VOWEL VARIATION AND CHANGE AMONG MIDDLE-CLASS FEMALE SPEAKERS IN ST. JOHN'S NEWFOUNDLAND: A REAL- AND APPARENT-TIME ACOUSTIC ANALYSIS

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Vowel Variation and Change Among Middle-Class Female Speakers in St. John's, Newfoundland: A Real- and Apparent-time Acoustic Analysis

By

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Abstract

The current study examines the Canadian Shift (e.g. Clarke et al. 1995; Boberg 2005) in middle class female St. John's English and includes an analysis of the phonological factors which condition it. More than 1100 tokens of /ɪ,ɛ,æ,ɑ,ʌ,ʊ/, as well as /o:/ and /u:/, are included in the analysis. Twelve participants are equally divided among three "Generational Groups": a younger and older cohort recorded in 2003 and a younger group recorded in 1982-83.

This combined diachronic/synchronic time approach offers both real and apparent-time evidence which suggests that some of the features of the Canadian English Shift, as outlined by Clarke et al. (1995) and Boberg (2005), are found in St. John's English. My results point to a parallel lowering and/or retraction process of both (ɪ) and (ɛ), indicating that the Canadian Shift is active in St. John's, at least to some degree. Strikingly, it is the older female Generational Group that appears to demonstrate the most innovative, or "mainland"-like features. These findings, which suggest that older speakers may play an important role in the adoption of innovative phonological variants, are not readily accounted for by current age-based models of language change.

Acknowledgments

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Finally, I'd like to thank my mother and father who have been there since the beginning offering their support and love. This is for you.

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List of Abbreviations[1]

ANAE	Atlas of North American English.
CE	Canadian English.
CS	Canadian Shift.
foll-MOA	Following manner of articulation.
foll-POA	Following place of articulation.
foll-Voicing	Following voicing quality.
ME	Montreal English.
MOA	Manner of articulation.
POA	Place of articulation.
pre-MOA	Preceding manner of articulation.
pre-POA	Preceding place of articulation.
pre-Voicing	Preceding voicing quality.
SJE	St. John's English.
WE	Winnipeg English.

[1] Abbreviations are given in alphabetical order.

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Chapter 1

Introduction

This study constitutes the first sociophonetic investigation of the English spoken in the Canadian province of Newfoundland and Labrador. Using acoustic analysis and a small sample of middle-class female speakers, it examines potential change in progress in the vowel system of the province's capital and largest city, St. John's.

The main focus of the study is the lax vowel system of St. John's English as spoken by middle class, female, native speakers. Though they do not agree as to the exact nature of these changes, a number of studies have confirmed the existence of change in progress in the (front) lax vowel system of younger speakers of Canadian English. The "Canadian Shift" – first proposed by Clarke, Elms and Youssef (1995) on the basis of lax vowel articulation in innovative southern Ontario speech – was preceded by the observations of Esling and Warkentyne (1993) on (æ) retraction in Vancouver English. Subsequently, a number of studies have been conducted on lax vowel articulation among younger speakers of Canadian English, among them Hoffman (1999) in Toronto, De Decker (2002) in southern Ontario, Boberg (2005) in Montreal, and Hagiwara (2006) in Winnipeg.

Acoustic analysis of vowel variation as a means to access change in progress is grounded by such work as the recently published Atlas of North American English (ANAE; Labov, Ash and Boberg, 2006). This phonological atlas represents a record of

(1) "regional dialects of English spoken in the urbanized areas of the United States and Canada in the years 1992-1999…", providing "…a view of the systematic sound changes in progress among the regional dialects of North America".

Sociolinguistic studies of St. John's English (Clarke 1991; cf. D'Arcy 2000, 2005) suggest that much linguistic change in the St. John's speech community involves the adoption of supralocal variants, or variants resembling those of General Canadian English, on the part of more upwardly mobile community members, while traditional local variants are increasingly on the decline. If this is so, we might also expect changes in the lax vowel system among younger and upwardly mobile residents of St. John's.

A secondary focus of this study is the investigation of change in the high back tense vowels /u:/ and /o:/ in St. John's English (SJE) – vowels which, particularly in the case of /u:/, are known to be undergoing centralization in a number of varieties of English. The incorporation of these tense variables may offer further insight into the social motivation of the adoption of supralocal norms. In addition, the study investigates the effects of phonological conditioning on each of the SJE vowels investigated, particularly with respect to the place, manner and voicing features of the following segment.

This study adopts a traditional Labovian sociolinguistic framework, with one exception – the incorporation of real-time evidence, while traditional Labovian sociolinguistic studies generally apply apparent-time methodologies only, using age-related differences to make inferences about language change in progress. However, as

Bailey (2002:314) notes, apparent-time data are only a surrogate for real-time evidence. Bailey suggests that the best approach is to combine both, with the relative strengths of each offsetting the weaknesses of the other. Any inferences made about language change in progress based on apparent-time evidence can then be verified on the basis of real-time data. Moreover, any similarities found between the two types of evidence will offer added confirmation of the validity of using apparent-time data as a surrogate for real-time data.

In addition, the incorporation of both types of approach provides further information on the relationship that exists between individual linguistic change and more general linguistic change within the individual's speech community. Results for this study offer a potential testing-ground for current age-based models of linguistic change.

Section 1.1 discusses in more detail the Canadian Shift; this is followed in Section 1.2 by an outline of the lax vowel system in SJE and, more generally, Newfoundland English. Section 1.3 provides a more detailed description of the use of real and apparent-time data in sociolinguistic studies, and how these differing types of data can be used to interpret the results from the current study in terms of age-based models of linguistic change. Chapter 2 outlines the methodology used in this study, while results are presented in Chapters 3 and 4. This is followed by a concluding chapter, which relates the findings of this investigation to current models of language change.

1.1. Canadian English – The Canadian Shift

Labov (1991) viewed Canadian English (CE) as having a more stable vowel system than other dialects of North American English, such as those undergoing the Northern Cities Shift and the Southern Shift. Clarke et al. (1995) countered this claim and presented evidence for a Canadian English lax vowel shift, often referred to as the Canadian Shift (CS). Their study, a primarily impressionistic analysis of mainland (especially Ontario) CE was based on 1600 tokens of five lax vowels (the vowels in words like *kit, dress, cat, caught* and *putt*) by sixteen speakers. It suggested that lax vowels were participating in the general shift shown in Figure 1.1 below, adapted from Clarke et al (1995).

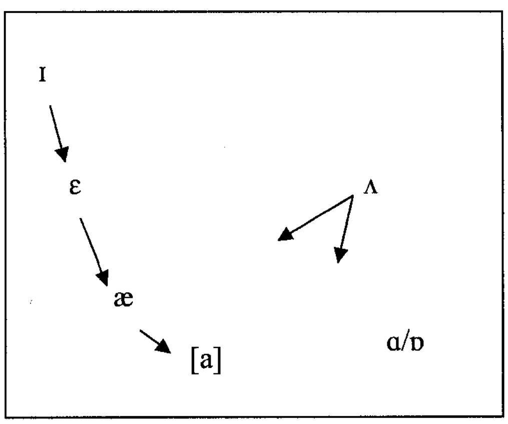

Figure 1.1. The Canadian English Shift (Clarke et al., 1995:212).

Clarke et al. (1995: 210) hypothesize that the pivotal point is the merger of the low back vowels /ɑ/ and /ɔ/, the resulting vowel typically being pronounced [ɑ] or [ɒ] in

CE. The low back merger acts as the trigger for the CS, creating an unoccupied slot in vowel space. This results in the lowering and retraction of the front lax vowels /æ/, /ɛ/ and /ɪ/. The authors also note a parallel development occurring in innovative CE, in the form of the centralization and lowering of /ʌ/. The ANAE (2006:130) confirms the existence of the Canadian Shift, as triggered by the low back vowel merger.

These findings have been replicated to some degree in other studies of Canadian English. For example, Hoffman (1999) provides further evidence from southern Ontario English for the front vowel shifting outlined by Clarke et al. (1995). De Decker (2002) shows that the retraction of /æ/ is robust in a non-urban speech community located about one hour outside of London, Ontario. The retraction and lowering of /æ/ that is associated with the CS has also been documented for Winnipeg (Hagiwara 2006), and has been found to stretch as far east as St. John's, Newfoundland (Clarke 1991, D'Arcy 2000, 2005) and as far west as Vancouver, British Columbia (Esling and Warkentyne 1993). Despite this apparently widespread distribution of /æ/ retraction/lowering, the ANAE (2006:130) indicates that "no Telsur Canadian city east of Montreal shows the Canadian shift." However, this conclusion is based on small sample sizes. The ANAE sample for Newfoundland, for example, consists of only two speakers, both from St. John's: a 25-year-old female and a 34 year-old-male.

In terms of phonological conditioning, Clarke et al. (1995) suggest that the front lax vowel lowering/retraction process may be dependent on the manner of articulation of the following consonant. When followed by a nasal, this process is inhibited; a following fricative constitutes the most favoring lowering environment. Point of articulation of a following consonant proves less significant in the Canadian Shift than manner of articulation and no clear generalizations emerge for place of articulation from the Clarke et al. (1995) study. They did find, however, that a following voiceless consonant favored lowering of the lax vowels, at least for /ɛ/ (other lax vowels showed a similar pattern though results were not significant).

Boberg (2005) suggests that Clarke et al.'s early view of the Canadian Shift may not be entirely accurate. His Montreal English (ME) results did not provide evidence for the lowering of /ɛ/, which would link the backing of /æ/ and the lowering of /ɪ/. Rather, it appears that this phoneme is centralizing in ME. If this is the case, the Canadian Shift (at least as it operates in ME) could be seen more as a retraction of similar vowels based on analogy, as opposed to a rotation of these vowels.

Boberg (2005) performed acoustic analysis on more than 1000 tokens of the six short lax vowels of English, /ɪ, ɛ, æ, ɑ, ʌ, ʊ/ as produced by 35 native speakers of ME. Unlike Clarke et al. (1995), Boberg included the vowel /ʊ/ so that the entire lax vowel sub-system could be examined. Boberg's revised version of the CS that emerged from his ME data is shown in Figure 1.2.

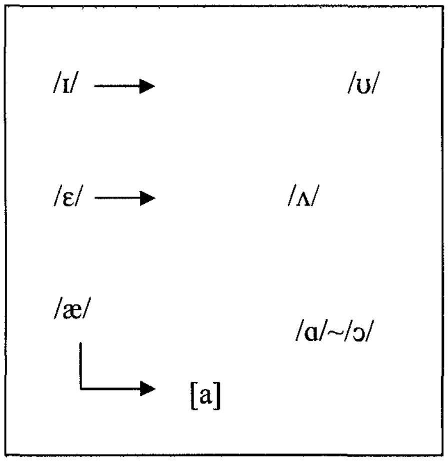

Figure 1.2. The Canadian English Shift in Montreal (Boberg, 2005:149).

