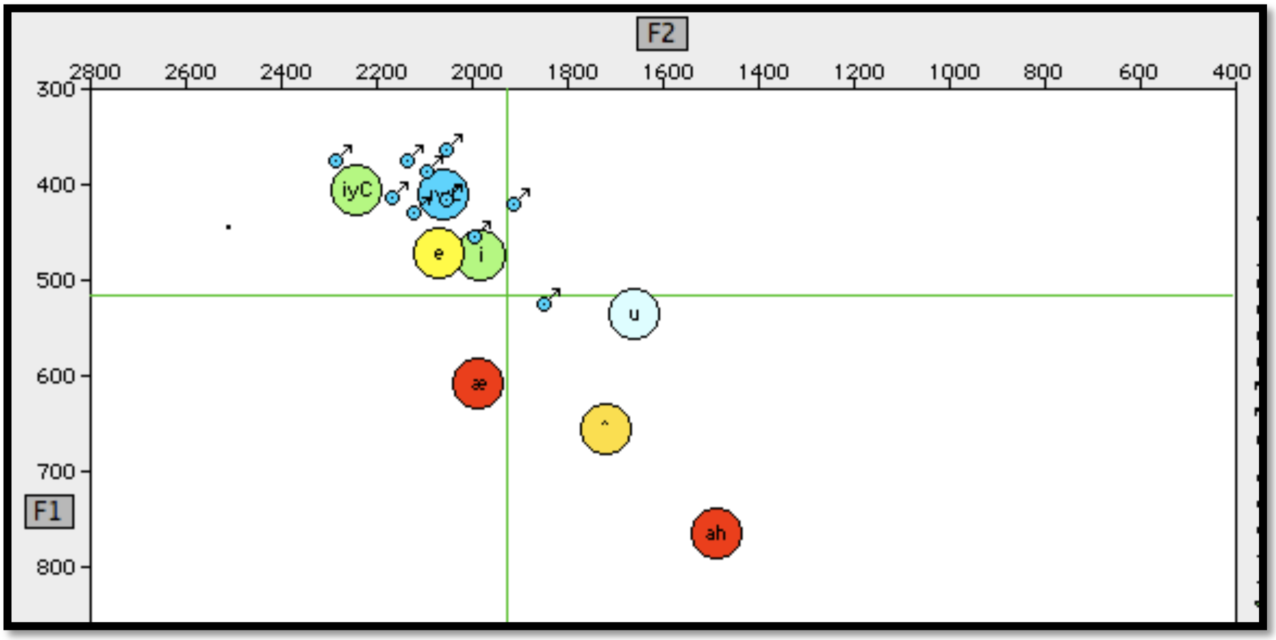


Figure 8. Mean vowel productions for a Pakeha female. Smaller dots represent tokens of /u/.

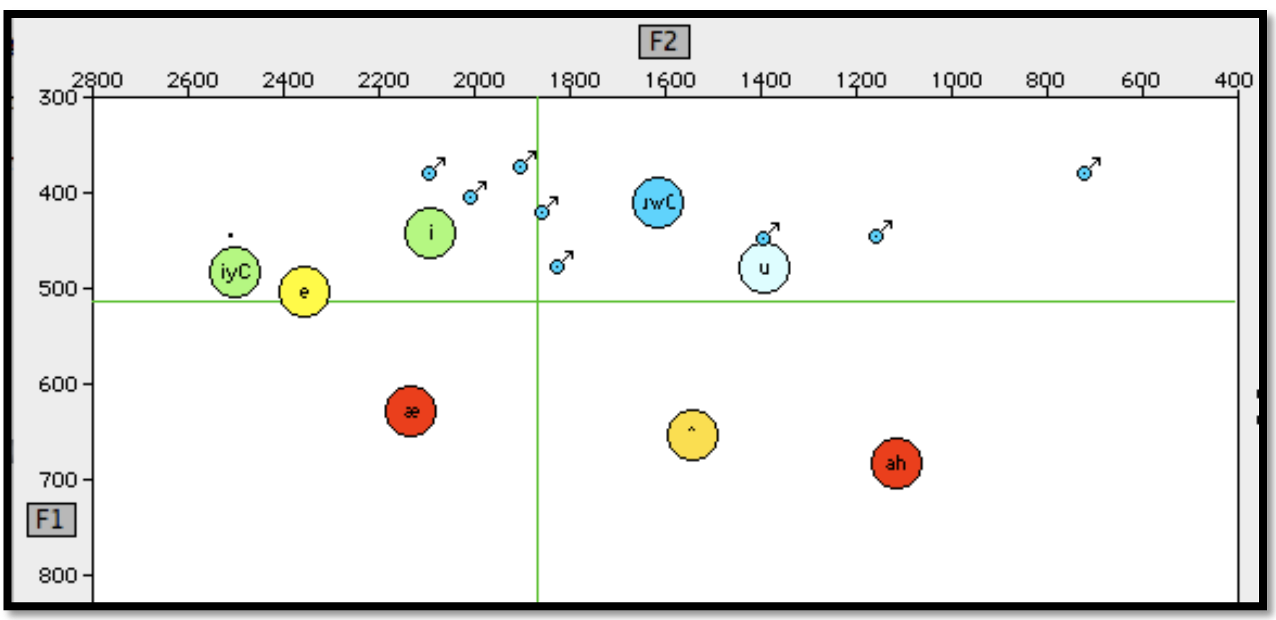


Figure 9. Mean vowel productions for a Maori female. Smaller dots represent tokens of /u/.

this population, /u/ fronting is not yet a distinctive feature of MVE, but possibly an incoming feature of NZE as a whole. As Bell's (1999) speaker came from a later generation, future studies of younger generations may reveal that /u/ fronting has been picked up by Maori speakers, but the results of this study do not confirm /u/ fronting as an MVE feature in the Auckland region.

