CONTACT-INDUCED SPLITS IN TORONTO HERITAGE CANTONESE MID-VOWELS*

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ABSTRACT

This paper illustrates how contact can facilitate the development of phonemic and allophonic splits by presenting results from a study of vowel variation and change in Toronto Cantonese, a variety of Cantonese spoken in a heritage language contact setting. The data includes hour-long sociolinguistic interviews from speakers from two different generational backgrounds. The vowel space of each of 20 speakers was created based on F1 and F2 measurements of 105 tokens per speaker (15 tokens for each of 7 monophthongs). This paper focuses on the results for two of the mid vowels (/ɛ/ and /ɔ/) where there is evidence for the development of two phonetically conditioned splits based on velar context. A third split, discussed in Tse (In Press), may have triggered the development of these two splits among second-generation speakers. Phonological influence from Toronto English is one possible explanation for these splits. Overall, the results of this study may partially address why there are more documented cases of vowel mergers than vowel splits. Splits may be more likely to develop in certain contact settings that have been under-researched in the variationist sociolinguistics literature.

Key words: sound change, contact-induced change, language variation and change, heritage language phonology, Cantonese

1. INTRODUCTION

Labov (1994:331) has observed that "most reports of phonemic change involve mergers: the reduction in phonemic inventory". He says that this "would lead to the odd conclusion that most languages are steadily reducing their vowel inventory" (Ibid.). This, however, is not what overviews of language history show. Thus, "it stands to reason that just as many phonemic splits must take place as mergers" (Ibid.). Yet, if this were true, it remains a puzzle as to why the literature in variationist sociolinguistics has identified relatively few examples of splits.

More recently, Nagy and Meyerhoff (2008) have made a different observation about the research literature in variationist sociolinguistics. Based on a survey of leading journals in the

* I would like to thank Naomi Nagy for access to the HLVC Corpus as well as overall guidance and support. The HLVC Corpus is funded by a research grant from the Social Sciences and Humanities Research Council of Canada 410-2009-2330 (2009-2012) and is developed by Naomi Nagy, Alexei Kochetov, Yoonjung Kang, and James Walker. I would also like to thank Scott Kiesling and Shelome Gooden for feedback on earlier versions of this paper, Rachel Coulter for copy editing assistance, audience feedback from presentations at the University of Pittsburgh and Memorial University of Newfoundland (APLA 39 ALPA), the two anonymous reviewers of this paper, and all of the HLVC Research Assistants (full list at: http://projects.chass.utoronto.ca/ngn/HLVC/0_0_home.php).

field, they show only 28% of articles in the *Journal of Sociolinguistics* and only 11% of articles in *Language Variation and Change* focus on contact settings involving two or more languages. They note that the general lack of attention paid to variationist research in contact settings is strange given that over 50% of the world's population is multilingual.

In this paper, I suggest that these two observations are related to each other. Could phonemic splits be more likely to develop in under-researched contact settings? If so, then it should be no surprise that there are relatively few examples of splits in progress, as Labov (1994:331) has observed. This could be because of the lack of research observing the type of settings in which splits would most likely develop. In fact, as I discuss in §2, many attested cases of phonemic splits do involve contact. Contact linguists have also recognized the possibility of phonological influence in situations involving widespread bilingualism, though there is some debate about the specific processes involved (see Thomason and Kaufman 1988; Winford 2003; Winford 2007 on structural borrowing). Phonological influence in intense contact situations can lead to both phonological mergers and splits. Such contact settings however, are under-researched in variationist sociolinguistics (Nagy and Meyerhoff 2008).

This paper addresses the larger question of contact and phonemic splits by focusing on a subset of results from an ongoing project investigating vowel variation and change in Toronto Cantonese. Combined with the results of Tse (In Press), which uses the same data, the evidence from Toronto Cantonese shows the development of up to three splits *in progress*[1]. The development of three splits in the vowel system of one language within a relatively short period of time seems remarkable in light of Labov's statement that "it is not easy for students of the speech community to locate the ongoing creation of phonemic distinctions" (1994:331). I will argue that early bilingualism has facilitated the development of these three splits.

Toronto Cantonese is spoken in a contact setting involving a major sociolinguistic transition between an immigrant generation (GEN 1) born and raised in Hong Kong, where Cantonese is the dominant spoken language, and a second generation (GEN 2) raised in Anglophone Canada. The GEN 2 group speaks Cantonese as a HERITAGE LANGUAGE (HL) and English as their dominant language. For the purpose of this paper, I define HL BILINGUALISM as a specific type of bilingualism characterized by early acquisition of two languages and as a type of bilingualism that develops in a diasporic context. The speech of HL speakers has recently become an area of interest among researchers adopting variationist sociolinguistic (Nagy 2011) as well as experimental and classroom-based approaches (Polinsky and Kagan 2007). In §2, I synthesize socio-historical research on vowel splits with recent experimental research on vowels among early bilinguals (including HL speakers). This will motivate the hypothesis that the contact setting is crucial to the development of up to three splits in the Toronto Cantonese vowel system. I will present specific details of the present study in §3 followed by the results in §4. I will then discuss the implications of this study in §5 and conclude in §6.

2. CONTACT AND PHONOLOGICAL SPLITS: SOCIO-HISTORICAL AND EXPERIMENTAL EVIDENCE

We can see some evidence of the importance of contact in facilitating splits by examining the few cases of split that Labov (1994:§11.2) has identified. These cases include loss of the conditioning factor, borrowing, and lexical splits. Loss of the conditioning factor involves two inter-

[1] I highlight the term *in progress* to make clear that I am not claiming that all three of these splits have become phonemic splits. Rather, I present evidence suggesting that these three splits are in different stages of development.

acting phonological processes (usually diachronic). An example discussed by Labov (1994: 332). comes from Western Pennsylvanian English, a dialect characterized by both back vowel fronting and /l/-vocalization. Back vowel fronting occurs only for /u/ and /ow/ in contexts other than coda /l/ and coda /r/ while /l/-vocalization is a more recent change that involves the assimilation of coda /l/ with a preceding back round vowel resulting in the loss of /l/. These two processes result in minimal pairs involving a contrast between /u/ and /y/ such as 'too' [ty] vs. 'tool' [tu][2] (Ibid.). The outcome is, thus, a phonemic split.

The second case discussed by Labov is lexical borrowing, which can result in new phonemes and new phonological contrasts. One example is the development of the /f/~/v/ contrast in English. In Old English, [f] and [v] occurred in complementary distribution with [f] occurring only word-initially and [v] occurring only word-medially. This changed during Norman-era England when many French loan words containing [v] in word-initial position such as 'vagabond', 'very', 'village', 'voice', and 'vulgar' entered the English language (Labov 1994: 333). A phonemic contrast between /f/ and /v/ then developed.

While the previous two cases result in the reorganization of existing word classes (loss of the conditioning factor) or the addition of word classes (borrowing), the third case (lexical splits) results in the division of a preexisting word class into two classes "along lines that cannot be predicted by any rule" (Labov 1994: 333). Characteristic of lexical splits are patterns that appear to be phonetically or etymologically conditioned but have exceptions. One example discussed by Labov (1994: 334) is British broad /ɑː/, which developed in preceding nasals in many French loanwords such as 'dance' and 'chance' and in many words preceding front voiceless fricatives as in 'half', 'laugh', 'bath', 'pass', and 'past' (Ibid.: 334). The word 'grand', however is an exception even though it is a French loanword that follows this phonetic tendency. The outcome is a phonemic split in the words 'trap' and 'bath' (/æ/ vs. /ɑː/ in Received Pronunciation). These conditioning factors, however, are only tendencies in the synchronic phonology. Labov (1994: 334) argues that the only way to acquire these distinctions is through child language acquisition.