Significant generational differences emerged in Boberg's data for the F2 (tongue advancement) of /ɪ/ and /ɛ/: that is, both vowels proved to be retracting, with no significant lowering. Yet Boberg did find both tongue height and advancement of /æ/ to be significant in terms of generation, as had been claimed in the original Clarke et al. (1995) study, with younger speakers showing lower and more retracted realizations. There were no significant generational differences for /ʌ/; however the F2 of (ʊ) was found to be significant, at least with respect to the youngest generation. Boberg suggests that the centralization of this phoneme is a recent innovation introduced by the youngest generational group (those born after 1965).

It is not clear as to how to reconcile these differing views. Boberg (2005: 149) notes, however, that the CS may operate differently in Ontario than it does in Quebec English. What is clear from both versions of the shift is that /æ/-retraction and lowering is a change in progress, presumably triggered by the low back merger. It is not entirely clear if this shifting of /æ/ has resulted in a pull shift as reported by Clarke et al. (1995); in parallel retractions of the other front lax vowels, as found by Boberg (2005); or in some other outcome. Interestingly the ANAE (2006) reveals a pattern that combines both views of the CS discussed here. That is, they suggest that /æ/, /ɛ/ and /ɪ/ are moving diagonally, both downward and inward. Yet another view of the CS is that presented by Hoffman (1999) and Hagiwara (2006). In this view, the advancement of /ʌ/ is crowding the lower-front space of the vocal cavity, resulting in lowering of /æ/, with retraction being a secondary result due to the lowering of a front vowel.

1.2. Newfoundland English

Newfoundland varieties of English have always been viewed as distinct from those of the rest of Canada (for a recent statement of this view, see for example Chambers 2004). As pointed out by the authors of the ANAE (2006:217), a single variety of English is spoken from British Columbia to Ontario, with Newfoundland varieties being "notably distinct". The autonomy of this variety within Canada – and within North America more generally – can be explained by the unique settlement pattern and geographic isolation of Newfoundland. However, as noted by Clarke (1991) and D'Arcy (2005), St. John's is a community in which the regional standard variety is being affected by a more prestigious national variety.

As discussed by Clarke (2004), Newfoundland English displays the same vocalic phonemes as General Canadian English, but their phonetic realizations are different. This is evident in traditional Newfoundland pronunciations of the low lax vowels /ɑ/ and /æ/. In Newfoundland English, the merged low back vowel /ɑ/ – that is, the *cot/caught* class – is typically more fronted than in CE. For many Newfoundlanders, the vowel /ɑ/ is realized more like [a] than [ɑ] or [ɒ]. In addition, /æ/ is a more raised and fronted variant in Newfoundland varieties of English than in other CE varieties. D'Arcy (2000) found this to be the case for the members of her adolescent and pre-adolescent sample with locally-born parents, who use the raised, traditional variant more often than those with non-local parents.

1.2.1. St. John's English

St. John's is the largest city and provincial capital of Newfoundland and Labrador. The current population of Metropolitan St. John's stands at approximately 179, 900 – nearly 35% of the entire population of the province (Statistics Canada, 2005). The city is the centre of business, education, and government for the province and, according to Clarke (1991), the current linguistic situation in St. John's represents a speech community in a state of flux. Many older residents retain traditional linguistic features while those in the younger age groups show speech patterns that are more and more approximating those of urban mainland Canada. That is, as Clarke (2004: 359) points out, younger upwardly mobile speakers are tending towards more CE-like realizations; this is also confirmed by the linguistic behavior of D'Arcy's (2000) participants with non-locally born parents.

Clarke's (1991) study of phonological variation, based on 120 speakers in both formal and informal styles, examined four social variables: age, sex, religion and social class. Statistical analyses revealed that age was the most important social variable examined. Clarke also noted a general tendency for younger upper middle class city residents to use vowel variants that are more similar to innovative "mainland" variants while local variants are particularly characteristic of older speakers, males and social classes lower on the socioeconomic hierarchy. Also, the adoption of supralocal Canadian English features differentiates age groups more significantly in formal styles rather than in casual speech. This provides evidence for stylistic diffusion of supralocal linguistic variables in innovative SJE.

D'Arcy's (2000) MA thesis is an investigation of dialect acquisition in SJE based on 16 adolescent and pre-adolescent females, half with local parental origin and half whose parents were non-local. She investigated nine phonological variables, eight of which were vocalic. One pattern that emerges from this study is quite similar to one of Clarke's (1991) observations. That is, sound change is entering the community through more formal speech styles. D'Arcy also found that adolescents tend to use more non-local variants than pre-adolescents; in addition, speakers with non-local parents are less embedded in the community's social networks and thus are innovators of language change. As Milroy (1980:175) states, "…the closer an individual's network ties are with his [sic] local community, the closer his language approximates to localized vernacular norms." Thus, non-local parent adolescents have local ties that are not as strong as those who have closer connections in the social network (here, the local parent subjects). Yet this same group may introduce innovative forms into this network.

Since at least some members of the SJE speech community appear to look to supralocal norms, an important issue is whether the CS is active in SJE, and if so, to what degree. As outlined above, the vowel space in SJE is used differently than it is in most other varieties of CE. The effects of these structural differences on how the CS might manifest itself in SJE is not entirely clear. If /æ/-lowering/retraction is active in this CE variety, it should begin to encroach upon the more fronted, [a]-like /ɑ/. What the outcome of this might be has not been previously investigated.

1.3. Real- and Apparent-time Evidence: Age-based Models of Language Change

The use of apparent-time (or "synchronic") evidence as a surrogate for real-time (or "diachronic") evidence has been a cornerstone of the study of language change in progress since Labov's methodological innovations on Martha's Vineyard (see for example Labov 1963, 1994). Apparent-time evidence refers to differences among age cohorts which are observed at the same point in time while stylistic and social factors are held constant. Within the Labovian paradigm, this synchronic evidence of language change in progress can be expected to mirror real-time changes that are occurring in the speech community (Bailey 2002).

Real-time studies are often less practical. Although on the surface they appear to be the ideal methodology, they have their weaknesses. For example, real-time "trend" type studies pose potential problems for comparability due to differing sampling methodologies in that studies of this sort examine the same age cohort and not the same speakers over two or more points in history. Relatively small differences in samples may have statistically significant effects on results. As Turell (2003) notes, in trend studies, the speech community would have to be one that remains demographically stable, otherwise it is possible that changes are externally motivated. "Panel" studies, which reinterview the same informants over two or more points in time, can help minimize this kind of variation (Bailey 2002). However, they may be difficult to implement, as the original informants may no longer be available.

It is not entirely clear how well apparent-time evidence reflects real-time changes. However, several studies have examined the validity of synchronic evidence to make inferences about actual diachronic language change. As discussed by Turell (2003), Cedergren's study of Panamanian Spanish offers evidence that apparent-time can act as a surrogate for real-time (see for example Cedergren 1984). Cedergren's original 1969 Panamanian Spanish study investigated CH-lenition, a change in progress; she re-investigated this variable in a study conducted in 1982-1984. Both studies found that it was age that was the most significant of the social variables examined in determining the distribution of CH-lenition.

Evidence for the validity of the apparent-time approach as a surrogate for real-time evidence was also found by Pope (2003), who attempted to replicate Labov's study of centralization of (ay) and (aw) on Martha's Vineyard in the early 1960s. Similarly, Nahkola and Saanilahti (2004) examined the real-time progress of several Finnish variables. In 10 of their 14 variables, the authors found that advancing variables were more frequent in the speech of teenagers in 1996 than they were among teenagers in 1986, supporting the apparent-time conclusions. Interestingly, the authors found that there is a significant relationship between variation and the stability of an individual's idiolect. That is, they found that if a speaker, as a child, learns a linguistic feature with little or no variation, that feature is less likely to undergo change over the speaker's lifetime than if he/she acquired a feature that exhibits variation.

Labov (1994:76) examined the relations of real-time and apparent-time evidence in terms of four possible relations between the individual and the community: (i) stability, which refers to the situation of no linguistic change on the part of either the individual or the community; (ii) age-grading, involving change in the individual rather than change in the community at large; (iii) generational change, involving change in the community as a whole while individuals retain their early acquired pattern; and (iv) communal change, which refers to situations in which both the individual and the community change together, in that individuals continue to participate in an ongoing change which is being implemented by the community in general.

Boberg (2004a) construes the relationship between the individual and the community in terms of three basic categories, or "models" of age-based linguistic variation. The first of these is the apparent-time approach. As in both Clarke et al.'s (1995) and Boberg's (2005) studies of CE, generational differences in synchronic data are used to infer language change in progress. Crucially, as Boberg (2004a:250-251) notes, this approach relies on the assumption that speakers do not "significantly alter the way they speak over their adult lifetimes." However, he points out that this assumption is misleading, since the differences observed may well be age-graded patterns. Moreover, as Labov's approach suggests, the notion of communal change recognizes the possibility of continued language change in adulthood.

The second of Boberg's (2004a) models of linguistic variation, the age-grading model, has been regularly applied within sociolinguistics. As he points out, the age-grading model assumes that individual speakers' grammars do not fully stabilize after acquisition, but rather vary as they move through childhood, adolescence, adulthood and into maturity. Thus, generational differences in linguistic behavior may reflect the speaker's life-stage rather than actual diachronic change. The most typical manifestation of age-grading is the use of more innovative features in younger speakers which decreases as the speakers grow older; these features may be adopted again by the next generation of younger speakers.

Boberg's third category, the late adoption model, has yet to be tested extensively, especially in terms of phonological data. In examining lexically-embedded phonetic changes in ME, Boberg (2004a) found that there are cases when older speakers do not become more conservative with age. Rather the pattern is incrementation, in that the innovative (lexical) features that are typically associated with younger speakers are also being adopted by older speakers. Boberg's late adoption model thus involves change in both the individual and the community, and corresponds to Labov's communal change. The late adoption model situates older speakers as helping to accelerate change in the community.

There is sociophonetic evidence that adults can acquire distinct dialect features after relocating to another community: see for example Conn and Horesh (2001). Their study of two individuals who moved from Michigan to a middle class Philadelphia neighborhood showed that speakers' degree of dialect acquisition was relative to their involvement in community life. The same may be the case for older speakers within a speech community who exhibit upward social mobility and/or exhibit weaker network ties.