4.3 General discussion

Based on the results of this study, a few things become clear. First, production of front variants of /ɪ/ can be correlated with Maori language ability. One possible reason for this correlation, as Bell suggests, is language transfer. If language transfer is the cause of this correlation, we are seeing atomic transfer between two languages being acquired simultaneously; that is, one element of the Maori language is being transferred into that speaker's production of the English language. Because we are not seeing other components of the bilingual speakers' vowel systems being transferred, any transfer that is occurring cannot be seen as systemic, but must be viewed on a piece by piece basis. Two questions arise from this hypothesis: why might /ɪ/ be susceptible to language transfer while other variables do not appear to be, and is it plausible that language transfer could occur in simultaneous bilinguals? As suggested in section 4.1.1 above, one possibility is that /ɪ/ was a target for language transfer for Maori bilinguals because of its salience in NZE. Recall that centralized /ɪ/ is one of the most noted features of NZE, and is noted by speakers and linguists alike. If all speakers of this Auckland community were aware of a centralized production of the /ɪ/ vowel, it is possible that this vowel was more available to variation than other vowels. Maori speakers may have been aware of the variation in this vowel, hearing both centralized and non-centralized tokens. As can been seen in Figure 3, the bilingual participant does produce central tokens of the vowel, but is more likely to produce high, front tokens than the monolingual participant (seen in Figure 4). These high front tokens of the vowel eclipse even the bilingual speaker's production of their English /i/ vowel, suggesting that speakers are not relying on the /i/ vowel in English for their production of /ɪ/. In selecting a variant to use for production of the /ɪ/ vowel, bilingual speakers may have turned to the closest vowel in their Maori inventory, the short high front /i/. This vowel would be the most likely comparison between English and Maori, as the short /i/ in Maori would act as the less peripheral high front vowel (as would /ɪ/ in English). This analysis suggests that transfer could occur between two languages being learned simultaneously when there is salient variation at the focus of the transfer. Yet as the review of previous studies above (section 2.3) suggests, there is little previous research to gives us reason to believe that transfer occurs between the two languages being acquired by simultaneous bilinguals. While several studies found a U-shaped curve in perception with young children, none of the studies found lasting effects on adult perception that could be attributed to transfer between the speakers' two native languages (Bosch & Sebastian-Galles, 2003; Burns, Werker, & McVie, 2003; Sundara, Polka, & Baum, 2006; Sundara & Polka, 2008). These studies, though, focus on perception of phonemic contrasts, not contrasts where salient phonetic variation in production within one phoneme is present. Phonetic variation within a language can be influenced by many factors, including social motivations, and the results of this study do not rule out the possibility that such variation may also provide a locus for language transfer to take place in languages being learned simultaneously. As communities and languages become increasingly intertwined in a globalizing world, more research investigating variation and language transfer in communities with multilingual populations should be conducted in order to assess the possible effects of variation on language transfer and vice versa.

Until more on the role of variation in the process of language transfer can be determined, other alternatives should be considered to explain the correlation between language background and front production of /ɪ/ in the English speech of Maori/English bilinguals. Another possible influence conditioning this variation could be a difference in input between the bilingual and monolingual groups of Maori speakers. As noted above, it is possible that this variation represents a sound change in progress, one that might be advancing in the Pakeha community more quickly than the Maori community. While the monolingual Maori participants were involved in the Maori community, they were often also quite heavily involved in the Pakeha community and often had parents that did not speak Maori. It could then be the case that these monolingual Maori participants received more input with centralized /ɪ/, while the bilingual Maori participants were more removed from the community in which this variant was gaining popularity. Conversely, it is also possible that the bilingual participants, whose parents all spoke Maori, received more input with a front variant of /ɪ/ due to interference from Maori to English before their generation. These participants were all heavily involved in the Maori community and were less involved in the Pakeha community, especially when younger. The production of more front variants of /ɪ/ could be a result of language transfer from a past generation of L1 Maori speakers who then later learned English as an L2, a type of transfer that is well-documented. As Watson et al. (2000) report, the earliest forms of NZE contained a more canonical front pronunciation of /ɪ/, but Bell (1997) suggested that the pronunciation of older Maori speakers was often even higher and more fronted than the canonical close front vowel. What we may be seeing here could be a result of further fronting by L1 Maori speakers on their English L2, which was then passed down in the Maori community, even while the Pakeha community had begun shifting the vowel to the center of the vowel space. While it would likely be difficult, if not impossible, to find present day speakers with Maori as an L1 and English as an L2 in order to test this hypothesis, it would be possible to test Maori-English simultaneous bilinguals. These bilinguals will likely be involved in both Maori- and English-speaking communities, as the current situation in Auckland makes it difficult to avoid English-speaking culture. These speakers could then serve as a test of interference between English and Maori in simultaneous learning, without the likelihood that these speakers will be removed from the Pakeha community and not privy to the centralized variant of the vowel.

In addition to considering the linguistic possibilities of different inputs, social motivations should be explored. It was noted in section 4.1.2 above that the patterns exhibited by the monolingual Maori females could potentially be explained as either a possible change from above the level of awareness, in which the monolingual females were more attuned to the 'prestige' variable already established in the Pakeha population, or a change from below the level of awareness in which the monolingual females were picking up an innovative variant with unknown prestige (that is, unknown to the users themselves). In light of the patterns found for /u/ variation, it seems likely that the change in /ɪ/ is above the level of awareness. Observances of /u/ fronting, which is not a feature noted by speakers of NZE to this day, shows Pakeha females as the likely /u/-fronters and not Maori females, regardless of language ability. It seems clear that this change is coming from below the level of awareness for this generation of speakers (as it is still below the level of awareness of today's speakers) and is only being taken up by the Pakeha females. If the change in /ɪ/ production was also coming from below the level of awareness, we might expect to find the same pattern as for /u/ variation: monolingual Maori females patterning with the bilingual Maori females. Instead, we find these monolingual females patterning with the Pakeha speakers, suggesting that the variable is more established in the NZE dialect. Historic accounts of NZE back this up, as centralized /ɪ/ is one of the first features to be noted distinguishing NZE from other dialects of English. It seems quite plausible, then, that use of the central variant of /ɪ/ by the monolingual Maori females marks the beginning of a sound change in the Maori population to the Pakeha variant of /ɪ/ and *not* a residual effect of language transfer from Maori/English bilingualism.

Turning to the /u/ vowel, it is clear from the results of this study that /u/ fronting cannot be correlated with Maori language ability or Maori ethnicity. In fact, we find that the Maori participants in this study, particularly the females, are more likely than Pakeha speakers to have productions of /u/ in the back of the vowel space. The conflict of these results with the earlier findings from Bell's study (1999) allow for several possible explanations. Although there large geographical differences have not been reported in the NZE studies, it is possible that there are geographical variations in MVE. Recall that all participants in this study were from the Auckland area in the North Island of New Zealand, while most previous studies used participants from the metropolitan areas in the South Island, such as Wellington and Christchurch (Bell, 1999; Easton & Bauer, 2000). Differences in relationships and interactions between the Pakeha and Maori communities in these areas could lead to a difference in the way that Maori speakers adapted their language to the NZE 'standard'. While this study cannot ascertain any regional variation patterns, future research should investigate the possibility of variation within MVE on a geographical basis.