What is important to note is that two out of the three cases discussed by (Labov 1994:§11.2) involve contact. Borrowing loan words is one way in which contact-induced change can develop as in the example of the /f/~/v/ contrast in English. French loanwords were also involved in the 'trap'-'bath' split example. Borrowing of loan words, however, is only one possible process through which contact-induced change can develop. The other process is structural influence, a process that has previously been under-explored in studies of vowel variation and change in sociolinguistics.

Cases of structural influence, however, are much better documented in the contact linguistics literature. Thomason and Kaufman (1988) have proposed an analytical framework that describes how different types of contact settings can condition different outcomes of contact-induced change. Their model shows that structural influence[3] is more likely in higher intensity contact settings. Figure 1 shows the parts of their model that are most relevant to this paper. In red are examples I have identified. The two general factors included in this model are 1) a distinction between LANGUAGE MAINTENANCE and LANGUAGE SHIFT and 2) intensity of contact. LANGUAGE MAINTENANCE refers to cases in which the language of a community is maintained and transmitted to subsequent generations of speakers. LANGUAGE SHIFT, on the other hand, refers to cases in which one group acquires the language of another group and has an impact on the

[2] I converted the original transcriptions to IPA here.

[3] Thomason and Kaufman (1988) distinguish between "structural borrowing" and "structural interference". Here, I use the term "structural influence" as an all-encompassing term for the various structural outcomes of contact.

subsequent development of the TARGET LANGUAGE (TL). Intensity has a different meaning depending on whether the situation is one involving maintenance or shift.

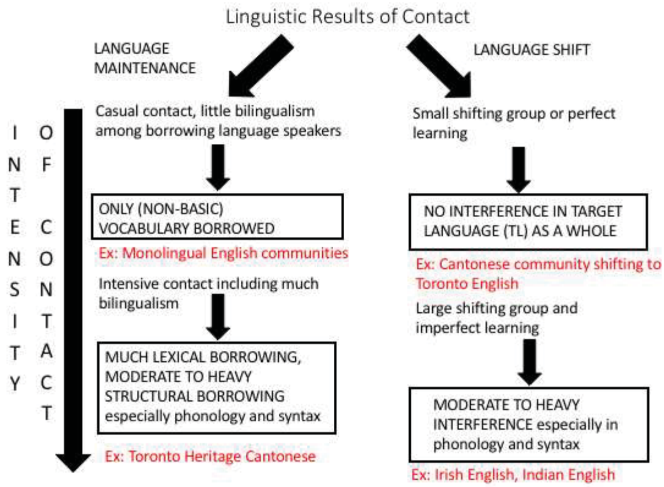

FIGURE 1.

Linguistic results of contact (chart adapted from Thomason and Kaufman 1988:50 with red print added to indicate examples discussed in §2)

The lowest intensity[4] maintenance situation is one that involves monolingualism and only casual contact with speakers of another language. This describes the overwhelming majority of studies in variationist sociolinguistics (Nagy and Meyerhoff 2008). Under such a setting, the only type of contact-induced change that is possible is the borrowing of loan words. If speakers in a community are monolingual, then it follows that they lack access to the grammatical system of another language. If they lack access to an alternative grammatical system, then structural transfer from another language through contact is unlikely at least in the short-term. The borrowing of loan words from another language, however, is still possible. Loanwords can in turn introduce new phonemic contrasts as in the example of the development of the /f/~/v/ contrast in English (Labov 1994:333; Thomason and Kaufman 1988:54). Higher intensity contact under maintenance involves bilingualism or multilingualism in a community. It is in higher intensity settings that Thomason & Kaufman describe the possibility of structural influence. If speakers are familiar with more than one language, then it becomes possible for them to transfer not only lexicon but also structural patterns from one language to another.

In shift settings, the difference between low and high intensity contact is related to the impact that non-native speakers of a language have on the subsequent development of the TL. An example of a low-intensity shift situation would be a small immigrant group learning the lan-

[4] Thomason & Kaufman (1988) describe several different levels of intensity. For the purpose of this paper, the important distinction is that between lower and higher intensity settings.

guage of a host society. Although first-generation adult immigrants often speak the host society language with phonological and syntactic features influenced by their native language, what is most important in Thomason & Kaufman's model is the extent to which these non-native features spread to subsequent generations of speakers of the TL. If these features do not persist and spread, then there is little to no impact on the development of the TL. A case of high-intensity shift would be one in which these non-native features do persist and spread across the speech community. Specific examples of high-intensity shift identified by Thomason & Kaufman (1988: 47) include languages spoken in isolated subgroups such as Indian English and Irish English. An example of a phonological feature of Indian English (as well as in English loan words in Hindi) is the systematic substitution of English alveolar stops with retroflex stops (Winford 2003:47). The use of retroflex rather than alveolar stops in Indian English is, thus, an example of the phonological outcome of a high-intensity shift situation conditioned by the type of contact setting. This illustrates an example of structural influence.

It is important to note that both maintenance and shift can occur within the same community. This is particularly true in immigrant communities. Thomason and Kaufman (1988:40), for example, describe the English spoken within a Yiddish-speaking immigrant community in the US as a shift situation and the Yiddish spoken as a maintenance situation. This example seems comparable to the heritage language community discussed in this paper. Hoffman and Walker (2010) have examined the English spoken by Cantonese-English bilingual speakers in Toronto. While the immigrant generation shows evidence of Cantonese structural influence in the English spoken, the second-generation of Cantonese-English bilinguals in Toronto is indistinguishable in their English speech from the English of other ethnic groups in Toronto (at least in the features examined by Hoffman and Walker 2010). This illustrates a low-intensity shift situation. The other language spoken within this community, Cantonese, would be a case of higher intensity maintenance. Under such a contact setting, structural influence from another language (in this case English) is described as more likely than in a low-intensity maintenance setting such as in a monolingual English speaking community. The extent to which structural influence is present is an empirical question.

Experimental studies of the vowels of speakers with different types of language backgrounds support the general consequences of different contexts for languages in contact that Thomason & Kaufman (1988) have proposed between monolingual communities (low intensity maintenance), bilingual communities in which many speakers acquired the second language as adults (interference through shift), and bilingual communities in which many speakers acquired both languages as children (high intensity maintenance). For instance, Chang et al. (2011) compared native speakers of English who also speak Mandarin either as a HL (acquired as a child) or as an L2 (non-heritage) acquired as an adult. While Mandarin has a phonological contrast between two high round vowels, /y/ and /u/, English has only one high round vowel, /u/, which Chang et al. (2011) describe as phonetically intermediate between the average F2 of Mandarin /y/ and Mandarin /u/. Although the advanced L2 Mandarin speakers did acquire a phonological contrast between /u/ and /y/, they still showed phonetic influence from English in terms of a relatively high F2 for /u/. The HL Mandarin speakers, on the other hand, produced Mandarin /u/ with lower F2 and thus more closely approximated the pronunciation of native monolingual speakers of Mandarin. In some cases, the HL Mandarin speakers produced Mandarin /u/ with even lower F2 than native monolingual Mandarin speakers resulting in the retraction of /u/, the exact opposite of what would be predicted if these speakers were assimilating their Mandarin system with their English system. Chang et al. (2011) also show that the HL Mandarin speakers produced the greatest average F2 difference between Mandarin /u/ and English /u/.