By investigating vowel variation in SJE in terms of these different age-based models of linguistic change, via both real- and apparent-time evidence, the nature of the social embedding of sound change in SJE can be more fully explored.

Chapter 2

Methodology

This thesis attempts to examine language variation and change in SJE via an acoustic evaluation and subsequent statistical analysis of eight vocalic variables in the speech of twelve native middle-class female residents of St. John's. Traditional Labovian sociolinguistic interviews conducted in the early 1980s, as well as in 2003, yield both real-time and apparent-time evidence as to the state of the SJE vowel system.

This chapter presents the methodology employed in this study. Section 2.1 discusses the linguistic variables and conditioning factors examined, along with the selection of participants; Section 2.2 outlines the interview process; and section 2.3 provides the methods used to analyze the data.

2.1. The Variables

The following sections outline the variables examined in the current study.

2.1.1. The Linguistic Variables

The study involves eight linguistic variables: six lax vowels and two tense vowels. As noted in Chapter 1, the lax vowels /ɪ/, /ɛ/, /æ/, /ɑ/, /ʌ/ and /ʊ/ were chosen because of their apparent involvement in the CS as outlined by Clarke et al. (1995) and Boberg (2005).

Two tense vowels, /o:/ and /u:/, were also included in order to examine another phenomenon found not only in CE, but also in many other English varieties: the fronting of back vowels, particularly /u:/. The inclusion of these tense vowel variables may allow for a broader analysis of sound change among middle class female speakers of SJE, in terms of innovative forms and the adoption of supralocal features, beyond those associated with the CS. This may help add to the understanding of how sound change may be both structurally and socially motivated.

2.1.1.1. *<u>The Lax Vowels</u>*

1. <u>/ɑ/</u>

The variable /ɑ/ represents the low back merged vowel, that is, the *cot/caught* class. As outlined in Chapter 1, this low back merger is characteristic of CE (Labov et al, 2006) and is viewed by Clarke et al. (1995) to be the triggering event of the CS. As also noted, mainland CE realizations of this vowel generally approximate [ɑ], while traditional realizations of this variable in SJE are considerably more fronted. The ANAE (Labov et al, 2006) show that for both SJE speakers included in the study, the low, back merged vowel remained in a relatively fronted position. Furthermore, according to the authors (141), outside of the low back merger, the Atlantic Provinces (including Newfoundland) are not involved in any of the sound changes seen in other varieties of North American English.

2. /æ/

This variable represents the low front lax vowel of the *mad/mat* class. A number of studies (e.g. Clarke et al. 1995, Boberg 2005 and Labov et al, 2006) have found /æ/ to be retracting in innovative CE, though the ANAE (Labov et al, 2006) showed Atlantic Canadian English varieties as not participating in this retraction. Furthermore, traditional pronunciations in Newfoundland pattern differently. This vowel tends to be realized historically in Newfoundland English as tensed and raised, relative to standard CE. Since the low back merger may well be the triggering event of the CS, the structural conditions of this shift may not be present in the current data, and how the CS might manifest itself in SJE is unclear (cf. Section 1.2.1 above).

3. /ɛ/

The variable /ɛ/ represents the front lax vowel in words such as *head* and *dress*. According to Clarke et al. (1995), the retraction of /æ/ in CE triggers lowering and retraction of /ɛ/. Although Boberg (2005) did find not find lowering of this vowel to be significant in ME, /ɛ/-retraction is the most active component of the CS in Montreal. For most speakers of Newfoundland English, as for general CE, the /ɛ/ vowel is realized as the standard front lax vowel [ɛ]. Noteworthy, as Clarke (2004:358) points out: "On the Irish Avalon[2], conservative rural speakers display variable and conditioned raising of this vowel to [ɪ] in the environment of a following stop or affricate…" Since this pattern characterizes conservative rural speakers, it is unlikely that it would affect the CS, should this shift be active in SJE.

4. /ɪ/

The variable /ɪ/ represents the high front lax vowel in words such as *kit* or *miss*. Again, as previously discussed, this vowel is clearly involved in ongoing change in mainland CE, whether via lowering and retraction (Clarke et al. 1995) or retraction alone (Boberg 2005). According to Clarke (2004), this vowel is typically realized as standard [ɪ] in most Newfoundland English varieties. The author does note, however, a "variable tendency" of /ɪ/-tensing in more traditional vernacular speech, particularly on the Irish Avalon.

5. /ʌ/

The lax vowel in words such as *strut* and *mug* is represented by the variable /ʌ/. Although not an obvious part of the CS, this vowel was found by Clarke et al. (1995) to show lowering or centralizing in more innovative forms of CE. The advancement of /ʌ/ has also been noted as a feature of Winnipeg English, at least relative to general

[2] The Irish Avalon refers to the southern part of the Avalon Peninsula on the island portion of Newfoundland and Labrador, which was predominantly Irish-settled. St. John's is situated in the northeast corner of this region, and its traditional speech variety displays many traces of its Irish English roots.

American English (Hagiwara 2006). No significant shifting, however, was found for this variable in ME (Boberg 2005).

According to Clarke (2004), this vowel is typically realized as non-rounded [ʌ] in Newfoundland English. However, again on the Irish Avalon, many speakers pronounce this vowel with lip-rounding. Clarke's (1991) SJE study found that older males – the greatest users of traditional variants for all variables examined – showed retracted and rounded variants of /ʌ/. Given its social distribution, it is unlikely that such retraction and rounding will emerge for the female speakers included in the current study.

6. <u>/ʊ/</u>

The variable /ʊ/ denotes the high, back, lax, rounded vowel in words such as *put* and *wood*. This vowel was not examined by Clarke et al. (1995); however Boberg (2005:144) suggests that among his younger ME speakers, /ʊ/ has begun to centralize. Clarke (2004) notes, for the Irish Avalon region of Newfoundland, that this vowel is occasionally somewhat raised and tensed.

In at least some varieties of English, lax /ʊ/ has been noted as undergoing fronting alongside the fronting of its tense counterpart, /u:/ (as discussed in the following section).

2.1.1.2. <u>*The Tense Vowels*</u>

7. <u>/o:/</u>

The variable /o:/ represents the diphthongs in words such as *low* and *most*. This variable, seldom mentioned when speaking of vowel variation in CE, was included as a point of comparison for the variable /u:/, discussed in more detail immediately below. Hagiwara (2006), however, found that /o:/ remains a back rounded vowel in Winnipeg English, and does not participate in the advancement displayed by the other high to high-mid back vowels in this variety.

The ANAE (Labov et al, 2006) shows the realization of this variable as having clear geographic correlates. Lower variants of /o:/ are found primarily in the southern US, while in the northern U.S. and Canada, /o:/ variants have relatively high nuclei. In addition, the fronting of /o:/ is shown to be a characteristic feature of the southern US, while resistance to /o:/ fronting dominates in northern U.S. cities and most of Canada.

In SJE, Clarke (1991) found that conservative older male speakers showed a much greater frequency of use of the local monophthongal variant of /o:/. Female speakers of all ages seldom used this local variant.

8. <u>/u:/</u>

The variable /u:/ represents the high back tense vowel in words such as *boot* and *goose*. The process of /u:/-fronting has been noted for many varieties of

English. According to Stockwell and Minkova (1997:294) fronting of /u:/ (and /ʊ/) have been found in Southern British and Australian varieties of English. Milroy (2004), in her discussion of local vs. supralocal changes, includes the fronting of /u:/ – and its lax counterpart – as supralocal or "off-the-shelf" changes ongoing in both the U.S. and the U.K. Unlike local changes, off-the-shelf features do not require the "kind of repeated exposure that regular social interaction gives…" (Milroy, 2004: 1). Socially-marked changes of this sort would be accessible, then, to speakers of any dialect who possess the necessary social and/or geographic mobility. Milroy thus views supralocal changes such as /u:/-fronting to be socially-motivated, unlike vowel shifting, which is generally structurally motivated. Watt (2000:97) found socially-motivated (or "speaker-motivated") adoption and rejection of socially-marked surface forms in his Tyneside English data. Such changes he attributed to factors such as "a shift in the balance of identity with respect to broader region rather than immediate location, or some desire to appear modern, well-educated, or well-spoken."

In 1987, Hinton, Moonwomon, Bremner, Luthin, Van Clay, Lerner and Corcoran discussed a trend towards the fronting of the back vowels /u:/, /o:/ and /ʊ/ among speakers under the age of 30 in California. Almost fifteen years after the Hinton et al. (1987) study, Fridland (2000) discussed the fronting of the nuclei of these same three vowels (i.e. /u:/, /o:/ and /ʊ/) in the southern U.S., where they form a structural component of the Southern Shift. However, as Fridland (251) notes, the fronting of back vowels in the South is not coming up against the same sorts of social barriers that front vowel shifting is, suggesting greater accessibility of the back vowel innovative forms. This evidence seems supported by Hall-Lew (2004) in her examination of the "Western Vowel Shift" in Northern Arizona, in which both /u:/ and /o:/ fronting are involved. The author shows that that /u:/-fronting alone does not indicate a speaker's participation in the Western Shift. The accessibility of this sound change is attested, then, since /u:/ fronting is used by both those participating in and those not participating in the shift.

Boberg (2004b) looked at /u:/ fronting in CE in speakers from various regions of the country and found that women are leading this sound change. In terms of region, he found that British Columbia and Ontario are leading the fronting (and lowering) of /u:/, while the Prairies, Montreal and the Maritimes (represented by New Brunswick and Nova Scotia) are more conservative. Newfoundland was not represented in Boberg's data.

The ANAE (Labov et al, 2006) also considers the relative fronting and backing of /u:/ in terms of distinguishing dialect areas in North America. With respect to /u:/ following coronals, fronting is noted as being "the most widespread tendency across all North American dialects" (101). The fronting of /u:/ after non-coronals meets resistance in the northern areas of the United States. This resistance stretches as far as the Atlantic Provinces (including one of the two SJE speakers included in the Atlas), while the remainder of Canada generally shows some degree of /u:/ fronting when preceded by a non-coronal segment.

Fought (1999) notes that minority groups in California do not typically prove to be participating in sound changes that are characteristic of the majority group. However, she found /u:/-fronting to be an exception, in that Mexican American communities were adopting this change from the California Anglo majority. Similarly, Anderson (2004:8) points out that although fronting of /u:/ and /ʊ/ has been generally characteristic of European American speech, studies in both rural and urban areas have reported fronting for African American speakers as well.