In addition, recall that Bell's study involved only male participants. In this study, we find Maori male participants with a slightly more fronted production of the /u/ vowel than Pakeha participants. The largest difference came between females, a result that would not have been apparent in Bell's study due to the absence of female participants. As suggested in the discussion above, the role of the female participants in this variation may reveal a change in progress beginning in the Pakeha community from below the level of awareness. The fronted variant of the /u/ vowel was not found in the earliest versions of NZE and thus a sound change must have occurred at some point. It seems quite likely, based on the arguments made above, that the Pakeha females are leading the change in this generation of speakers. As fronted variants of /u/ are found in the speech of current Pakeha and Maori speakers (Bell, 1999), future studies should investigate the status of this variant over several generations to determine the progress of the change over time.

Ultimately, it appears that social motivations are the more likely explanation for the variation found in the speech of this generation of New Zealand speakers. There is a great deal of previous research that has shown effects of social reasons for phonetic variation, yet little to no research that supports the idea of language transfer in simultaneous bilinguals. Future research including more recent or earlier generations of speakers may provide solid evidence of a sound change, and help to investigate when or if the Maori community in Auckland took up this change. Yet despite the lack of previous support from the field of language transfer, it is a field that is still vastly undiscovered, suggesting that it may not be time to abandon this possibility just yet. Although there are other plausible explanations, these findings do keep the door open for the possibility of language transfer in speech production between two languages being learned simultaneously and future research should be conducted to that end before the possibility is wholly rejected. It may be the case that variables undergoing a sound change are more susceptible to transfer effects, and more research to this end should be conducted to investigate such a possibility.

5.0 Conclusions

The investigation of linguistic variation based on regional and social identity factors has been going on for decades, and the study of New Zealand English and Maori Vernacular English are nothing new. Yet few studies have returned definitive results nailing down the distinctions between the vowel systems of MVE and NZE, and this study aimed to add to the body of research on the MVE vowel space. In addition, this study aimed to investigate the correlation of variation with bilingual language ability and the possibility of language interference in simultaneous bilinguals.

In order to accomplish these goals, the English vowels /ɪ/ and /u/, two vowels that had previously been revealed as possible distinctions between MVE and NZE (Bell, 1997, 1999), were studied for correlation with social and linguistic factors. Acoustic measurements and rates of non-central /ɪ/ and fronted /u/ were measured. All data came from speakers within one generation to avoid generational differences that may have conditioned results in previous studies (Bell, 1997). These measurements were tested for correlation with sex, ethnicity, and language ability, in order to test the hypotheses that front productions of /ɪ/ could be found only in the speech of ethnically Maori participants with Maori language ability, while /u/ fronting could be found for the entire group of ethnically Maori participants. While the first hypothesis was supported, with front /ɪ/ correlating with Maori language ability, the second hypothesis was refuted by the results of this study. Maori ethnicity was not found to be correlated with fronted /u/, and in fact Pakeha females were the most likely to use an extremely fronted variant of /u/. These results leave open the possibility of transfer between languages of simultaneous bilinguals, but fail to nail down distinct features in the MVE vowel space of the generation studied here.

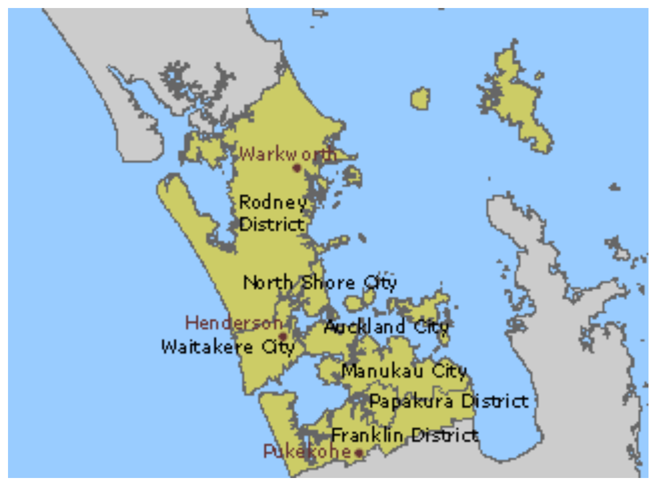
Although this study does not find clearly identified features of an MVE dialect for this generation of speakers, it does add to the body of research on MVE in identifying several future avenues of investigation. Language is constantly evolving and although definitive MVE features were not found in this study, that does not mean they do not exist, particularly in later versions of the dialect. The variation in both /ɪ/ and /u/ suggests possible sound changes in progress, and therefore only studies involving speakers in other generations can tell us more of the story. In addition, the results here showed that the Maori language ability of the participants correlated with their pronunciations in English, and should encourage future studies to investigate both the social and linguistic characteristics of participants to reveal the possibilities and implications of language transfer in variation. In addition, delving further into a connection between participants' involvement in the Maori community and Maori language ability may help to reveal whether language ability is acting as a factor causing language transfer, or if knowledge of the Maori language is simply an epiphenomenon correlated with deeper involvement in the Maori community. Finally, the current Maori revitalization efforts taking place in New Zealand should be taken advantage of to investigate variation between simultaneous bilinguals and L2 Maori speakers. These studies may help to reveal effects of transfer from Maori to English, and vice versa, and to further identify phonetic characteristics of an MVE dialect.

Going beyond the implications of this study for MVE, the findings in this paper have sociolinguistic implications, informing previous hypotheses on what Labov identifies as the "gender paradox", wherein women tend to be innovative in their production of incoming sound changes and conservative with stable sociolinguistic variables (2001). For the /u/ variable, a likely change from below, the Pakeha women are being innovative by producing a more fronted variant, while Maori women are being conservative by conforming to the previous standard, the backed variant. These findings support the gender paradox, suggesting that a change has begun in the Pakeha community that has not yet started in the Maori community. The /ɪ/ variable may also supports the gender paradox, in that we find the Maori women that are more involved in the Pakeha community (the monolingual Maori women) using more of the centralized variant. By using the variant associated with Pakeha speech, these speakers support Labov's hypothesis that women will conform to the variant in use by the group with more social prestige. While the Maori women that are more invested in the Maori community are not prone to using this variant, the women that are involved in both communities conform to the variant that is noted for being a feature of NZE, particularly by the Pakeha. These findings again support Labov's previous findings (2001), and continue to suggest that the level of awareness that speakers have of phonetic variation affects the direction they go in choosing a variant for production.