Baker and Trofimovich (2005) showed similar differences between early and late Korean-English bilinguals. Early bilinguals showed evidence for bi-directional influence resulting in distinct vowel systems for their English and Korean. Those that acquired Korean as adults, however, showed only uni-directional influence from their native English to Korean. Other studies that examined the vowel systems of HL speakers or other early bilinguals include studies of speakers of French (Mack 1990), Western Armenian (Godson 2004), Spanish (Ronquest 2013), and Arabic (Saadah 2011). All of these studies have shown that the vowel space of early bilinguals is characterized by maintenance of phonological contrasts. This is likely facilitated by early age of acquisition of two languages. Where there are differences with successful adult L2 learners is in the low-level phonetic realization of vowels. While adult L2 speakers sometimes assimilate L2 sounds with the most phonetically similar sound in their native language, HL speakers sometimes show the opposite pattern. They show dissimilation between phonetically similar sounds in their two languages, possibly as a way of maintaining cross-linguistic phonetic distinctions.

The crucial issue for the purpose of this paper is the implications these experimental findings may have for the diachronic development of vowel systems in languages spoken in bilingual communities. One study that illustrates the long-term impact that sustained bilingualism can have is Stewart (2014), which documented a very similar phenomenon in the vowel system of Pijal Media Lengua, a bilingual mixed language that historically developed from Spanish and Quichua. Traditionally, both Media Lengua and Quichua have been described as languages with only three vowels (/i/, /u/, and /a/) while Spanish has five (/i/, /u/, /e/, /o/, /a/). Stewart's acoustic analysis of Pijal Media Lengua, however, shows evidence for up to eight different vowel categories, each of which derives from either Spanish or Quichua. Thus, Quichua derived words with /i/ were shown to be significantly different from Spanish derived words with /i/. The same applies to the other vowels traditionally described as the same in both Spanish and Quichua. What is particularly remarkable about the Pijal Media Lengua case is how phonetically similar vowels in Spanish and Quichua maintained relatively distinct pronunciations for multiple generations. Furthermore, more recent work (Stewart, p.c.)[5] has even shown that Pijal Media Lengua speakers are able to perceive differences between mid and high vowels contrary to what would be expected if Pijal Media Lengua only had three vowels as has traditionally been described. Although Pijal Media Lengua is not a HL per se, it historically developed in an intense contact situation as is the case for HLs. Thus, through the Media Lengua example, we can see that one of the potential consequences of sustained inter-generational maintenance of bilingualism is maintenance of cross-linguistic vowel distinctions and hence even possible expansion of a language's sound inventory.

An important finding from these aforementioned studies is the lack of evidence for vowel mergers[6]. This is quite a contrast to what has been documented in much of the variationist literature on monolingual communities as noted by the discussion in the introduction of this paper. The mutual influence of vowel systems can sometimes result in increasing cross-linguistic phonetic differences between similar vowels in two languages. Vowel systems characterized by cross-linguistic dissimilation can even lead to the emergence of a larger vowel inventory as evi-

[5] E-mail correspondence: April, 10, 2016.

[6] I would like to thank one of the reviewers for mentioning a vowel merger in Michif French (cf. Rosen and Lacasse 2014) as an exception to this pattern. For the purpose of this paper, my main focus is to highlight the possibility of phonemic splits in intense contact settings even if this is not always an outcome of high intensity contact.

denced by work on Pijal Media Lengua (Stewart 2014). Thus, early bilingualism appears to be more dissimilatory while late bilingualism appears to be more assimilatory. If HL phonological development leads to different structural outcomes from adult L2 phonological development, we can expect different outcomes from contact-induced change based on whether adult L2 speakers of a language (high intensity shift) or HL speakers of a language (high intensity maintenance) are the primary agents of change. While cross-linguistic assimilation would be favorable to the diachronic development of mergers, dissimilation would be more favorable to the development of splits. The ability to make more phonetic distinctions than monolingual speakers could make the development of splits more likely in communities with widespread early bilingualism. One place to investigate the possible development of splits would be in inter-generational changes in allophonic conditioning. This is one aspect of HL phonology that has not been previously investigated with the exception of Tse (In Press).

3. RESEARCH CONTEXT AND METHODS

3.1. Research context and data

The source of data for the present study is the HerLD (Heritage Language Documentation) Corpus, a product of the Heritage Language Variation and Change (HLVC) in Toronto Project (Nagy et al. 2009; Nagy 2011). The corpus includes hour-long sociolinguistic interviews of 40 speakers of each of eight heritage languages (Cantonese, Faetar, Hungarian, Italian, Korean, Polish, Russian, and Ukrainian) spoken in Toronto. For each language, the corpus includes two or three generations of speakers. This data was transcribed by native speakers (including heritage speakers) of each of these languages using the program ELAN (Sloetjes and Wittenburg 2008).

The present study compares two generations of Cantonese speakers. First-generation (GEN 1) speakers include those born and raised in Hong Kong. All GEN 1 speakers immigrated to Canada as adults and have lived in the Greater Toronto Area (GTA) for at least 20 years. They all speak Cantonese as a native language. Many but not all have also acquired English. The second-generation (GEN 2) consists of speakers who were raised in the GTA. All GEN 2 speakers speak English as a dominant language and have acquired Cantonese primarily in a home context. GEN 2 speakers are HL bilingual speakers of both English and Cantonese while GEN 1 speakers who also speak English are adult L2 bilingual speakers.

According to Ethnologue, Cantonese has over 62 million speakers worldwide with about 52 million in Mainland China and 10 million elsewhere (Lewis et al. 2015). This includes approximately 5 million in Hong Kong and 5 million scattered across many different regions around the world including Southeast Asia, Australia, the US, and Canada. With over 372,000 speakers, Canada has one of the largest populations of Cantonese speakers outside of Asia (Statistics Canada 2012). The GTA alone has over 177,000 speakers making Cantonese the GTA's second most widely spoken language after English[7]. Most of the Cantonese speaking community arrived after the 1960s when Canadian immigration laws were relaxed. Because of the requirement that all GEN 1 participants in the HLVC project must be residents of the GTA for at least 20 years, all GEN 1 speakers arrived in Canada prior to the handover of Hong Kong from Britain

[7] Italian is the second most reported language with 178,000 speakers. The census, however, also showed 157,000 speakers who reported "Chinese" without specifying a specific variety. At least some of these speakers are likely to be Cantonese speakers. Therefore the actual number of Cantonese speakers is almost certainly higher than reported.

to the People's Republic of China in 1997. Thus, all GEN 1 speakers lived in Hong Kong during a time when it was a British colony rather than part of the People's Republic of China.

A list of the speaker groups examined is shown in Table 1. Data comes from a total of 20 speakers stratified according to sex and generational group. While many studies of HL speakers have focused on those with lower levels of proficiency in the HL (cf. Polinsky and Kagan 2007), the present study focuses on those at the higher end of the proficiency continuum as determined by self-reported ability to participate in an hour long spontaneous conversation in Cantonese. Ultimately, however, proficiency may be a less relevant issue for studies of HL phonology than it would be for studies of HL morpho-syntactic features. Polinsky and Kagan (2007:378), for example, have noted that "heritage speakers generally sound so native like – one could easily imagine that there would be no differences in phonological representations between the heritage language and the baseline, although that remains to be shown". They note that this even applies to those on the lower end of the proficiency continuum. All studies of HL vowel spaces discussed in §2 support the claim that HL speakers show no evidence of attrition in terms of phonological contrasts. What has not been as well researched, however, is phonetic conditioning of vowel variation. That will be the focus of this paper.