This combined evidence, which spans several decades and many varieties of English, tends to support Milroy's (2004) idea of /u:/-fronting as being available for speakers of any variety of English to pull "off the shelf". Consequently, we might expect some evidence of /u:/-fronting in the SJE data, particularly for those participants who are more geographically and/or socially mobile.

2.1.2. The Internal Factors: Phonological Conditioning

Phonological conditioning of lax vowel lowering/retraction (as well as back vowel fronting) is examined in two phonological contexts: preceding and following environment. These are discussed in more detail in Sections 2.1.2.1 and 2.1.2.2 below.

2.1.2.1. The Following Phonological Context

As reported by Clarke et al. (1995), the following phonological environment tends to promote or disfavor the effects of the CS, though the overall pattern was not uniform for all vowels. Manner of articulation (MOA) of the following segment, in particular, proved more significant than either point of articulation (POA) or voicing in the Clarke et al. study. Generally, lax vowel lowering was inhibited when vowels were followed by a nasal; rather, this environment tended to promote tensing and raising. Clarke et al. found the most favoring MOA to be a following fricative. Results for POA showed no general pattern and offered only one significant effect, for the vowel /ʌ/. In terms of voicing, a following voiceless consonant appeared to have a favoring influence on the vowel shifting that is involved in the CS.

D'Arcy (2005), who examined /æ/-retraction in SJE adolescent and pre-adolescent speech, did not find the same results for following phonological environment as Clarke et al. (1995). Her study showed POA to be significant, in that following velars (and also to a lesser degree alveolars and bilabials) favored innovative CE-like retracted variants of /æ/ for speakers with local parentage. In terms of voicing, D'Arcy found that /æ/-retraction/lowering was most favored when followed by a voiced rather than a voiceless segment. MOA, the most significant factor in Clarke et al. (1995), did not emerge as significant in D'Arcy's study. Hoffman (1999) however confirms Clarke et al.'s (1995) finding in that the retraction of /æ/ was strongly disfavored when followed by a nasal, though she did not uncover any evidence for phonological conditioning of /ɪ/ and /ɛ/ in her Ontario English sample. Furthermore, voicing did not prove to be significant in the Hoffman study.

Fridland and Bartlett (2003) found alveolars and palatals to promote more fronted realizations of /u:/ in their Memphis English sample. As the authors point out, there is an inherent pressure toward drift in languages with large vowel inventories. Thus, a back vowel transitioning to or from a consonant with a high F2 value[3] (e.g. palatals, alveolars) will be the most likely candidate for fronting. Back vowels following consonants with a low F2 (e.g. labials) are more resistant to fronting. This is somewhat in contradiction to Anderson and Childs (2003), who found that for their Detroit speakers, pre-alveolar and pre-labial environments promoted /u:/-fronting.

Based on the evidence, then, phonological conditioning as a result of the following environment seems to play an important role in vowel shifting in English dialects, though the exact nature of such influence is not consistent in the literature. The current study investigates the effects of POA, MOA and voicing of the following segment[4], referred to hereafter as following-POA, following-MOA and following-Voicing respectively.

Three possible environments are investigated with respect to the POA of the following segment. These are: (i.) labial; (ii.) coronal; and (iii.) dorsal. These terms refer to three basic natural sound classes[5]. In the current study, the labial category includes both labials (/p/, /b/, and /m/) and labio-dentals (/f/ and /v/); the coronal category includes interdentals (/θ/ and /ð/), alveolars (/t/, /d/, /s/, /z/ and /n/) and alveo-palatals (/ʃ/, /ʧ/, and

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[3] For a discussion of vowel formants, see Section 2.3 below.

[4] Several tokens in which the variable occurred word-finally (e.g. *though*) were not included in the analysis of following environment due to small numbers.

[5] Note that only those sounds which occur in the present data are listed here.

/ʤ/); and dorsals include velars (/k/ and /g/), glottals (/h/) and the labio-velar approximant, /w/.

In terms of MOA, three possible environments are examined: (i.) pre-(oral) stop; (ii.) pre-fricative; and (iii.) pre-nasal. Pre-lateral and pre-rhotic environments were not included to avoid the effects of l-coloring and r-coloring. Voicing includes two phonological environments: (i.) pre-voiceless; (ii.) pre-voiced.

Table 2.1 below provides a summary of all the following phonological environments investigated.

Table 2.1. Summary of factors for following phonological environment.

Following-MOA	Following-POA	Following-Voice
Stop	Labial	Voiceless
Fricative	Coronal	Voiced
Nasal	Dorsal	

2.1.2.2. <u>The Preceding Phonological Context</u>

Preceding phonological environment was not discussed by Clarke et al. (1995) in their analysis of CE. D'Arcy (2005) found preceding environment not to be significant in her examination of /æ/ retraction/lowering in SJE. However, as noted by Anderson, Kretzschmar and Arehart (2003), formant transitions between vowels and consonants are also important in understanding vowel variation and change, suggesting possible contextual effects involving the preceding segment.

The effects of preceding POA on /u:/ fronting have been documented in a number of studies. For example, Ash (1996) shows that in the U.S. Midwest, /u:/ variants preceded by an apical segment favored fronting, while those preceded by non-apical segments favored the most retracted realizations. Likewise, Hall-Lew (2004) notes that when /u:/ follows a coronal consonant, it is more likely to be fronted. The ANAE (Labov et al, 2006) confirms the widespread North American tendency towards /u:/ fronting in post-coronal environments, and, as noted earlier, the resistance in certain dialect areas to the fronting of this high back vowel in other environments (including St. John's, as shown by one of the two SJE speakers in the ANAE).

Preceding environment is included in the current analysis in order to provide a broader picture in SJE of phonological effects on the front lax vowel lowering associated with the CS, as well as on back vowel fronting. Thus, both manner and place of articulation as well as voicing of the preceding segment are investigated in the present study; these are referred to hereafter as Preceding-MOA, Preceding-POA and Preceding-Voice respectively. A full listing is provided in Table 2.2. The factors for each group are broken down in the same way as those for following phonological environment.

Table 2.2. Summary of factors for preceding phonological environment.

Preceding-MOA	Preceding-POA	Preceding-Voice
Stop	Labial	Voiceless
Fricative	Coronal	Voiced
Nasal	Dorsal	

2.1.3. The Social Factor: Generational Group

Within a traditional Labovian framework, random sampling is emphasized in order to achieve a true representative sample of the population, without bias towards any particular sub-group (Milroy 1987). However, it is precisely one of these sub-groups that this study seeks to examine. Based on evidence from both SJE (e.g. Clarke 1991 and D'Arcy 2000) and CE (Clarke et al. 1995), it is younger middle-class females who tend to lead linguistic change[6]. In addition, the ANAE (Labov et al., 2006:2) notes that women aged 20 to 40 are generally found to be in the forefront of change.

Thus, this subgroup is an ideal focus group for the study of language change. As a result, a judgment sample was employed in this study. Twelve middle-class female participants were selected. Four of these participants were chosen from data already collected in the early 1980s, while the remaining were selected from my own social

[6] According to Labov (1994:156), change from below enters the speech community via "interior groups', i.e. upper working class and lower middle class. Clarke (1991) however, found that it was middle to upper-middle-class speakers in St. John's who were the most advanced in the adoption of CE-like variants.

network in such a way as to ensure cross-speaker comparability. In addition, a participant background information form was administered to these eight speakers to ensure the validity of the judgment sample.

Depending on the age of the speakers recorded in 2003, one of two forms was administered. For the four younger females (see Appendix A), the Participant Background Information Form was constructed such that the speakers' parent's occupations could be recorded. This differs from the Participant Background Information Form for the older speakers (Appendix B) which was formatted to obtain information on spousal rather than parental occupation.

Each participant selected from the earlier data had provided informed consent, as per ethics guidelines in effect at the time. Similarly, participants recorded in 2003 were administered a consent form (see Appendix C) as per guidelines laid forth by the Interdisciplinary Committee on Ethics in Human Research at Memorial University of Newfoundland, which approved the current study.

The twelve participants were divided equally among three Generational Groups: (i) younger females recorded in 1982-83 (YF80); (ii) younger females recorded in 2003 (YF03); and (iii) older females recorded in 2003 (OF03). All four speakers in the YF80 cohort were recorded in conjunction with Clarke's sociolinguistic survey of St. John's English. These participants were matched with the eight 2003 speakers in terms of social background and also in terms of age: not only does their age (early adulthood) parallel that of the YF03 group, the YF80 group also represents the same age cohort in real time as the speakers in their 40s (OF03) recorded in 2003. The overall sample is summarized in Table 2.3[7] below.

Table 2.3. Generational Groups (n=12).

Interviews recorded in 1980s	Interviews recorded in 2003
YF80 (N=4)	YF03 (N=4)
	OF03 (N=4)

Table 2.4 provides the individual demographics of each of the speakers. As can be observed, at the time of recording, all younger speakers fell between the ages of 20 to 25, while older speakers ranged from 45 to 48 years old. That is, the older speakers are of the same generation as the younger females recorded in the early 1980s (thereby providing trend-type real-time evidence) and are approximately one generation older then their YF03 counterparts (the control which provides the apparent-time data for this study). With some small exceptions, the occupations of the set are comparable, as is education level, with all speakers having completed at least some post-secondary education. All sample members were born and grew up in St. John's and generally, all informants had spent the majority of their life in St. John's. One younger female

[7] Though the scope of the current study limits the sample size used, the choice of four speakers per cell is not uncommon (see for example D'Arcy 2000, 2005). Furthermore, this sample size is not out of line with those used in other sociophonetic studies. For example, Hagiwara's (2006) study of WE is based on ten speakers (five males, five females) and Anderson (2004) performed analysis on 13 of her 27 participants.

recorded in 2003 had been residing in Antigonish, Nova Scotia for six months at the time of the interview, attending a post-secondary institution. One older female recorded in 2003 had spent one year living in Ontario. If anomalies are found for either of these speakers, such linguistic behavior may be related to the time they spent living away.

Table 2.4. Age, occupation and education of participants[8].

Generational Group	Age (time of recording)	Occupation	Education (level of post-secondary)
YF80	23	Student, RN	Completed
	25	Clerk, telephone company	Completed
	20	Student	Some
	25	Secretary	Completed
YF03	23	Student, bartender	Some
	23	Secretary	Completed
	23	Retail clerk	Some
	23	Apprentice cook	Some
OF03	46	Real estate agent	Some
	46	RN	Completed
	48	Executive assistant	Completed
	45	Accountant	Some

[8] Here, "some" post-secondary indicates that the respondent attended a post-secondary institution but had not completed or was in the process of completing a degree/diploma. "Completed" post-secondary indicates that the speaker had obtained a degree/diploma from a post-secondary institution (including both university and public/private colleges).