Finally, the results found here also hold implications for the quantity of transfer of features from one language to another. First, the correlation of bilingual language background with front production of /ɪ/ promotes the hypothesis that language transfer can be atomic, affecting a language's inventory one phoneme at a time instead of having an impact on the whole system. While front /ɪ/ is correlated with Maori language ability, variation in the /u/ vowel is not, and instead correlation was shown with an interaction of sex and gender. We thus find that if the correlation of Maori language ability and front /ɪ/ is to be attributed to language transfer, the

Maori vowel space is not interacting with the English vowel space as a whole, but one piece at a time. Secondly, the results of this study leave open the possibility of language transfer in simultaneous bilinguals. While current research in this field is limited, the previous findings have suggested that language transfer effects are not present in adults who acquired two languages from early childhood. The results in this study, on the other hand, show that speakers who learned Maori and English in the home as children exhibit effects that may be the result of transfer. If the findings here can be attributed to language transfer, it is also possible that the salience of variation plays a role in determining the target of such transfer. Centralization of the /ɪ/ vowel in NZE is well noted and awareness of such variation may lead to volatility in assigning a production target for the vowel when multiple options are available. This volatility could be opening the door for transfer between languages, even within the speech of simultaneous bilinguals, suggesting that future studies might be wise to consider the role of variation in language transfer.

Appendix A



Map of New Zealand (Auckland is highlighted) Map of Auckland area
(Maps taken from Statistics, New Zealand, 2006)

Figure 10. Maps of the areas of study

Appendix B

Information from Statistics, New Zealand, 1991 and 1996 Census

Table 11. Population by Gender, 1991 Census

1991		
Male	Female	Total
462,144	481,632	943,776

Table 12. Ethnic Groups in Auckland Region, 1996 Census

	Ethnicity						
Sex	European	NZ Maori	Pacific Island	Asian	Other	Not specified	Total
Male	324,081	61,296	57,171	46,371	3,804	29,373	522,093
Female	341,082	65,118	60,621	49,380	3,297	27,054	546,552

Table 13. Languages Spoken (no. in Total speakers reported), 1996 Census

	Languages Spoken						
Area and Sex	English	Maori	Samoan	NZ Sign Language	Other	None	Not specified
Male	456,162	15,543	22,671	3,036	75,117	15,408	35,046
Female	480,288	16,437	24,177	3,783	81,693	13,719	32,985

Appendix C

Table 14. Participant Demographics

	Sex	Ethnicity	Speaks Maori?	Year of Birth
Speaker 1	F	Pakeha	no	1921
Speaker 2	M	Maori	yes	1930
Speaker 3	F	Maori	yes	1927
Speaker 4	M	Pakeha	no	1915
Speaker 5	F	Pakeha	no	1928
Speaker 6	F	Pakeha	no	1925
Speaker 7	F	Maori	no	1923
Speaker 8	M	Maori	yes	1920
Speaker 9	M	Pakeha	no	1916
Speaker 10	M	Pakeha	no	1919
Speaker 11	F	Maori	yes	1917
Speaker 12	M	Pakeha	no	1919
Speaker 13	M	Maori	no	1931
Speaker 14	M	Maori	no	1937
Speaker 15	F	Pakeha	no	1919
Speaker 16	F	Pakeha	no	1916
Speaker 17	M	Maori	yes	1919
Speaker 18	M	Pakeha	no	1915

Appendix D

Phonetic environments

All vowel tokens used in this study were taken from stressed syllables. Vowels that were preceded and followed by obstruents (including plosives fricatives and affricates) were used whenever possible. When it was not possible to reach the desired number of tokens for a particular speaker using only inter-obstruent tokens other phonetic environments were used. Below are breakdowns of both the preceding and following segment environments for the vowels used in this study as well as a list of environments by vowel. In a multiple regression analysis phonetic environment was not found to be a factor influencing rates of variation in vowel quality.

Preceding segments

By place and manner:

- 90% of tokens preceded by obstruents (846/936)
  - 44% – alveolar [tdsz ʃ ʒ tʃ dʒ θ ð] – 412
  - 29% – bilabial or labiodental [pbfv] – 274
  - 16% – velar [kg] – 108
  - 5% – glottal [h] – 52
- 5% were preceded by nasals (50/936 – 32 bilabial 18 alveolar)
- 4% were preceded by glide or liquid (35/936)
- 1% were syllable initial (5/936)

By voicing:

- 39% – voiced onset (372/936)
- 60% – voiceless onset (559/936)
- 1% – no onset (5/936)

Following segments

By place and manner:

95% of the tokens were followed by an obstruent (884/936)

50% – dental alveolar or post-alveolar [tdsz ʃ ʒ tʃ dʒ θ ð] – 467

23% – bilabial or labiodental [pbfv] – 212

22% – velar [kg] – 205

.5% – glottal [ʔ] - 5

2% were followed by a nasal (24/936 – 12 bilabial 20 alveolar and 2 velar)

2% were in open syllables (22/936)

1% were followed by an l (6/936)

By voicing:

59% – voiceless coda (550/936)

38% – voiced coda (364/936)

2% – no following segment (22/936)

List of phonetic environments by vowel

ɪ :

d__d
s__v
t__p
k__p
d__g
d__d
p__k
s__s
d__d
v__v
s__t
d__f
p__k
d__d
h__s
s__d
g__v
d__d
b__g
b__z
f__f
s__k
d__f
b__t
s__k

h__t
b__g
s__t
s__ɾ
s__g
s__s
s__tʃ
θ__ŋ
b__z
t__p
g__t
d__s
s__tʃ
m__t
d__d
v__ʒ
s__t
ð__s
s__n
b__g
b__t
s__k
h__tʃ
b__g
d__d
d__f

k__tʃ
d__ʃ
f__f
d__d
f__ʃ
k__n
d__f
k__k
s__k
g__v
d__ʃ
s__ɾ
f__f
p__t
f__ʃ
d__g
b__g
b__ʃ
l__v
s__k
b__s
d__d
k__tʃ
d__d
p__k
d__d

p__k
b__b
f__f
d__f
s__k
t__tʃ
k__p
s__k
f__f
t__k
p__k
v__k
v__k
f__f
ʃ__p
ʃ__p
d__d
s__k
s__s
f__ʃ
b__g
g__v
s__k
p__k
h__p
d__f
k__d
d__g
l__v
ɹ__b
ʃ__p
ʃ__p
g__n
b__t
d__d
l__dʒ
d__d
θ__ŋ
d__ʃ
m__d
l__ɾ
s__ɾ
s__k
s__s
s__s
b__g
b__z
s__k
p__g
d__d
tʃ__k
k__d
s__t
d__g
b__g

m__t
p__t
f__ɾ
ʃ__f
b__g
k__tʃ
s__k
d__d
s__k
s__s
s__k
p__k
m__k
d__g
t__k
s__k
s__s
f__f
d__s
p__g
p__k
d__ʃ
f__f
s__s
t__f
b__k
b__g
k__d
t__t
s__k
d__f
p__k
b__g
ʃ__p
t__v
s__ɾ
ʃ__f
v__z
s__s
s__k
tʃ__k
p__k
ʃ__f
k__tʃ
v__k
d__k
g__v
s__v
b__t
d__k
s__d
f__f
s__p
s__k
b__g

f__f
p__k
d__b
d__s
h__s
b__t
k__k
k__s
t__k
ʃ__ɾ
n__p
s__ɾ
p__t
h__t
p__g
k__tʃ
f__f
k__t
d__ʃ
f__k
s__t
b__g
s__k
ʃ__f
v__k
b__s
d__d
s__s
d__d
b__g
t__k
k__tʃ
f__t
b__g
v__z
p__k
s__k
b__g
t__p
k__d
b__g
f__ʃ
b__z
k__p
s__k
b__t
d__f
s__s
v__z
m__s
s__s
s__k
s__s
s__k
h__s

	b__ʃ	b__g	v__v
	b__g	b__t	l__t
	f__n	v__k	t__p
	d__d	b__b	k__d
	d__s	d__d	m__s
	ð__s	f__f	p__t
	θ__s	p__k	k__f
	s__s	s__s	s__k
	p__k	b__g	
		z__t	