TABLE 1

Speaker Groups Examined

Group	*Total*
GEN 1 Female	5
GEN 1 Male	5
GEN 2 Female	5
GEN 2 Male	5
	N = 20

3.2. The current study

As mentioned above, the present study focuses on variation and change in the Cantonese monophthong system. Cantonese has a typologically large vowel inventory with 8 contrastive monophthongs and 11 contrastive diphthongs. The complete monophthong inventory is shown in Table 2. Of the eight contrastive monophthongs, all but /ɐ/ can occur in open syllable context. I follow the rime group convention used by Bauer and Benedict (1997). This involves using the long vowel diacritic to represent the seven vowel phonemes that can occur in open syllable context. Three of these vowels are described as having allophonic variants: /iː/, /uː/, and /œː/. Both /iː/ and /uː/ have lowered variants preceding velar consonants: [ɪ] and [ʊ] respectively. The third vowel with allophonic variants is /œː/, which is pronounced as [ɵ] (a mid central vowel higher than [ə]) before alveolar consonants and as [œː] elsewhere (open syllable and before velars).

Tse (In Press) showed that allophonic conditioning of /iː/ and /uː/ is maintained among GEN 2 speakers. This study also showed low-level phonetic changes developing for the allophones of /iː/ (henceforth represented as [iː] and [ɪk/ɪŋ]). In particular, GEN 2 speakers were shown to be increasing the acoustic difference between [iː] and [ɪk/ɪŋ]. This could be due to phonological influence from Toronto English, which has two phonetically similar vowels that are distinct phonemes rather than distinct allophones of the same phoneme. Thus, under the influence of a contrast between words such as 'seek' (/i/) vs. 'sick' (/ɪ/) in Toronto English, some

GEN 2 speakers may be increasing the acoustic distinction between [iː] and [ɪk/ɪŋ] in Cantonese. These speakers may be reanalyzing this phonetic difference in Cantonese as a phonemic difference as in the ‘seek’ vs. ‘sick’ contrast in English.

TABLE 2

Cantonese Monophthong Inventory

Front		*Central*	*Back*
Unrounded	*Rounded*		
iː	yː		uː
ɛː	œː	ɐ	ɔː
		aː	

In the present study, I extend the analysis developed in Tse (In Press) to the mid vowels, /ɛː/ and /ɔː/. If /iː/ and /uː/ have lowered variants preceding velar consonants, it seems possible that /ɛː/ and /ɔː/ would also lower in the same environment as a way of maintaining contrasts. Previous descriptions of Cantonese that describe the allophonic lowering of /iː/ and /uː/ do not show any phonetically conditioned differences in the pronunciation of /ɛː/ and /ɔː/ based on phonetic context (cf. Yue-Hashimoto 1972; Bauer and Benedict 1997; Zee 1999). The results that will be presented show evidence for the contrary among GEN 2 speakers.

3.3. Methods

The procedures for creating the vowel space for each of the 20 speakers involved reviewing each transcript for relevant tokens of each of the seven monophthongs that can (but do not always) occur in open syllable context. Each of the ELAN transcripts was exported into the phonetics analysis program PRAAT (Boersma and Weenink 2016). The review began after the 15-minute point of each interview. The first 15 tokens of each of these vowels were identified. F1 and F2 measurements for each of these tokens were taken and entered into a spreadsheet. The full token distribution for each speaker is shown in Table 3. Phonetic environment is shown using the rime group format (Bauer and Benedict 1997). The number of tokens based on phonetic environment depended on their general occurrence in the corpus data and on phonotactic constraints. For example, zero tokens of /œː/ in open syllable context and 15 in pre-velar context were measured because /œː/ in open syllable context is extremely rare in spontaneous speech. For /yː/, zero tokens were measured preceding velar consonants because /yː/ never occurs in this environment. For each of the two vowels analyzed in this paper, /ɛː/ and /ɔː/, the 15 tokens included 10 tokens in open syllable context and 5 tokens in pre-velar context. Tokens included only Tone 1 (the high-level tone in Cantonese). Exceptions were made in cases in which excluding other tones would have resulted in less than 15 tokens for a particular vowel category. This was especially the case for /uː/, /yː/, and /œː/, which were generally among the least common vowels across all contexts.

Once F1 and F2 measurements were recorded for each token, the data was uploaded to NORM, the vowel normalization suite (Thomas and Kendall 2007). The vowel measurements were normalized using the Lobanov normalization procedure. The output was then uploaded to the program R-brul (Johnson 2009) to run mixed effects models. Separate models were run for F1 and F2 for each vowel category. In each model, the dependent variable was either F1 or F2.

The independent variables included random effects and one fixed effect. The random effects were "speaker" and "word" while the fixed effect was "speaker group allophone".

TABLE 3

Token Distribution for Each Speaker

Vowel	*Open Syllable*	*Pre-velar*	*Other*	*Total*
/aː/	15 [aː]			= 15
/ɛː/	10 [ɛː]	5 [ɛːk]/[ɛːŋ]		= 15
/iː/	10 [iː]	5 [ɪk]/[ɪŋ]		= 15
/ɔː/	10 [ɔː]	5 [ɔːk]/[ɔːŋ]		= 15
/œː/		15		= 15
/uː/		10 [ʊk]/[ʊŋ]	5 [uː], [uːn]	= 15
/yː/	10 [yː]		5 [yːt], [yːn]	= 15
	= 60	= 40	= 5	N = 105

The "speaker group allophone" variable was created to address whether or not there is evidence for the development of allophonic splits among any of the speaker groups for the mid-vowels /ɛː/ and /ɔː/. This variable has eight possible values for each vowel category. GEN and Sex are combined to create four speaker groups (GEN 1 Female, GEN 1 Male, GEN 2 Female, and GEN 2 Male). Each speaker group has a total of two values corresponding to phonetic context: velar vs. open-syllable context. The total number of possible values for the speaker group allophone variable is eight.

The motivation for combining generation and sex into four speaker groups is previous HLVC project research showing that sex-based conditioning of variation among GEN 1 speakers may be different from that among GEN 2 speakers. Kang and Nagy (2012), for example, found that a VOT merger led by GEN 1 Female speakers of Toronto Korean lacks sex-based differentiation among GEN 2 speakers. Tse (In Press) found evidence for a greater distinction in the production of the two allophones of /iː/ among GEN 2 Toronto Cantonese speakers along the F2 axis. While GEN 2 Female speakers lead this change, sex-based conditioning is absent among GEN 1 speakers.

If GEN 2 speakers are innovating increasing acoustic distinction between the two allophones of /iː/ based on velar context, it could be possible that this change motivates other changes in the GEN 2 vowel system. This is the motivation for focusing specifically on velar context for the mid-vowels /ɛː/ and /ɔː/. Although, Tse (In Press) showed lack of inter-generational change for /uː/, it may be possible that pre-existing allophonic lowering of /uː/ before velar consonants may also motivate change in /ɔː/ in the same environment. The results presented in this paper, in fact, show evidence that innovation may be developing in velar context for both of these vowel categories.

4. RESULTS

4.1. The vowel /ɛː/

The first set of results focus on the vowel /ɛː/. Figure 2 shows zoomed-in plots of this vowel in open syllable vs. pre-velar context (represented as [ɛː] and [ɛːk/ɛːŋ]) for each of the four speaker groups while Table 4 shows the formant means for both contexts across these four groups. Table 4 also shows the difference in hertz between the formant means for the two allophones. These differences (in absolute values) indicate relative degree of allophonic split. Vowel plots showing the entire vowel space for each speaker group are included in the appendix.