Although age, and to at least some extent, social backgrounds have been matched for the participants, it is difficult to determine the degree of upward social mobility that these individual speakers may possess. As Chambers (1995) notes, the effect of social mobility on language variation has rarely been investigated. There is however, "a set of people who frequently stand apart linguistically from their peers" and whose social ambitions "stretch beyond their immediate social domain" (95). Chambers refers to these speakers as "aspirers" and points to Feagin's (1979) study of six teenaged males in Anniston, Alabama. Feagin showed that there is a correlation between the use of local versus supralocal variants and the social status/aspiration of the individual. Since eight of the current study's twelve participants were selected from my own social network, if one of these speakers stands apart linguistically from the rest, it may be possible to trace such linguistic behavior to individual social mobility or aspiration.

2.2. Data Collection

Traditional Labovian sociolinguistic interviews were carried out with the twelve participants. Interviews conducted in 2003 were digitally recorded on a Sony MD(Model MZ-NH600), while interviews conducted in the early 1980s were recorded on analog cassette using a Sony TC-142. The latter data set was digitized and saved as *wav* files using Sound Forge 5.0.

Both sets of participants were interviewed in their home, or in an environment with which they were very familiar. The interviews elicited both more careful speech (word list) and less careful speech (free conversation) styles; however the present study analyzes only word list data, to ensure cross-participant comparability. Furthermore, as Clarke (1991) and D'Arcy (2000) point out, change from above is entering the SJE speech community through more formal (or careful) speech styles. Thus, it is in the more careful style of a word list where supralocal changes are most expected.

The word list employed for the 2003 sociolinguistic interviews consisted of 240 words (See Appendix D) and was replicated from that used in the 1982-83 interviews (se Appendix E) whenever possible, although the scope of these studies differed. In total, more than 1100 stressed-syllable tokens were selected to represent the eight vowel variables in differing phonological environments. Table 2.5 provides an overview of number of tokens per vowel, by generation group. For each of the vowel variables a maximum of 168 tokens was selected. Three of the variables, however, had a total of fewer than 168 available tokens. Tokens for /ʊ/ are particularly lacking, since this variable was not included in the original 2003 research design during the data collection process.

Table 2.5. Number of tokens analyzed by vowel variable and Generational Group.

Generation Group	/ɑ/	/æ/	/ɛ/	/ɪ/	/ʌ/	/ʊ/	/o:/	/u:/	Total
YF80	56	56	52	56	48	16	36	56	376
YF03	56	56	56	56	48	20	44	56	392
OF03	56	56	56	56	48	20	40	56	388
Overall	168	168	164	168	144	56	120	168	1156

2.3. Data Analysis

The data analysis consisted of two stages: acoustic analysis and subsequent statistical analysis. The methodology implemented in this thesis employs an examination of vowel formants in order to understand the relative advancement/retraction and raising/lowering of vowels among native speakers of SJE. Section 2.3.1 outlines the acoustic analysis, while the statistical analysis is discussed in Section 2.3.2.

2.3.1. Acoustic Analysis

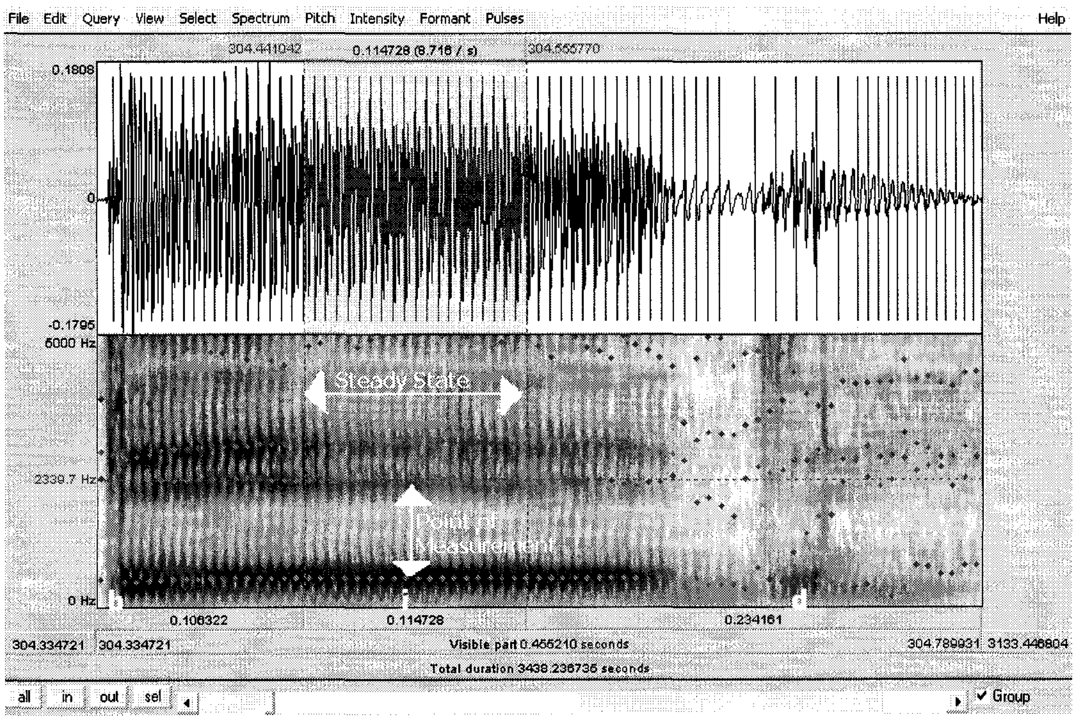
Acoustic analysis of the tokens was performed using Praat Version 4.2, a program designed specifically for the acoustic analysis of speech (www.fon.hum.uva.nl/praat/).

Measurements were taken of the frequency (in Hz) of the first two vowel formants (F1 and F2), reflecting tongue height and tongue advancement respectively. The higher the F1 value, the lower the tongue position during vowel production; a higher F2 measurement correlates with a more fronted vowel.

There has been some discussion in the literature on the role of F3 in the perception of vowels. As Anderson et al. (2003:2) observe, the first two formant frequencies "may lack information crucial to vowel perception and phonological distinctiveness". The authors note in addition that formant transitions between vowels and consonants should also be examined to better understand vowel variation via acoustic analysis. However, there is typically little discussion of the effects of the third formant on vowel variation in the literature. Because of time constraints, this thesis also examines only F1 and F2 values. An analysis of F3 must remain a topic for future investigation.

In the present study, a single point measurement was taken at the location that best represented the central tendency of the vowel, typically at the midpoint of the steady state of the nucleus – the point most representative of the vowel timbre (Labov & Boberg 1995). This was achieved first by using visual judgments in order to locate the steady state of the vowel, that is, the period at which vowel formants remain at a fairly constant frequency. Once the steady state phase had been located, its duration was measured within Praat; the F1 and F2 values were taken at the midpoint of that duration. An example of this methodology is illustrated in the screenshot below, Figure 2.1. Similar to the ANAE (Labov et al, 2006), this method of analysis selected a single point for measuring F1 and F2 involving an inspection of steady state, though the Atlas used a more involved analysis that including an examination of points of inflection, which indicate "when the tongue stops its movement away from an initial transition into the vocalic nucleus" and when the tongue "begins moving away from the nucleus" (38).

Figure 2.1. Locating the point of measurement for F1 and F2 of [ɪ] in the token "bid", using Praat.



Trajectory of the glide was ignored in the current analysis. As Anderson (2004) points out, however, the reliance for F1 and F2 measurements on a single temporal location may be problematic, since it ignores the formant transitions between vowels and consonants. Due to the relatively small scope of the current study, multiple point measurements of the vowels could not be included.

All F1 and F2 values were imported into Plotnik 07, which applies a log mean normalization to calculate normalized values. According to Labov (2003), this is more successful than other types of normalization procedures because it eliminates the effects due to differences in vocal tract length, while preserving the social differences in sex and age, inherent characteristics of any speech community. The resulting vowel systems can then be superimposed on a single grid. A list of normalized values obtained for all tokens included in the current study has been included as Appendix F; this appendix also lists the coding scheme used to code for each variable in the current data. Appendices G through L summarize the significance results obtained via SPSS.

Normalization is a necessity for cross-participant comparisons due to factors such as physical differences in vocal tract size across speakers. However, as Evans and Preston (2001) point out, discrete differences among individual systems may be lost when only normalized data are examined. Other methodologies for comparing raw F1 and F2 measurements obtained for the current study must also remain a topic for further investigation.

2.3.2. Statistical Analysis

Statistical analysis of the normalized data was conducted via SPSS (Version 12 for Windows), using a general linear model. In order to determine statistically significant differences among the independent variables, ANOVAs were performed upon the data followed by Tukey post-hoc tests, with F1 and F2 as the dependent variables. Two four-way ANOVAs were conducted for each vocalic variable such that Generational Group could be compared against each of the two other independent variable groups: following and preceding phonological environment. That is, the two ANOVAs consisted of the following independent variables: (i.) Generational Group, following-MOA, following-POA and following-Voicing; (ii.) Generational Group, preceding-MOA, preceding-POA and preceding-Voicing.

Tukey post-hoc tests allow for an analysis of statistical differences among and within each of the independent variables involved; these were used in all cases apart from the voicing of the preceding and following segments, which includes only two variants (voiceless vs. voiced). In order to provide means for the voicing variables, Compare Means was used twice whereby F1 and F2 comprised the dependent variables and each of following- and pre-Voicing comprised the independent variable.

Results for statistical analysis are presented in Chapters 3 and 4 and summarized in Appendix G through Appendix L. Significant interactions among the independent variables are presented in Chapter 5 and summarized in Appendix M.

Chapter 3

Results – Generational Group

This chapter presents results for the independent variable Generational Group, based on the methodology discussed in the previous chapter. This variable is broken down into three subgroups: a cohort of younger females recorded in the early 1980s, and a younger and older female cohort recorded in 2003 (labeled YF80, YF03 and OF03 respectively). Comparisons among these three age cohorts offer both apparent-time and real-time evidence as to the state of the eight vocalic SJE variables investigated in this study.

Prior to a discussion of results for each of the vowel variables in terms of Generational Group differences, Section 3.1 provides an overview of the (lax) SJE vowel system, as represented by the 12-speaker sample. Section 3.1 also situates this SJE system relative to the lax system of Montreal English and Winnipeg English, the two varieties of CE for which there is comparable socioacoustic data.