---

u:	n__m	m__v	k__p
	d__t	s__p	m__v
	s__p	n__t	t__n
	m__v	k__l	t__n
	ʃ__z	t__	ʃ__z
	ʃ__z	d__	s__t
	s__t	ʃ__t	z__m
	f__d	f__d	t__p
	s__t	m__v	k__l
	s__t	t__n	n__p
	t__	m__v	n__z
	t__	n__z	ʃ__t
	s__t	tʃ__n	d__ɾ
	dʒ__	t__	b__t
	m__v	dʒ__d	l__s
	m__n	t__p	l__ʃ
	m__v	t__p	ʃ__z
	m__v	h__p	h__s
	t__z	k__p	t__s
	t__z	ɹ__s	ʃ__z
	s__p	n__ɾ	ʃ__z
	dʒ__d	l__	n__z
	dʒ__d	tʃ__d	t__b
	l__d	__d	l__p
	m__v	t__	t__ʃ
	h__v	f__ʔ	m__n
	m__v	t__	dʒ__n
	t__f	l__z	tʃ__z
	m__v	k__l	m__v
	t__k	ɹ__m	n__
	d__s	t__	n__z
	l__t	t__	d__
	tʃ__d	j__	d__ð
	t__z	n__	s__t
	s__t	t__	t__
	s__n	ʃ__s	d__
	tʃ__z	m__v	n__
	s__p	k__l	j__k
	k__p	t__	t__
	s__z	d__	j__s
	m__v	f__d	s__p
	m__v	m__v	n__p
	m__v	f__d	t__s
		k__ɾ	p__k

	j___t	k___l	n___z
	n___n	ɹ___m	
	k___l	s___n	

i:	p___p	p___s	p___p
	h___d	ð___z	ð___z
	b___tʃ	p___p	p___p
	k___p	b___tʃ	k___p
	p___p	t___tʃ	f___tʃ
	p___p	m___d	f___t
	k___p	p___p	d___t
	s___k	b___tʃ	b___tʃ
	tʃ___f	tʃ___p	p___t
	t___θ	m___t	f___t
	p___p	p___p	b___d
	ð___z	p___s	tʃ___p
	p___p	t___θ	p___p
	p___s	t___tʃ	θ___t
	s___n	tʃ___p	p___n
	k___p	ɹ___t	k___p
	s___z	p___p	ʃ___p
	h___p	tʃ___f	t___z
	f___t	___s	ʃ___d
	f___d	m___t	θ___t
	p___tʃ	p___p	p___p
	p___p	g___s	s___d
	b___tʃ	p___k	p___p
	p___p	b___t	ɹ___t
	p___s	h___z	p___p
	d___t	t___p	l___d
	n___k	f___tʃ	θ___t
	p___s	t___tʃ	w___k
	ð___z	b___tʃ	
	s___d	t___tʃ	

a :	f___ð	t___k	p___t
	dʒ___b	ʃ___p	p___p
	g___t	k___t	k___n
	tʃ___p	s___d	b___t
	θ___t	t___p	ʃ___p
	f___ð	p___p	h___f
	dʒ___b	s___d	dʒ___b
	b___m	k___ʔ	t___k
	d___k	θ___t	ʃ___p
	g___t	p___s	l___k
	s___f	b___ʔ	dʒ___b
	b___k	ʃ___p	ʃ___p
	b___ð	p___t	l___k
	f___k	f___ð	p___p
	b___t	d___k	f___ð
	b___t	d___t	k___s
	k___k	b___t	g___t
	p___k	g___d	d___g
		t___k	f___ð

ʃ__p	tʃ__p	ʃ__p
d__k	k__z	d__p
p__k	t__k	ʃ__p
t__p	t__p	t__t
dʒ__b	b__d	f__ð
d__k	p__t	t__k
h__b	tʃ__k	d__t
d__t	dʒ__b	ʃ__p
d__p	k__k	ɹ__k
g__b	f__ð	h__b
b__d	p__p	dʒ__b

æ :	s__k	p__tʃ	f__s
	ð__t	h__f	k__t
	h__d	ð__t	tʃ__p
	b__tʃ	b__k	h__tʃ
	b__k	ð__t	f__t
	k__θ	b__k	p__d
	h__v	b__k	b__k
	ð__t	h__p	s__t
	p__d	b__g	p__s
	b__k	k__θ	h__p
	ð__t	dʒ__k	b__s
	f__k	t__g	b__k
	f__k	b__k	d__d
	b__k	z__s	s__d
	k__b	tʃ__p	p__d
	p__d	b__d	b__k
	f__k	f__k	s__t
	b__k	h__d	d__d
	t__k	b__d	ð__t
	s__t	__k	h__f
	p__s	d__d	s__t
	b__k	h__d	b__k
	f__k	s__t	k__b
	d__n	ð__t	b__tʃ
	s__t	p__d	__k
	b__dʒ	h__p	ð__t
	k__p	z__k	b__k
	f__b	p__s	l__t
	s__ʔ	g__s	b__k
	k__p	f__k	
	h__p	h__p	

ε :	s__k	t__s	b__ɾ
	z__d	h__d	s__k
	tʃ__k	ʃ__d	h__v
	n__k	s__k	s__p
	t__p	tʃ__k	s__v
	f__b	s__k	g__t
	g__ð	b__ɾ	d__d
	m__d	t__d	ʃ__t
	tʃ__s	p__ʃ	s__k
		g__ð	s__p

v__dʒ
s__v
s__t
g__ð
t__s
s__k
b__t
s__v
g__s
t__d
t__s
h__d
s__t
s__k
p__ʃ
s__s
s__d
t__d
l__t
ʃ__d

k__m
f__k
p__k
h__d
m__ʔ
ʃ__f
f__b
s__v
b__ɾ
t__p
s__v
s__d
s__p
s__v
s__k
b__d
h__d
s__t
f__k
b__d

s__v
f__b
s__t
s__d
v__dʒ
b__d
s__ɾ
h__d
s__k
h__d
p__ʃ
ʃ__d
ʃ__d
v__dʒ
b__d
b__s
s__t
h__d
__v