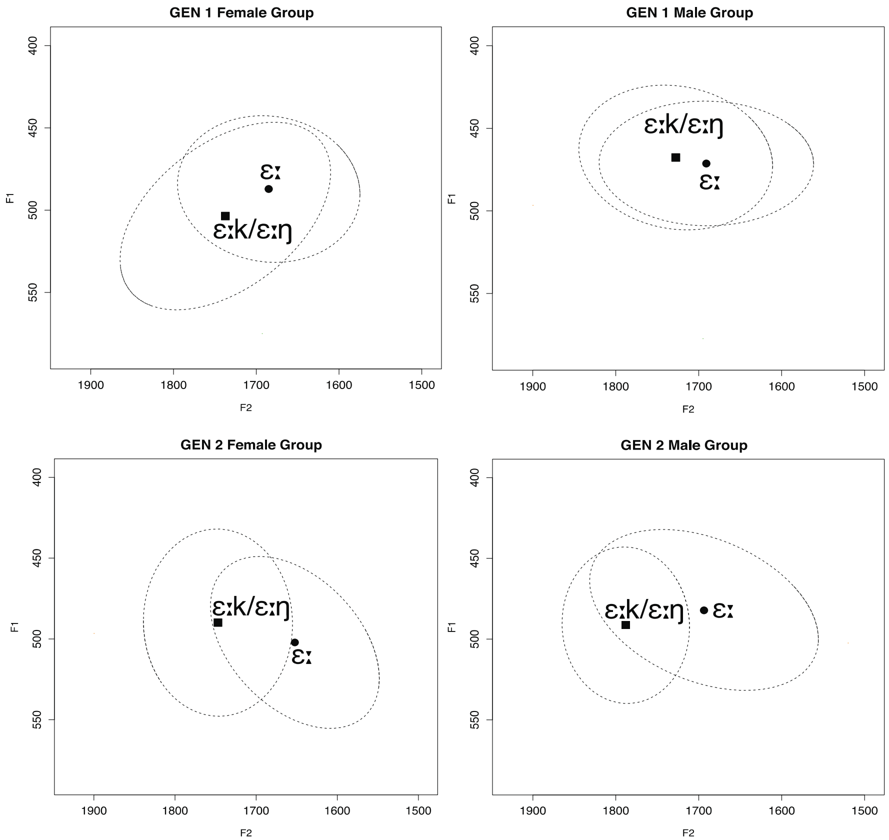

FIGURE 2

F1/F2 means of [ɛː] vs. [ɛːk/ɛːŋ] with ± 1 standard deviation indicated with ellipses

The results show evidence for the development of an allophonic split among GEN 2 speakers. As illustrated in Figure 2, the GEN 1 Male group shows substantial overlap in the F1/F2 means ± 1 standard deviation across both phonetic contexts. GEN 2 speakers, on the other hand, appear to be developing an allophonic split. Table 4 shows that the mean F1 difference between the two phonetic contexts is relatively small compared to the mean F2 differences. The mean F2 difference is 95 Hz for the GEN 2 Female group and 94 Hz for the GEN 2 Male group. These two values are larger than the differences for either of the GEN 1 groups (52 Hz for the female group, 37 Hz for the male group). An allophonic split, thus, appears to be developing along the F2 axis.

TABLE 4

Formant means (Hz) for [ɛː] and [ɛːk/ɛːŋ] and differences

Group	*F1 [ɛː]*	*F1 [ɛːk/ɛŋ]*	*F1 Dif.*	*F2 [ɛː]*	*F2 [ɛːk/ɛːŋ]*	*F2 Dif.*
GEN 1 F	487	504	17	1685	1737	52
GEN 1 M	471	468	3	1691	1728	37
GEN 2 F	502	490	12	1652	1747	95
GEN 2 M	482	491	9	1694	1788	94

TABLE 5

Best step-down model for F2 of /ɛː/

Speaker Group Allophone[a] r^2 = 0.058 p = 0.033*	***Coefficient***	***N***	***Mean (Hz)***
GEN 2 M [ɛːk/ɛːŋ]	40.36	25	1788
GEN 1 F [ɛː]	22.76	50	1685
GEN 1 F [ɛːk/ɛːŋ]	13.83	25	1737
GEN 1 M [ɛː]	13.35	50	1691
GEN 2 F [ɛːk/ɛːŋ]	2.938	25	1747
GEN 1 M [ɛːk/ɛːŋ]	-14.00	25	1728
GEN 2 M [ɛː]	-18.78	50	1694
GEN 2 F [ɛː]	-60.47	50	1652

[a] r^2 [random] = 0.347, r^2 [total] = 0.405

Table 5 shows the best-step down model for the F2 with speaker group allophone included as a statistically significant fixed effect. Here, we can see a relatively large difference in the coefficients for [ɛː] vs. [ɛːk/ɛːŋ] for the GEN 2 Female group (2.938 vs. -60.47). This is a difference of about 62 Hz. Similarly large is the [ɛː] vs. [ɛːk/ɛːŋ] difference for the GEN 2 Male group. The coefficient for [ɛː] is -18.78 while the coefficient for [ɛːk/ɛːŋ] is 40.65 amounting to a difference of about 58 Hz. In terms of relative coefficient rankings, the GEN 2 Male group is almost at both extreme ends. Therefore, this group has the greatest tendency to front [ɛːk/ɛːŋ] (higher F2) and the second highest tendency to retract [ɛː] (lower F2). Both the GEN 2 Female and GEN 2 Male group appear to be increasing the distinction between these two allophones along the F2 axis. In contrast, the GEN 1 Male group shows a coefficient of 13.35 for [ɛː] and -14.00 for [ɛːk/ɛːŋ] (a difference of 27.35 Hz) while the GEN 1 Female group shows a coefficient of 22.76 for [ɛː] and 13.83 for [ɛːk/ɛːŋ] (a difference of 8.93). These differences are smaller than the ones for the GEN 2 groups.

Table 6 shows the results of Tukey Post-Hoc tests to determine whether the F1/F2 differences between [ɛː] and [ɛːk/ɛːŋ] are significant for each speaker group. The results show that these differences are statistically significant only for the GEN 2 groups. The GEN 2 groups produce the vowel /ɛː/ with increasing differentiation based on velar context along the F2 axis. GEN 1 speakers as a whole, on the other hand, lack such differentiation. The differences for F1 are not significant for any group.

TABLE 6

Tukey post-hoc tests of differences between [ɛː] and [ɛːk/ɛːŋ]

Group	*F1*	*F2*
GEN 1 F	n.s.	n.s.
GEN 1 M	n.s.	n.s.
GEN 2 F	n.s.	$p = 0.001$**
GEN 2 M	n.s.	$p = 0.001$**

4.2. The vowel /ɔː/

In Table 7 are formant means for the vowel /ɔː/ across two phonetic contexts (represented as [ɔː] and [ɔːk/ɔːŋ]) for each of the four speaker groups. The difference in the F1 and F2 means across these two contexts is also included. These results show that the GEN 2 Male group has the greatest difference in F1 means across two phonetic contexts (46 Hz). This difference is more than twice as high as the next highest group (GEN 1 Female). Along the F2 axis, both of the GEN 2 groups have a relatively high difference across the two contexts (70 Hz for GEN 2 Female and 67 Hz for GEN 2 Male). The GEN 1 groups, however, appear to be split with the GEN 1 Female group showing the highest F2 difference (103 Hz) and the GEN 1 Male group showing the smallest F2 difference (27 Hz).