3.1. St. John's English: An Overview of the Vowel Subsystem

Table 3.1 below summarizes the overall mean F1 and F2 results, along with standard deviations, obtained via ANOVAs (performed with Tukey post-hoc tests) for the eight variables investigated. Figure 3.1 plots[8] these overall F1 and F2 means for the entire SJE sample (n=12).

Table 3.1. Overall normalized mean F1 and F2 values and standard deviations for SJE (n=12).

Variable	F1	Std. Dev.	F2	Std. Dev.
/ɪ/	497	70	2174	231
/ɛ/	642	78	2139	205
/æ/	779	77	2046	157
/ɑ/	811	97	1248	161
/ʌ/	756	63	1276	171
/ʊ/	502	57	1141	135
/o:/	623	69	1124	136
/u:/	435	46	1399	336

[8] The standard plotting program in sociophonetics is Plotnik (see for example The Atlas of North American English by Labov et al, 2006), which plots the vowels in a space that more closely resembles the actual vocal tract, that is with a less spread F2 and a more spread F1. Acoustic analysis for the current study was completed using Windows-based software. Since Plotnik is available only for Macintosh operating systems, the vowel plots given throughout the current work were produced in Microsoft Charts using a scattergram with reverse axes. This method of vowel plotting does not allow for a less spread F2 and a more spread F1, as is the case with Plotnik.

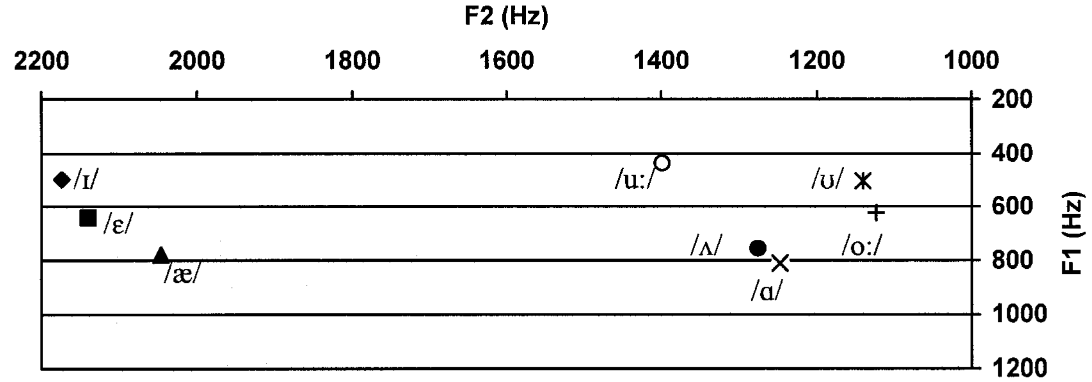


Figure 3.1. Vowel plot of the overall (normalized) mean F1 and F2 values for SJE (n=12).

A comparison of the overall means of the three Generational Groups examined suggests considerable similarity, though several obvious differences are observable. The overall lax vowel means for YF80, OF03 and YF03 are presented in Figure 3.2., which displays F1 by F2 plots per group.

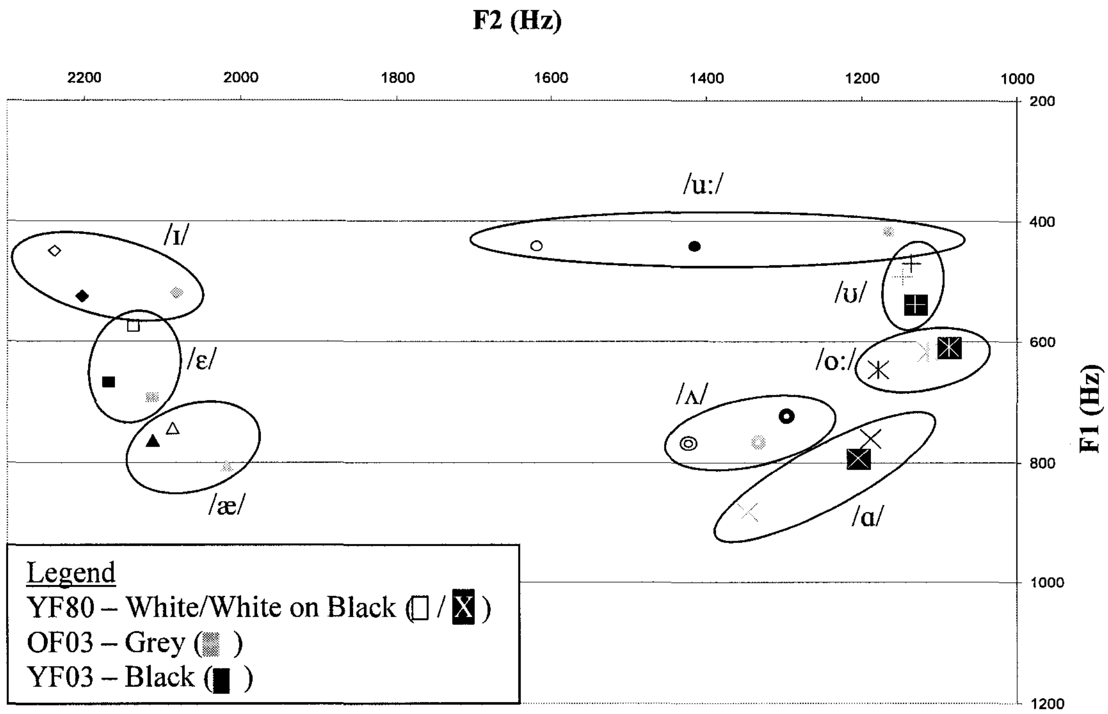


Figure 3.2. Vowel plot of the overall (normalized) means for YF80 (n=4), YF03 (n=4) and OF03 (n=4).

In terms of the back tense variables, both the younger Generational Groups show similar mean realizations of /u:/, much more fronted than that for the older female cohort. With respect to the lax vowel variables, again the two plots for the younger cohorts (YF80 and YF03) are remarkably similar, apart from small differences: the YF03 group shows slightly lower articulations of the front lax vowels /ɪ/ and /ɛ/, yet considerably more retracted mean values for /ɑ/ than OF03 and than YF80. Unexpectedly, the OF03 group differs from both the younger groups in its somewhat lower and/or more retracted realizations of the front lax vowels /ɪ/, /ɛ/ and /æ/. Yet the older females also show more fronted and lower realizations of /ɑ/. Significant differences among these three cohorts are discussed in more detail in Section 3.2.

A comparison of the findings for SJE with those for other dialects of CE helps to initially situate the lax vowel system in SJE relative to that of other CE varieties. The English spoken in the province of Quebec, where French is the majority language, may not be representative of general CE. However, in the absence of detailed acoustic data for most other CE varieties, Boberg's (2005) overall F1 and F2 mean realizations for ME are presented by way of comparison. The St. John's results will also be compared to the mean values of the lax vowel system in WE, as presented in Hagiwara (2006.). Ideally, a comparison of the SJE results with the mainland varieties of CE investigated in Clarke et al. (1995) would also be included. However, since their study was based primarily on impressionistic analysis, such a comparison is not possible.

Care must be taken when making inferences from a comparison of the above-mentioned varieties of CE, which are included only to situate SJE very roughly in terms of other varieties. The samples themselves are far from uniform, being made up of differing age cohorts and social groups. Speakers in Boberg's (2005) youngest generation group were born between 1971 and 1981, situating about half these speakers somewhere midway between the current study's YF03 and OF03 groups in terms of age. Hagiwara's (2006) study involves only speakers aged 18-25. As to gender, since the SJE data consist exclusively of female speakers, the ideal cross-dialect comparison would involve only females. While Hagiwara's Winnipeg results enable such a comparison, this is not the case for Boberg's ME data, the presentation of which does not permit a separate representation of female and male speakers. More than half of the youngest age cohort in Boberg's study, however, was made up of female speakers (seven of the eleven members of this cohort).

Figure 3.4, above, displays the overall F1 and F2 means for YF03 in the current study – the SJE group which is most comparable to the speaker group investigated by Boberg (2005) and Hagiwara (2006). Figure 3.3 is a plot of Boberg's normalized mean F1 and F2 values for ME (n=11) and Figure 3.4 presents the comparable WE mean values, as reported in Hagiwara (2006)[9].

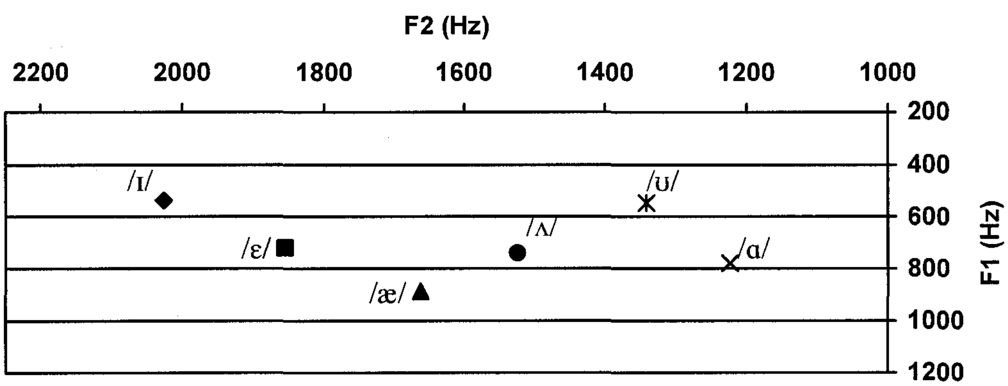


Figure 3.3. Vowel plot of the overall mean F1 and F2 values of the ME younger speaker sample (n=11); as reported in Table 4 by Boberg (2005:142).

[9] Figure 3.4 is based on actual mean F1 and F2 values as reported for WE by Hagiwara (2006). However, the picture that emerges from the vowel plot given in Figure 3.4 and that which Hagiwara presents in his vowel plots may differ. Hagiwara's vowel plots are based on values that have undergone "coarse auto-normalization", which plots the F1 and F2 relative to each particular speaker's own "calculated neutral". It is unclear at this point as to how these two approaches can be reconciled. The current study included only Hagiwara's mean F1 and F2 values in order to maintain consistency with data available for SJE and ME.