ʊ:

p__t
l__k
g__d
k__d
p__t
f__t
g__d
b__tʃ
f__t
t__k
b__k
ʃ__d
k__d
p__t
l__k
b__tʃ
k__d
g__d
t__d
l__k
k__d
b__ʃ
f__t
ʃ__d
k__k
g__d
t__k
p__ʃ
g__d

ʃ__g
g__d
p__t
k__d
p__ʃ
k__k
b__ʃ
g__d
t__k
p__ʃ
g__d
b__k
ʃ__d
k__ɾ
g__d
b__k
g__d
g__d
k__k
t__k
t__d
p__t
b__ʃ
f__t
f__t
g__d
b__ʃ
b__k
g__d

k__d
b__ʃ
b__ʃ
t__k
k__d
k__d
l__k
ʃ__g
g__d
p__ʃ
b__ʃ
t__k
tʃ__k
f__t
p__t
f__t
g__d
b__ʃ
g__d
g__d
k__d
w__d
k__k
h__d
b__k

ə: k__t
dʒ__s
b__t
ʃ__v
k__z
k__t
d__b
h__t
h__m
k__m
k__z
p__m
s__tʃ
h__z
m__n
dʒ__s
dʒ__s
k__p
k__t
dʒ__dʒ
d__g
d__k
k__t
s__b
b__d
d__b
p__b
k__p
k__f
b__ɾ

h__z
t__b
k__t
s__b
s__m
k__z
s__tʃ
b__t
d__k
s__n
k__z
dʒ__g
p__b
d__b
b__t
t__k
s__b
dʒ__s
dʒ__s
s__tʃ
d__k
dʒ__s
k__z
dʒ__m
k__m
k__z
d__b
d__k
s__b
d__k

p__b
b__t
t__f
t__d
d__b
b__g
s__k
t__b
s__b
s__p
t__k
n__θ
b__ɾ
t__p
k__z
dʒ__s
s__b
b__t
b__s
s__b
m__tʃ
s__d
k__z
h__z
k__s
dʒ__s
s__b
b__t
w__t

Appendix E

Sample spectrograms

The first vowel in each of the spectrograms below, taken from the speech of Maori male speaker, provide illustrative evidence of the difference between ‘front’ (application) and ‘central’ (non-application) tokens of /ɪ/.

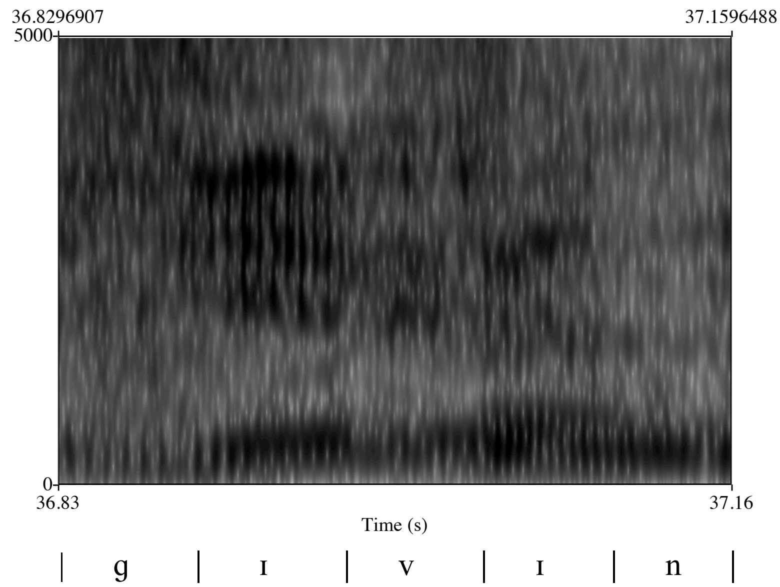


Figure 11. Front /ɪ/ : *given*

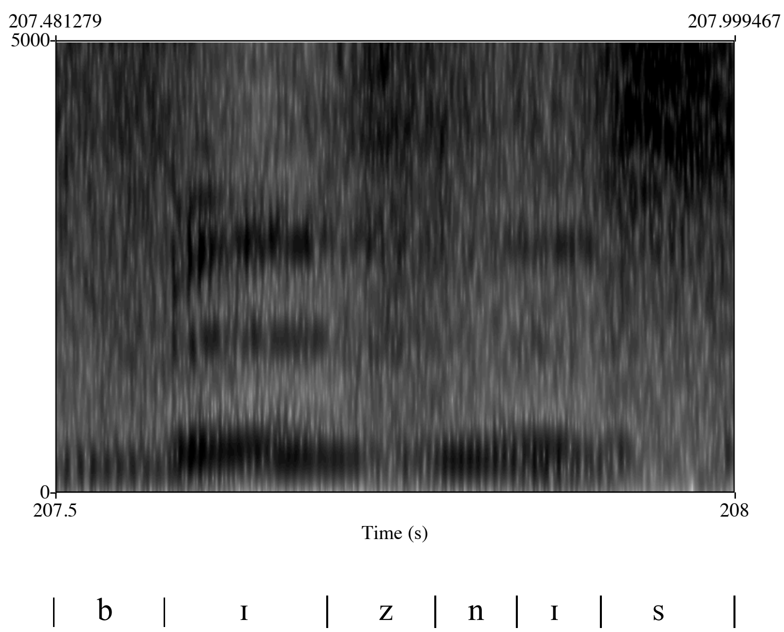


Figure 12. Central /ɪ/ : *business*

The first vowel in each of the spectrograms below, taken from the speech of a Pakeha male speaker, provide illustrative evidence of the difference between ‘extremely fronted’ (application value) and ‘not extremely fronted’ (non-application) tokens of /u/.