TABLE 7

Formant means (Hz) for [ɔː] and [ɔːk/ɔːŋ] and differences

Group	*F1 [ɔː]*	*F1 [ɔːk/ɔːŋ]*	*F1 Dif.*	*F2 [ɔː]*	*F2 [ɔːk/ɔːŋ]*	*F2 Dif.*
GEN 1 F	492	514	22	1240	1137	103
GEN 1 M	511	524	13	1213	1186	27
GEN 2 F	486	503	17	1267	1197	70
GEN 2 M	474	520	46	1194	1127	67

In order to visualize what these values mean, Figure 3 shows zoomed-in vowel plots of [ɔː] vs. [ɔːk/ɔːŋ] for each of the four speaker groups. As was the case for /ɛː/, the GEN 1 Male group appears to have the smallest differences while both of the GEN 2 groups show much more differentiation. The GEN 1 Female group also seems to show evidence of a split. Unlike for /ɛː/, however, results from statistical tests show significance only for F1 ($p < 0.001$***). The results from the Best Step-Down Model for F1 with speaker group allophone as a fixed effect are shown in Table 7.

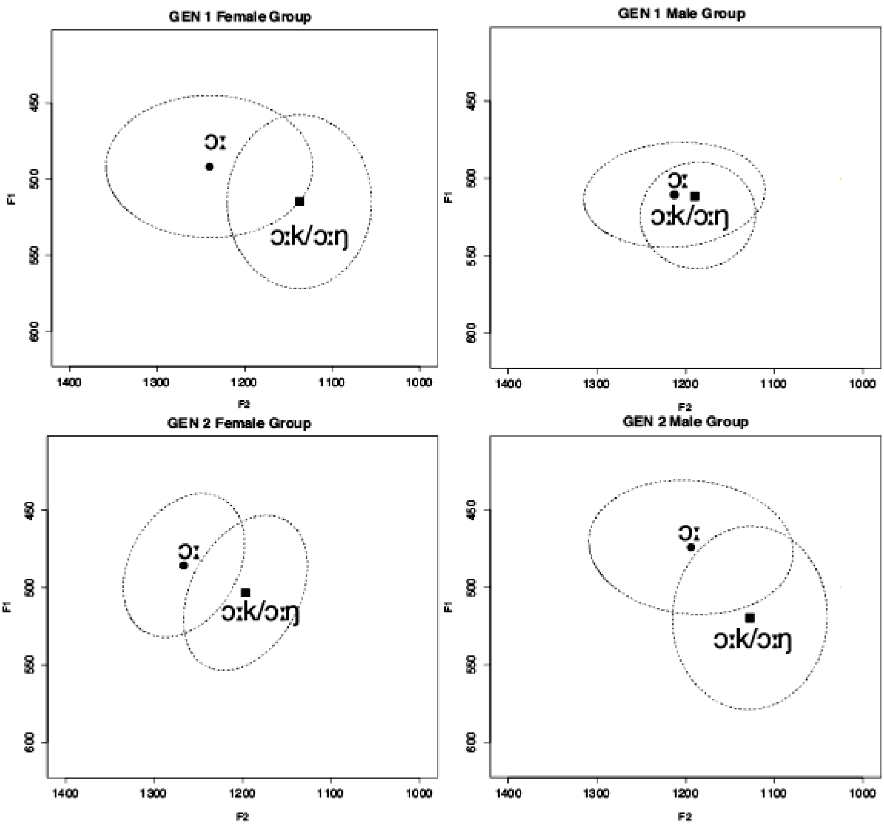

FIGURE 3.

F1/F2 means of [ɔː] vs. [ɔːk/ɔːŋ] with ± 1 standard deviation indicated with ellipses

The results in Table 7 show the GEN 2 Male group to be at both of the extreme ends in terms of coefficient rankings. The GEN 2 Male group has the most lowered (highest F1) variants of [ɔːk/ɔːŋ] as well as the most raised (lowest F1) variants of [ɔː]. The coefficient for the former is 24.08 and -34.30 for the latter amounting to a difference of about 58 Hz. All of the other groups have a much smaller [ɔː] vs. [ɔːk/ɔːŋ] difference including the GEN 2 Female group (3.538 vs. -23.39 or about 20 Hz).

TABLE 7

Best step-down model for F1 of /ɔː/

Speaker Group Allophone[a] ***$r^2 = 0.16$ $p < 0.001$******	***Coefficient***	***N***	***Mean (Hz)***
GEN 2 M [ɔːk/ɔːŋ]	24.08	25	520
GEN 1 M [ɔːk/ɔːŋ]	22.52	25	523
GEN 1 F [ɔːk/ɔːŋ]	18.53	25	515
GEN 2 F [ɔːk/ɔːŋ]	3.538	22	503
GEN 1M [ɔː]	3.417	50	511
GEN 1 F [ɔː]	-14.49	50	492
GEN 2 F [ɔː]	-23.39	53	486
GEN 2 M [ɔː]	-34.20	50	474

[a] r^2 [random] = 0.069, r^2 [total] = 0.229

Table 8 shows the results of post-hoc tests to determine whether any of these differences are significant. They show that only the [ɔː] vs. [ɔːk/ɔːŋ] difference for the GEN 2 Male group is significant ($p < 0.001$***). The 20 Hz difference in coefficient values for the GEN 2 Female group is not significant. These results show evidence for the emergence of a sex-based difference among GEN 2 speakers for /ɔː/ that is not present for /ɛː/.

TABLE 8

Tukey post-hoc tests of differences between [ɔː] and [ɔːk/ɔːŋ]

Group	*F1*
GEN 1 F	n.s.
GEN 1 M	n.s.
GEN 2 F	n.s.
GEN 2 M	$p < 0.001$***

5. DISCUSSION

The results from Tse (In Press) combined with the results presented in §4 show evidence for the development of up to three phonemic splits in progress in Toronto Heritage Cantonese. These splits all appear to be at different stages in progress and may be motivated by phonological influence from English. Thus, the specific contact setting may have played an influential role in the development of these splits.

The first split, reported in Tse (In Press), involves the vowel /iː/ and is the most advanced of the three. Descriptions of Hong Kong Cantonese describe an allophonic split in which /iː/ is pronounced as [ɪk/ɪŋ] when preceding velar consonants and as [iː] elsewhere (Yue-Hashimoto 1972; Bauer and Benedict 1997). Tse (In Press) confirms the presence of this allophonic distinction among GEN 1 Toronto Cantonese speakers and also shows evidence that these two allophones have become increasingly distinct among GEN 2 Toronto speakers.

One explanation for the increasing differentiation between [iː] and [ɪk/ɪŋ] is influence from Toronto English phonology. If this is the case and it is HL speakers who acquired both English and Cantonese at a young age that are increasing the phonetic difference between these two allophones, it seems possible that what may have initially been an allophonic split in Hong Kong Cantonese has become a phonemic split. Ultimately, perceptual tests would need to be conducted in order to determine whether or not GEN 2 Toronto Cantonese speakers perceive the two allophones as distinct vowels.

The increasing distinction between [ɪk/ɪŋ] and [ɪː] may be analogous to the development of the /f/~/v/ contrast in English. As discussed in §2, [f] and [v] were allophones of the same phoneme in Old English. Likewise, both [iː] and [ɪ] are recognized as allophones of the same phoneme in Hong Kong Cantonese. Historic contact between French and English brought French loan words containing [v] in other environments into the English language. This eventually led to the [f]~[v] distinction to become a phonemic one (Labov 1994: 333; Thomason & Kaufman 1988: 54). Similarly, early acquisition of English in Toronto among GEN 2 Cantonese speakers has given access to a phonemic distinction between /i/ and /ɪ/. This distinction in Toronto English may have motivated increasing phonetic distinction among GEN 2 speakers in their Cantonese speech.