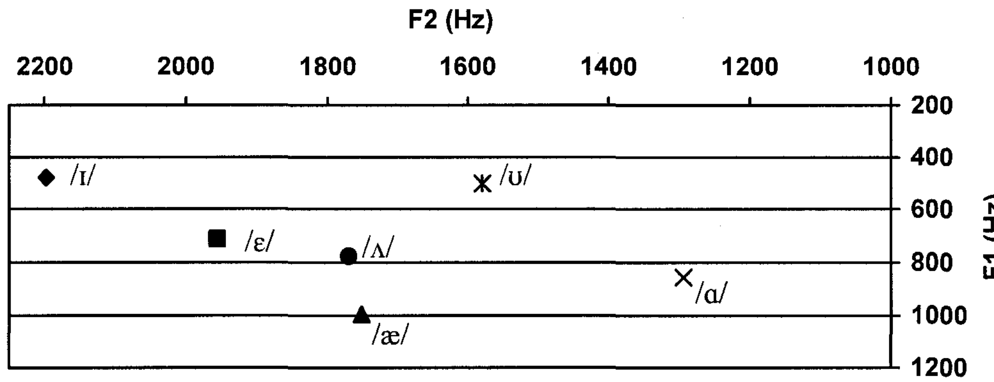


Figure 3.4. Vowel plot of the overall mean F1 and F2 values of the WE female speaker sample (n=5); as reported in Table 2 by Hagiwara (2006).

A comparison of Figures 3.3 and 3.4 shows several obvious differences between the mean lax vowel subsystems of ME and WE, though some commonalities are also observable. The variables /ɪ/, /ɛ/ and /æ/ are more retracted in ME, with the prior two also being lower in this variety. This suggests that ME is more advanced with respect to the front lax vowel shifting of the CS. Although /ɑ/ is somewhat similar across the two varieties, both /ʌ/ and /ʊ/ are less front in ME. Remembering that Clarke et al. (1995) noted the centralizing of /ʌ/ to be a feature of more innovative varieties of CE, the current results for the low to mid back vowels suggest that the speakers who comprise the WE sample display more innovative forms than those that comprise the ME sample with respect to this vowel. Though Boberg usually suggests that his Montreal speakers are conservative compared to the rest of Canada, whether this points to a greater degree of use of this innovative CE feature in WE, or to an age-graded pattern (as the WE speaker sample is a younger subset of the population than Boberg's ME speaker sample) or to something else remains unclear.

Despite their differences, the lax vowel systems of ME and WE are much more similar to each other than either is to the corresponding system in SJE – at least in terms of the data included in Figures 3.2 through 3.4. SJE speakers display considerably more distinction between the front and back lax vowels than do speakers of either of the other two CE varieties. As a comparison of the vowel plots reveals, the front lax vowels in SJE are all more fronted than the corresponding vowels in Boberg's Montreal or Hagiwara's Winnipeg studies.

In order to get a better understanding of the generational effects on the realization of these lax vowels in SJE, each vowel is examined in turn in Section 3.2 below. This is followed by a discussion of the Generational Group results for the tense vowels /o:/ and /u:/ (Section 3.3). Finally, Section 3.4 summarizes these results.

3.2. The Lax Vowel Variables

As noted above, there are several conflicting views of the set of lax vowel changes termed the "Canadian Shift" by Clarke et al. (1995). Clarke et al. suggest that the low back merger of /ɑ/ and /ɔ/ may have triggered some retraction and lowering of

/æ/[10]. That is, this merger in the low back vowel space may have created the context needed for a chain shift in the lax vowel system whereby /ɪ/ and /ɛ/ are affected via a pull shift. Alternatively, no pull shift may be involved: Boberg (2005) suggests rather, a parallel retraction of /ɪ/ and /ɛ/ to be operative in ME at least.

The following sections present the findings for each of the lax vowels in the current SJE sample. These are examined in vowel pairs. In total, 868 lax vowel tokens were analyzed (see Table 2.5).

3.2.1. /ɑ/ and /æ/

Although SJE differs from other varieties of CE in that /æ/ is phonetically more fronted and somewhat higher in the former (compare Figures 3.2-3.4 above), it resembles CE in that it exhibits the merger of /ɑ/ and /ɔ/. If younger St. John's females show more innovative mainland-like realizations of /ɑ/, we might expect younger speakers to also show a greater adoption of the CS. General group results for the /ɑ/ vowel are given in Table 3.2 below. This table presents mean F1 and F2 values (corresponding to tongue height and tongue advancement respectively) for each group, along with their statistical significance (p). Statistically significant differences among groups were determined by three pair-wise Generational Group comparisons via Tukey post-hoc tests; these are

[10] Recall that Hagiwara (2006) casts doubt on the idea that low-back merger has triggered the front lax vowel drag shift termed the CS. The author suggests that the low-back merger triggered a shift in terms of pushing /ʌ/, which then resulted in the retraction (and subsequent lowering) of /æ/.

provided in the right-hand portion of the table. Significant values are bolded in the tables that follow, while non-significant values are enclosed within parentheses and values that are approaching significance ($p \leq .080$) are indicated by underlining. Figure 3.5, which follows, presents a visual plot of mean F1 and F2 values per age group.

Table 3.2. Mean values and statistical significance of /ɑ/ by Generational Group as per ANOVAs performed with Tukey post-hoc tests.

Generational Group	Mean		Generational Group Comparisons	Significance (p)[11]	
	F1	F2		F1	F2
YF80	760	1190	YF80 *vs.* OF03	**.000**	**.000**
OF03	882	1347	OF03 *vs.* YF03	**.000**	**.000**
YF03	793	1206	YF03 *vs.* YF80	(.101)	(.742)
Overall Mean	811	1248			
Overall Significance (p)	**.000**	**.000**			

[11] Non-significant values are enclosed within parentheses. Values that are approaching significance ($p \leq .080$) are indicated in the table by an asterisk.

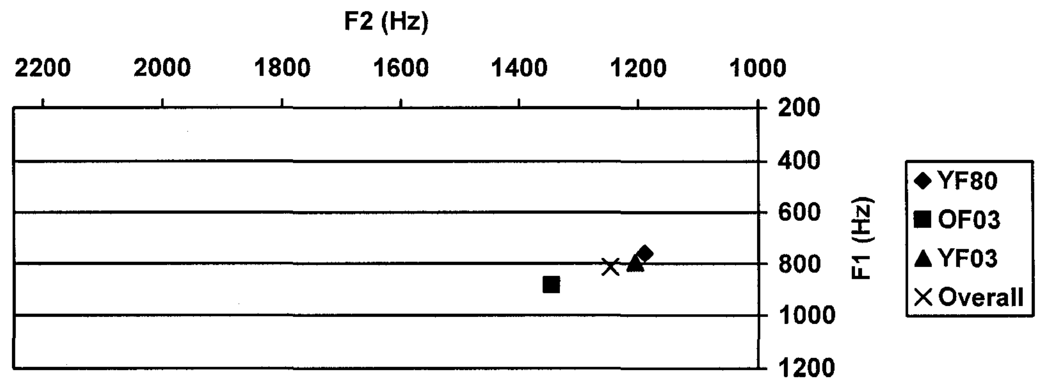


Figure 3.5. Vowel plot of the mean values of F1 and F2 of /ɑ/ by Generational Group.

As can be observed, both the F1 and F2 of /ɑ/ exhibit significant generational differences in the SJE sample. The older females show significantly lower and significantly more fronted realizations than the other two Generational Groups; the two younger female cohorts do not prove to be significantly different from each other, both having similar realizations which are closer to those of mainland CE[12] than are the realizations of the older females.

Given the difference between the YF80 and OF03 groups, this might suggest generational change, whereby the older females have become more sensitive to traditional Newfoundland fronted variants of /ɑ/ than are younger female speakers. By extension, we might expect a greater degree of retraction of /æ/ for the two younger female cohorts, since they have more retracted realizations of /ɑ/. That is, it would seem

[12] Mainland CE here refers to the general vowel pattern exhibited in Figures 3.3 and 3.4.

likely that the more fronted variant of /ɑ/ exhibited by the older speakers would disfavor the retraction of /æ/ among this group.

Table 3.3 displays the results of statistical analysis of /æ/, while Figure 3.6 represents a visual plot of these results. With respect to tongue height of this variable, all three Generational Groups are significantly different from one another, with the older females having the lowest realizations. In terms of tongue advancement, the older females are significantly different from the younger female Generational Groups in that they display more retracted realizations of /æ/. An age-differentiated pattern emerges, but in the opposite direction to what we would expect. That is, the older females have the lowest and most retracted realizations of /æ/, suggesting that they are the most advanced with respect to adoption of CE-like variants. In D'Arcy's (2005) SJE study, adolescent and pre-adolescent speakers with locally born parentage exhibit a decreased use of innovative variants of /æ/ in careful speech styles. D'Arcy attributes this anomalous behavior to linguistic insecurity within this cohort. It is questionable, however, whether linguistic insecurity accurately accounts for the difference in realizations of /æ/ between the early adult and the middle-aged females in the current study.

One possible reason for the generational differences found for /æ/ in the current study is that the older speakers are more sensitive to the mainland-like, supralocal realizations of this variable, discussed in more detail in Section 5.2.1. Furthermore, this cohort may be more sensitive to stigmatized local variants in the sense that they hypercorrect against traditional variants. As Kerswill (2003:226) points out, "people in

Newcastle are (in some sense) aware of what features are 'old' and what features are both more 'modern' and have a wider geographical distribution."

Table 3.3. Mean values and statistical significance of /æ/ by Generational Group as per ANOVAs performed with Tukey post-hoc tests.

Generational Group	Mean	
	F1	F2
YF80	743	2071
OF03	814	1997
YF03	781	2069
Overall Mean	779	2046
Overall Significance (p)	**.000**	**.012**

Generational Group Comparisons	Significance (p)	
	F1	F2
YF80 *vs.* OF03	**.000**	**.008**
OF03 *vs.* YF03	**.006**	**.009**
YF03 *vs.* YF80	**.001**	(.998)

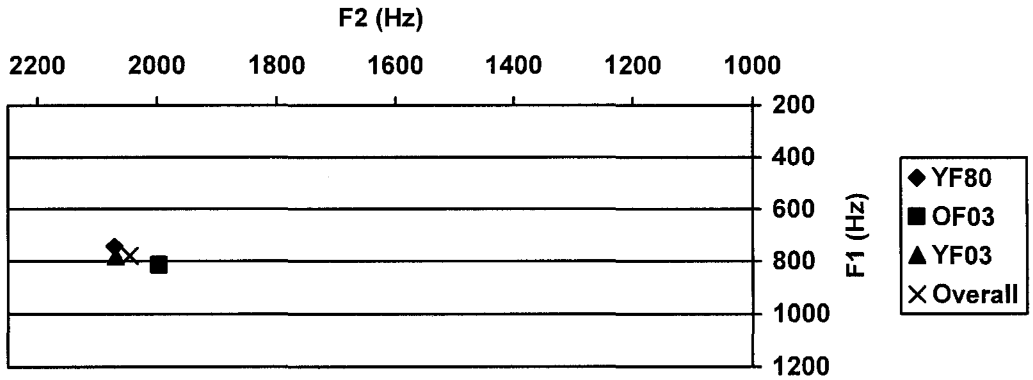


Figure 3.6. Vowel plot of the mean values of F1 and F2 of /æ/ by Generational Group.