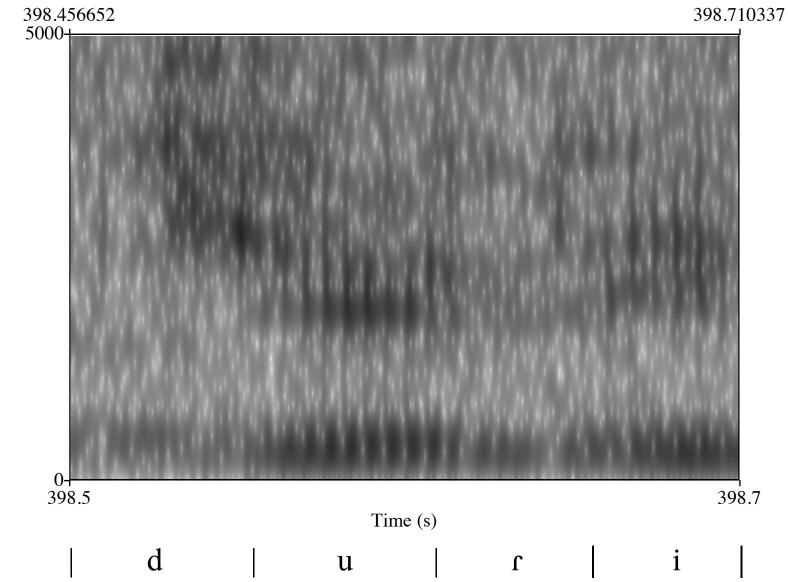


Figure 13. Extremely fronted /u/ : *duty*

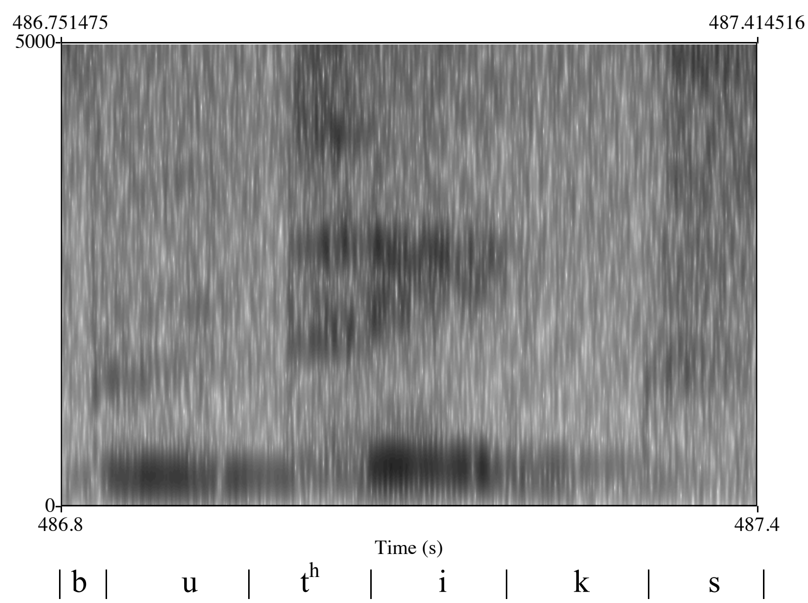


Figure 14. Not extremely fronted /u/ : *boutiques*

Bibliography

Allan, W.S. and Starks, D. (1999). 'No one sounds like us?' A comparison of New Zealand and other southern hemisphere Englishes. In Bell, A., and Kuiper, K. (Ed.), *New Zealand English.* Amsterdam and Philadelphia: John Benjamins Publishing Company. 53-83.

Baayen, R.H. (2008). *Analyzing Linguistic Data: A Practical Introduction to Statistics using R.* Cambridge: Cambridge University Press.

Barham, I.H. (1965). *The English Vocabulary and Sentence Structure of Maori Children* (Educational Research Series, no. 43). Wellington: New Zealand Council for Educational Research.

Batterham, M. (1999). The apparent merger of the front centering diphthongs – EAR and AIR – in New Zealand English. In Bell, A., and Kuiper, K. (Ed.), *New Zealand English.* Amsterdam and Philadelphia: John Benjamins Publishing Company. 111-145.

Bauer, L. (1994). Introducing the Wellington Corpus of Written New Zealand English. *Te Reo* 37, 21-28.

Bauer, W. (1993). *Maori.* London and New York: Routledge.

Bayard, D. (1987). Class and change in New Zealand English: a summary report. *Te Reo* 30, 3-26.

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. (1999a). Maori and Pakeha English: A case study. In Bell, A., and Kuiper, K. (Ed.), *New Zealand English.* Amsterdam and Philadelphia: John Benjamins Publishing Company. 221-248.

Bell, A. and Holmes, J. (Ed.) (1990). *New Zealand Ways of Speaking English.* Clevedon and Philadelphia: Multilingual Matters LTD.

Bell, A. and Holmes, J. (1991). New Zealand. In Cheshire, J. (Ed.), *English around the World: Sociolinguistic perspectives.* Cambridge: Cambridge University Press. 153-168.

Bell, A. and Kuiper, K. (Ed.) (1999b). *New Zealand English.* Amsterdam and Philadelphia: John Benjamins Publishing Company.

Benton, R.A. (1966). *Research into the English Language Difficulties of Maori School Children 1963-1964.* Wellington: Maori Education Foundation.

Bosch, L. and Sebastian-Galles, N. (2003). Simultaneous bilingualism and the perception of a language- specific vowel contrast in the first year of life. *Language and Speech* 46(2–3), 217–243.

Burns, T.C., Werker, J.F., and McVie, K. (2003). Development of phonetic categories in infants raised in bilingual and monolingual environments. In Beachley, B., Brown, A. and Conlin, F. (Ed.), *Proceedings of the 27th annual Boston University conference on language development.* Boston: Cascadilla Press.