The results from this paper build on the findings in Tse (In Press) by showing evidence for splits in progress in two other vowel categories. The first involves the vowel category /ɛː/. There is a lack of differentiation before velars among GEN 1 speakers. GEN 2 speakers, on the other hand, produce significantly more fronted (higher F2) variants of /ɛː/ in pre-velar contexts than they do in open syllable contexts suggesting an innovation among GEN 2 speakers. The other vowel showing evidence of a split is /ɔː/. For this vowel category, however, the split appears to be innovated among GEN 2 Male speakers, who produce the most raised (lowest F1) variants of /ɔː/ in open syllable context and the most lowered (highest F1) variants in pre-velar context. The GEN 2 Female group did not show a significant difference either along the F1 or F2 dimension based on velar context. The split in /ɔː/ is, thus, less advanced than the split in /ɛː/ since it is evident only in the GEN 2 Male group.

The more general question raised by these splits in progress is how contact could motivate their development. This may involve both social and structural factors as well as their interaction with each other. The social context has created the possibility of cross-linguistic structural influence from Toronto English to Cantonese. GEN 1 speakers were all born and raised in Hong Kong in an environment in which approximately 90% of the population spoke Cantonese. Though English was the language of government and commerce, a 1993 survey showed that only 33.7% of Hong Kong's population at the time was proficient in English (Joseph 1997:63). GEN 2 speakers grew up in a context in which English is the dominant language of everyday life and primary language of schooling. GEN 2 speakers are all fluent speakers of English. While previous research shows lack of substrate features in the English spoken by GEN 2 Toronto Cantonese speakers (Hoffman and Walker 2010), it may still be possible for English to have an influence on the Cantonese spoken by the same group of speakers. This is what appears to be the case for the increasing phonetic difference between [iː] and [ɪk/ɪŋ]. What is less apparent is how the other two splits may be motivated by influence from English phonology.

One explanation for the phonemic splits in the mid-vowels is that they are not independent of changes in the rest of the vowel system. The increasing phonetic distinction between [iː] and [ɪk/ɪŋ] could have become a trigger for other changes in the vowel system. The fronting of [ɛːk/ɛːŋ], for example, could have developed as a way of maintaining contrast between [ɪk/ɪŋ] and [ɛːk/ɛːŋ]. While evidence for a split in /ɛː/ was found for both GEN 2 Male and GEN 2 Female speakers, evidence for a split in /ɔː/ was found only among the GEN 2 Male group. The split in /ɔː/ appears to be the least advanced. Although the split in /ɔː/ could be motivated by the lowering of /uː/ in the same phonetic context, Tse (In Press) showed no evidence that GEN 2 speakers are further advancing the split in /uː/, which had already existed in Hong Kong Cantonese. Perhaps the reason that the split in /ɔː/ appears to be the least advanced is that there is no further advancement of a split in /uː/ as there is for /iː/.

The major limitation of this study is the relatively small number of vowel tokens examined in different phonetic contexts. This is currently being addressed in a larger study involving a larger set of vowel tokens. For the time being, this study has presented evidence for innovative splits among GEN 2 Toronto Cantonese speakers. This is an under-researched language in the variationist sociolinguistics literature. It is also a language spoken in a HL contact setting. As I have shown, this makes possible multiple types of changes that have not been as widely observed in monolingual settings. The potential for the development of phonemic splits in such a contact setting is a topic worth further investigation.

6. CONCLUSION

To conclude, this paper has shown how a high intensity contact setting (Thomason and Kaufman 1988) can facilitate the development of phonological splits. It has, thus, presented one plausible explanation for the question that Labov (1994:331) raises about why "it is not easy for students of the speech community to locate the ongoing creation of phonemic distinctions" (1994:331). Splits may be more likely to develop in high intense contact settings, which have been under-researched in the sound change literature. The results of the study presented in this paper showed evidence for up to three splits in progress in Toronto Heritage Cantonese.

The literature review in §2 showed several examples in which contact through the borrowing of loan words can lead to the development of phonemic splits. The contact situation shown in this paper, however, is a different type of contact situation that is only beginning to be researched in the variationist sociolinguistics literature (Nagy et al. 2009; Nagy 2011). A HL community includes speakers who have been exposed to two languages at an early age. This gives speakers access to an additional phonological system. The results show the innovation of phonetically conditioned splits based on velar context for Cantonese /ɛː/ and /ɔː/. The trigger for these changes may have been a phonological contrast in /i/ vs. /ɪ/ in English. This may have motivated increasing acoustic distinction between [iː] and [ɪk/ɪŋ] in Cantonese, which in turn may have motivated other changes including the split in the mid-vowels: /ɛː/ and /ɔː/.

If we are to better understand all the mechanisms involved in sound change, it is important to place more attention on understanding a greater variety of contact settings, some of which may show patterns of change that are otherwise less common in monolingual settings. This is a huge research gap that this paper is able to only partially address.

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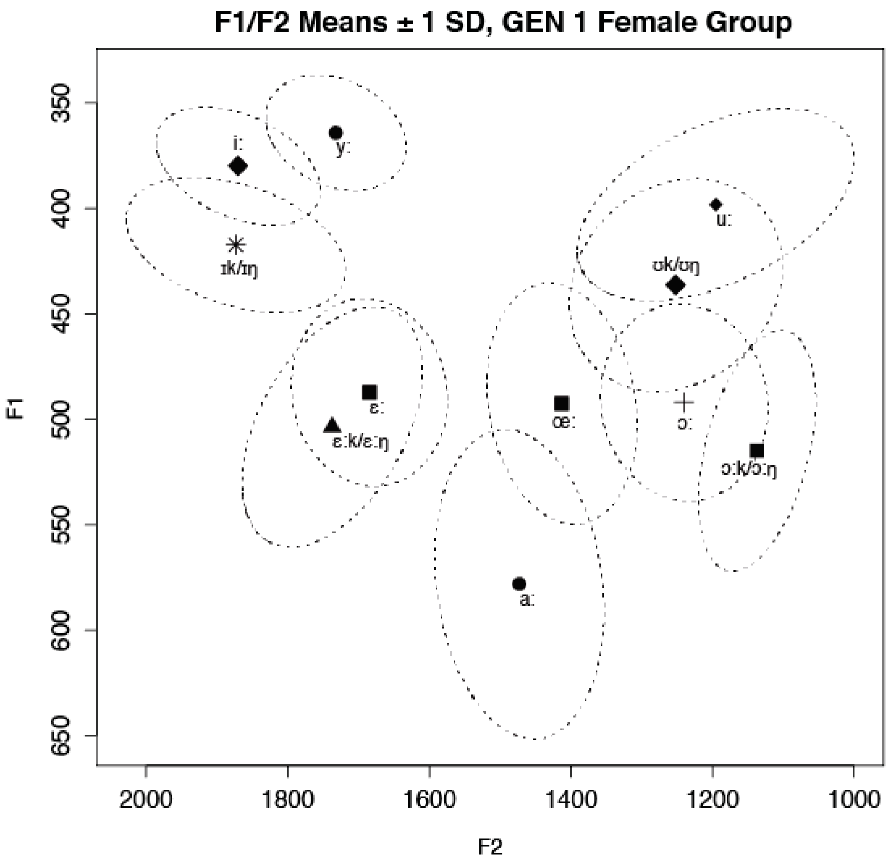
APPENDICES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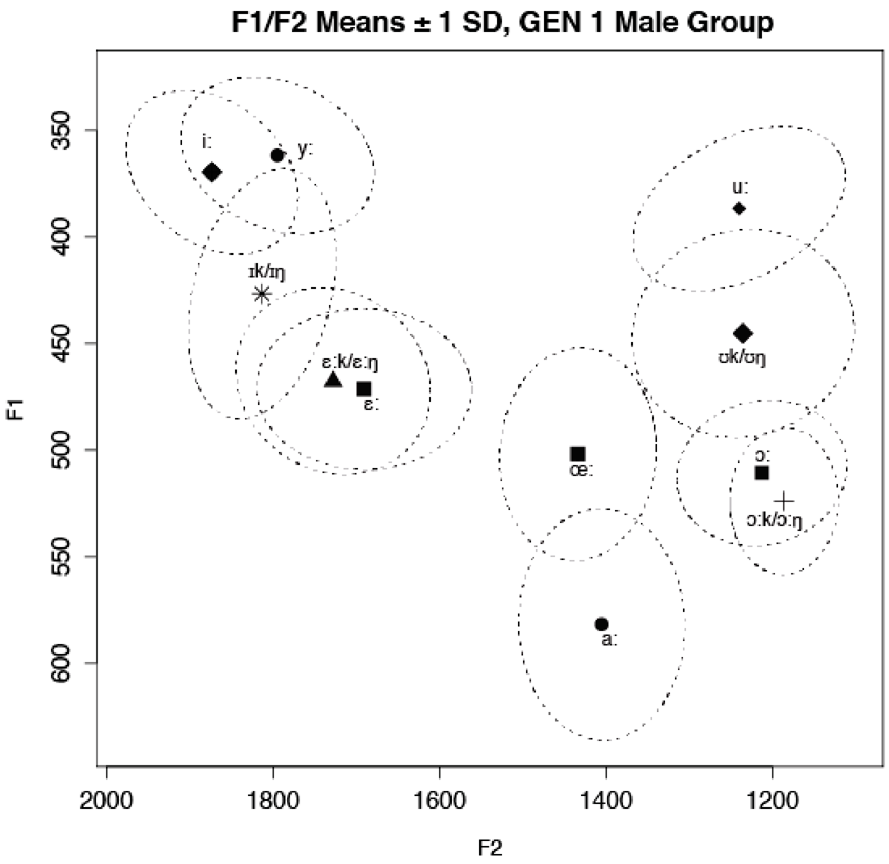
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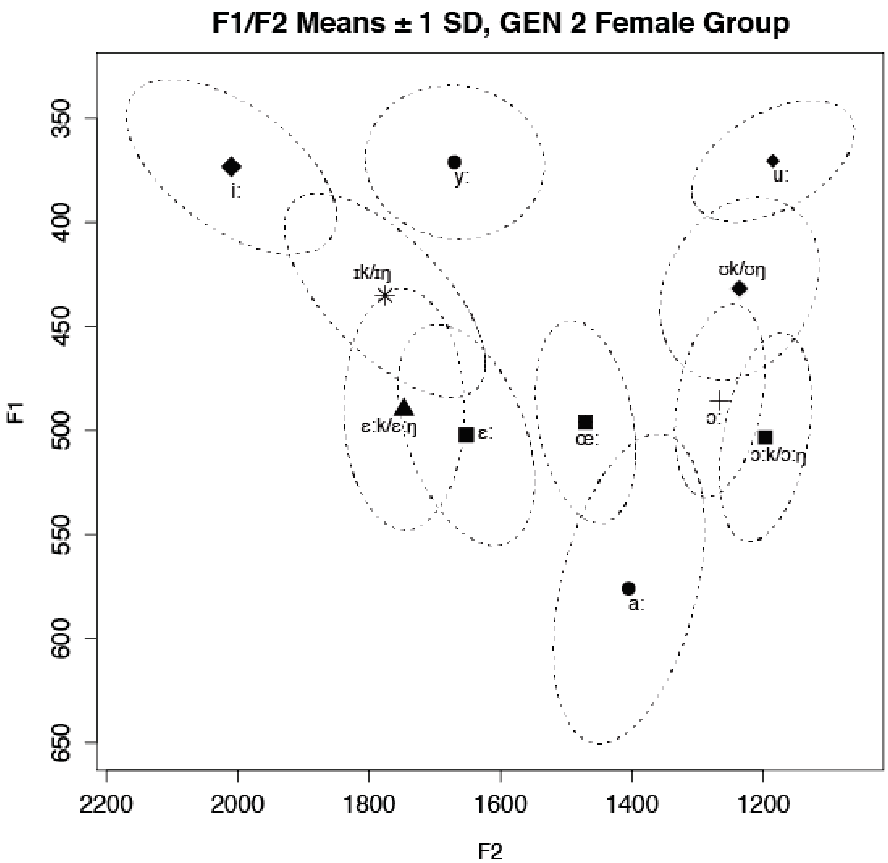
F1/F2 Means ± 1 SD, GEN 2 Female Group
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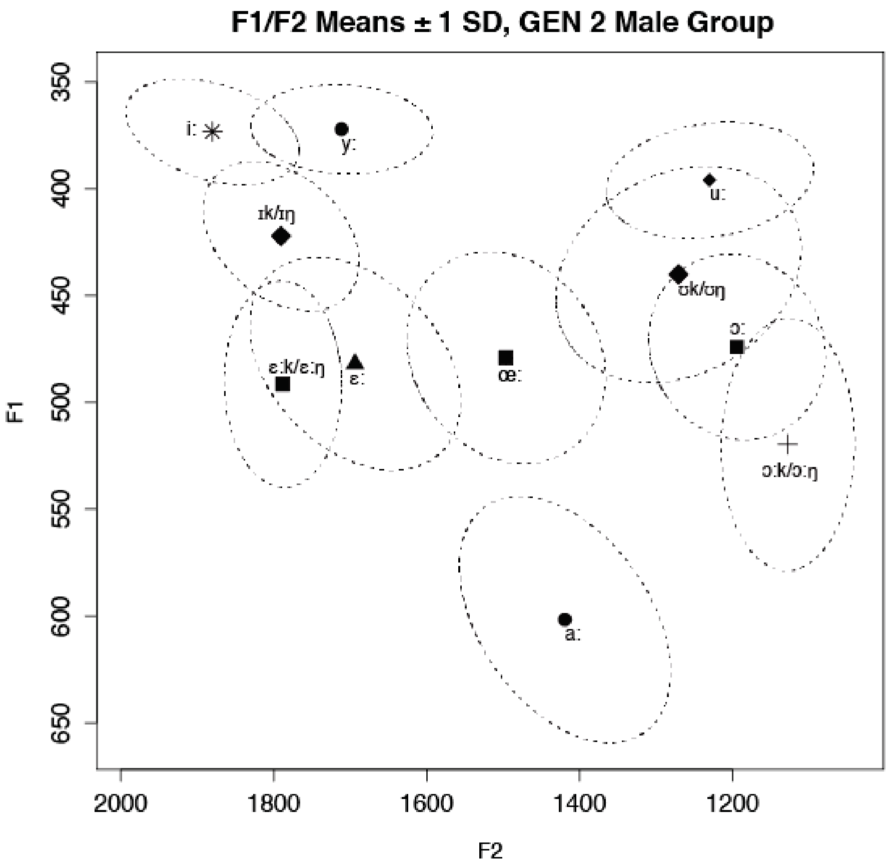
F1/F2 Means ± 1 SD, GEN 2 Male Group
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