Docherty, G., Hay, J., and Walker, A. (2006). Sociophonetic patterning of phrase-final /t/ in New Zealand English. In Warren, P., and Watson, C. I. (Ed.), *Proceedings of the 11th Australian International Conference on Speech Science & Technology.* 378-383.
Dubois, S. & Horvath, B.M. (2003). Creoles and Cajuns: A portrait in black and white. *American Speech* 78(2), 192-207.
Easton, A. and Bauer, L. (2000). An Acoustic Study of the Vowels of New Zealand English. *Australian Journal of Linguistics* 20(2): 93-117.
Eckert, P. (1996). The whole woman: Sex and gender differences in variation. In Brenneis, D. and Macauley R.K.S. (Ed.), *The Matrix of Language: Contemporary Linguistic Anthropology.* Boulder: Westview Press.
Eckert, P. (2000). *Linguistic variation as a social practice.* . Oxford: Blackwell.
Fought, C. (1999). A majority sound change in a minority community: /u/-fronting in Chicano English. *Journal of Sociolinguistics* 3: 5-23.
Gal, S. (1979). *Language shift: Social determinates of linguistic change in bilingual Austria.* New York: Academic Press.
Gibson, D. (1976). A thesis on *EH*. Unpublished MA dissertation, Vancouver: University of British Columbia. Referenced in Bell, A., and Kuiper, K. (Ed.), *New Zealand English.* Amsterdam and Philadelphia: John Benjamins Publishing Company.
Gordon, E., Campbell, L., Hay, J., Maclagan, M., Sudbury, A., and Trudgill, P. (2004). *New Zealand English: Its Origins and Evolution.* Cambridge: Cambridge University Press.
Gordon, E. and Maclagan, M. (1990). A longitudinal study of the 'ear/air' contrast in New Zealand speech. In Bell, A. and Holmes, J. (Ed.), *New Zealand Ways of Speaking English*. Philadelphia: Multilingual Matters LTD. 129-148.
Holmes, J. (1995). Time for /t/: initial /t/ in New Zealand English. *Australian Journal of Linguistics* 15, 127-156.
Holmes, J. (1996). Collecting the Wellington Corpus of Spoken New Zealand English: some methodological challenges. *New Zealand English Journal* 10, 10-15.
Holmes, J. (1997). Maori and Pakeha English: Some New Zealand social dialect data. *Language in Society* 26: 65-101.
Holmes, J. and Bell, A. (1992). On shear markets and sharing sheep: The merger of EAR and AIR diphthongs in New Zealand English. *Language Variation and Change* 4: 251-273.
Holmes, J., Bell, A. and Boyce, M. (1991). *Variation and Change in New Zealand English: a Social Dialect Investigation*. Project Report to the Social Sciences Committee of the Foundation for Research, Science, and Technology. Wellington: Victoria University.
Jacob, J. (1991). A grammatical comparison of the casual speech of Maori and Pakeha women in Levin. *Te Reo* 34, 53-70.
Kuiper, K. and Bell, A. (1999). New Zealand and New Zealand English. In Bell, A. and Kuiper, K. (Ed.), *New Zealand English*. Philadelphia: John Benjamins Publishing Company. 11-22.
Labov, W. (1963). The social motivation of a sound change. *Word* 19, 273-309.
Labov, W. (1966). *The social stratification of English in New York City.* Washington: Center for Applied Linguistics.
Labov, W. (1972). *Sociolinguistic patterns.* Philadelphia: University of Pennsylvania Press.
Labov, W., Ash, S. and Boberg, C. (1996). A National Map of the Regional Dialects of American English.

http://www.ling.upenn.edu/phono_atlas/NationalMap/NationalMap.html, accessed 22 April 2009.
Labov, W. (2001). *Principles of Linguistic Change: Social Factors*. Oxford: Blackwell Publishers.
Labov, W. (2006). A sociolinguistic perspective on sociophonetic research. *Journal of Phonetics* 34: 500-515.
Ladefoged, P. (2001). *A Course in Phonetics.* Boston: Heinle & Heinle.
Mackey, W.F. (1965). Bilingual interference: Its analysis and measurement. *Journal of Communication* 15(4), 239-249.
Major, R.C. (2008). Transfer in second language phonology: A review. In Hansen Edwards, J.G. and Zampini, M.L. (Ed.), *Phonology and Second Language Acquisition*. Philadelphia: John Benjamins Publishing Company. 63-94.
McArthur, T. (2002). *The Oxford Guide to World English.* Oxford: Oxford University Press.
McCallum, J. (1978). In search of a dialect: an exploratory study of the formal speech of some Maori and Pakeha children. *New Zealand Journal of Educational Studies* 13, 133-143.
Meyerhoff, M. (1994). "Sounds pretty ethnic, eh?": a pragmatic particle in New Zealand English. *Language in Society* 23, 367-388.
Moore, C. (1990). Kiwis say an "I" in unique way. *The Press*. Christchurch, March 28.
Mougeon, R. and Nadasdi, T. (1998). Sociolinguistic discontinuity in minority language communities. *Language* 74(1), 40-55.
Odlin, T. (1989). *Language Transfer*. Cambridge: Cambridge University Press.
ONZE website. (2009). http://www.ling.canterbury.ac.nz/onze/index.html, accessed 5 April 2009.
Paradis, J. and Navarro, S. (2003). Subject realization and crosslinguistic interference in the bilingual acquisition of Spanish and English: what is the role of the input? *Journal of Child Language* 30, 371-393.
Poplack, S. (1980). The notion of plural in Puerto Rican Spanish: Competing constraints on /s/ deletion. In Labov, W. (Ed.), *Locating language in time and space.* New York: Academic Press. 55-68.
Richards, J. (1970). The language factor in Maori schooling. In Ewing, J. L., and Shallcrass, J. (Ed.), *Introduction to Maori Education.* Wellington: New Zealand Universities Press. 122-132.
Robertson, S. (1996). Maori English and the bus-driving listener: a study of ethnic identification and phonetic cues. *Wellington Working Papers in Linguistics* 8, 54-69.
Sanchez, L. (2003). *Quechua-Spanish bilingualism interference and convergence in functional categories.* Philadelphia: John Benjamins Publishing Company.
Schreier, D. (2003). Convergence and language shift in New Zealand: Consonant cluster reduction in 19th Century Maori English. *Journal of Sociolinguistics* 7(3), 378-391.
Statistics, New Zealand (2006). 2006 Census Products and Services. http://www.stats.govt.nz/census/census-outputs/.
Stockwell, R. and Bowen, J. (1965). *The sounds of English and Spanish*. Chicago: University of Chicago Press.
Stubbe, M. and Holmes, J. (1999). Talking Maori or Pakeha in English: Signalling Identity in Discourse. In Bell, A., and Kuiper, K. (Ed.), *New Zealand English.* Amsterdam and Philadelphia: John Benjamins Publishing Company. 249-278.

Sundara, M. and Polka, L. (2008). Discrimination of coronal stops by bilingual adults: The timing and nature of language interaction. *Cognition* 106, 234-258.
Sundara, M., Polka, L., and Baum, S. (2006). Production of coronal stops by simultaneous bilingual adults. *Bilingualism: Language and Cognition* 9(1), 97-114.
Tagliamonte, S.A. & D'Arcy, A. (2004). He's like, she's like: The quotative system in Canadian youth. *Journal of Sociolinguistics* 8(4), 493-514.
Thomas and Kendall. (2007-2009). NORM Website. http://ncslaap.lib.ncsu.edu/tools/norm/about_norm1.php, accessed 11 April 2009.
Trubetzkoy, N. (1939). *Fundamentals of Phonology.* Goettingen: Vandenhoek and Ruprecht.
Trudgill, P. (1974). *The social differentiation of English in Norwich.* Cambridge: Cambridge University Press.
Trudgill, P., Gordon, E., and Lewis, G. (1998). New-dialect formation and Southern Hemisphere English: The New Zealand short front vowels. *Journal of Sociolinguistics* 2(1), 35-51.
Watson, C. I., Maclagan, M., and Harrington, J. (2000). Acoustic evidence for vowel change in New Zealand English. *Language Variation and Change* 12, 51-68.
Weinreich, U. (1953). *Languages in contact.* New York: Linguistic Circle of New York.
Wells, J. C. (1982). *Accents of English* (3 vols). Cambridge: Cambridge University Press.