3.2.2. /ɛ/ and /ɪ/

Since the older females have the most retracted and lowest realizations of /æ/, and if this difference is the result of the chain shift referred to as the CS, it would follow that they might also have the most retracted/lowered variants of /ɪ/ and /ɛ/. In terms of /ɛ/, significant generational differences emerged only for tongue height (F1). As can be observed in Table 3.4 and Figure 3.7, YF80 displays the highest realizations and YF03 the lowest realizations. Boberg's (2005) ME results showed the retraction of /ɛ/ as the most active part of the CS in Montreal. This is not the case in SJE. In fact, tongue advancement is not significant for this vowel at all in SJE.

Table 3.4. Mean values and statistical significance of /ɛ/ by Generational Group as per ANOVAs performed with Tukey post-hoc tests.

Generational Group	Mean	
	F1	F2
YF80	576	2112
OF03	694	2136
YF03	668	2168
Overall Mean	647	2139
Overall Significance (p)	**.000**	**.027**

Generational Group Comparisons	Significance (p)	
	F1	F2
YF80 *vs.* OF03	**.000**	(.790)
OF03 *vs.* YF03	**.058**	(.132)
YF03 *vs.* YF80	**.000**	(.428)

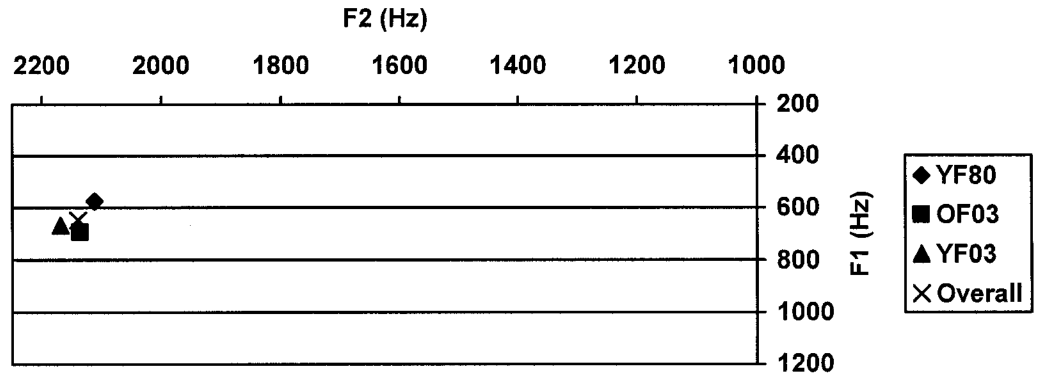


Figure 3.7. Vowel plot of the mean values of F1 and F2 of /ɛ/ by Generational Group.

The other high front lax vowel, /ɪ/, shows significant generational differences with respect to both F1 and F2. Results for /ɪ/ are summarized in Table 3.5 and means plotted in Figure 3.8.

Table 3.5. Mean values and statistical significance of /ɪ/ by Generational Group as per ANOVAs performed with Tukey post-hoc tests.

Generational Group	Mean	
	F1	F2
YF80	449	2239
OF03	519	2082
YF03	524	2203
Overall Mean	497	2174
Overall Significance (p)	**.000**	**.000**

Generational Group Comparisons	Significance (p)	
	F1	F2
YF80 *vs.* OF03	**.000**	**.000**
OF03 *vs.* YF03	(.881)	**.006**
YF03 *vs.* YF80	**.000**	(.629)

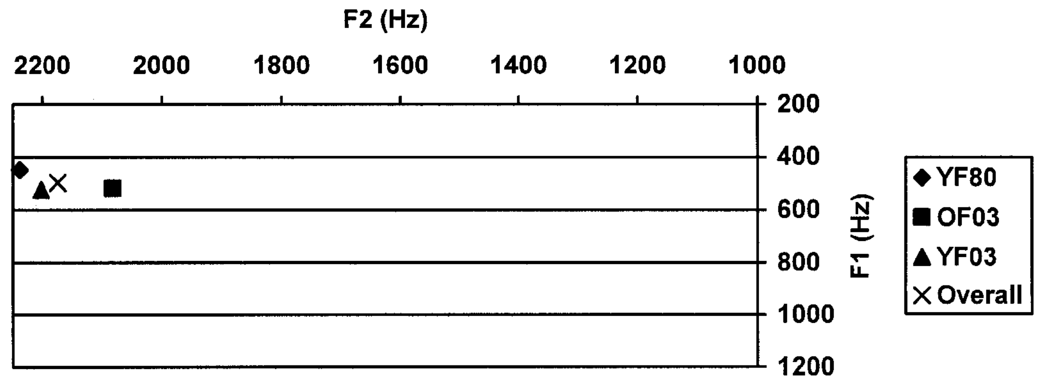


Figure 3.8. Vowel plot of the mean values of F1 and F2 of /ɪ/ by Generational Group.

Table 3.5 shows that the older females exhibit significantly more retracted articulations than either of the two younger groups, who do not differ significantly from each other on this dimension. At least in terms of tongue advancement, the older females once again have variants of /ɪ/ that more closely resemble mainland Canadian norms, as we also saw to be the case for /æ/ retraction. As to tongue height, both the 2003 cohorts exhibit significantly lower F1 realizations for /ɪ/ than do their YF80 counterparts.

<u>3.2.3. /ʌ/ and /ʊ/</u>

Results for /ʌ/ are provided in Table 3.6 and Figure 3.9. Both tongue height and tongue advancement show significant generational effects. The YF80 cohort displays the most fronted (i.e. centralized) realizations, significantly different from either of the other two groups. As to tongue height, the YF80 and OF03 cohorts have significantly lower articulations than YF03.

Table 3.6. Mean values and statistical significance of /ʌ/ by Generational Group as per ANOVAs performed with Tukey post-hoc tests.

Generational Group	Mean	
	F1	F2
YF80	764	1351
OF03	774	1258
YF03	731	1218
Overall Mean	756	1276
Overall Significance (p)	**.007**	**.000**

Generational Group Comparisons	Significance (p)	
	F1	F2
YF80 *vs.* OF03	(.730)	**.012**
OF03 *vs.* YF03	**.003**	(.444)
YF03 *vs.* YF80	**.030**	**.000**

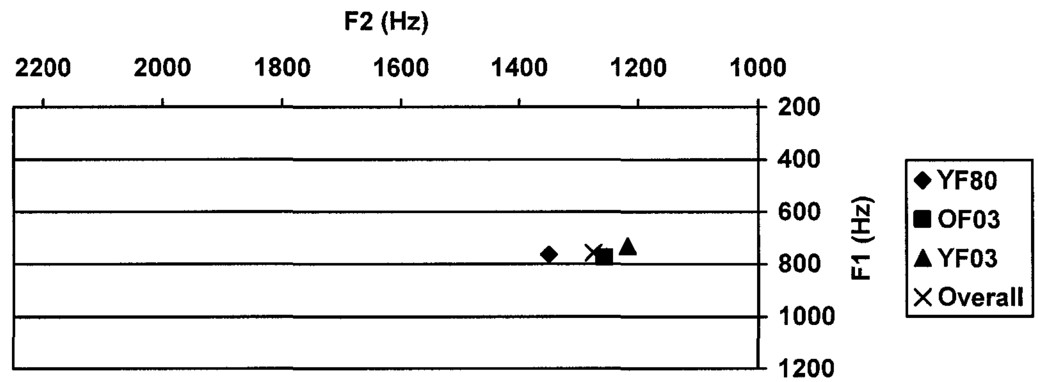


Figure 3.9. Vowel plot of the mean values of F1 and F2 of /ʌ/ by Generational Group.

The variable /ʊ/ was not included in Clarke et al.'s (1995) study; however, Boberg (2005) found that age has an effect on this vowel in ME. In Boberg's study, the F2 of /ʊ/ shows a significant correlation with generation, in that there is a large rise in the F2 (i.e. /ʊ/-centralization) from the middle to the youngest group of Montrealers. Hagiwara's study of WE (2006), likewise, shows relative advancement (centralization) of /ʊ/, as well as /u:/ and /ʌ/, among younger speakers aged 18-25.

Generation, however, yields no significant effects in terms of tongue advancement of /ʊ/ in the SJE data, as can be observed from the F2 results Table 3.7. Figure 3.10 plots the mean values given in this table.

Table 3.7. Mean values and statistical significance of /ʊ/ by Generational Group as per ANOVAs performed with Tukey post-hoc tests.

Generational Group	Mean	
	F1	F2
YF80	470	1136
OF03	492	1148
YF03	538	1138
Overall Mean	502	1141
Overall Significance (p)	**.001**	(.624)

Generational Group Comparisons	Significance (p)	
	F1	F2
YF80 *vs.* OF03	(.406)	(.999)
OF03 *vs.* YF03	**.017**	(.964)
YF03 *vs.* YF80	**.001**	(.999)

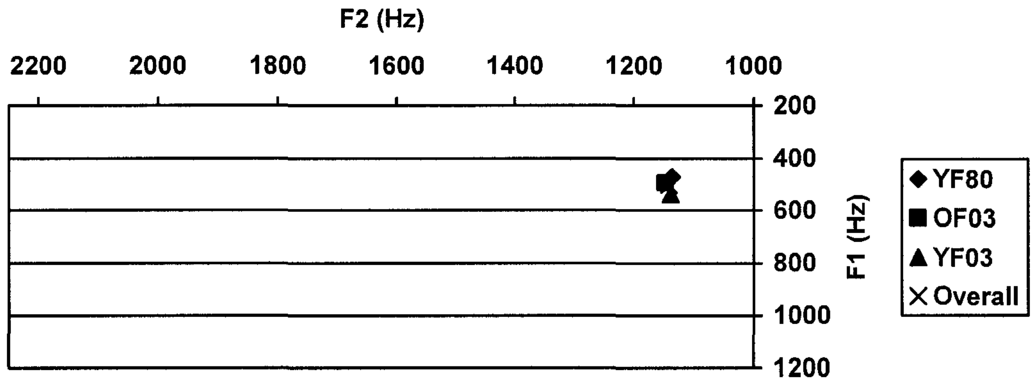


Figure 3.10. Vowel plot of the mean values of F1 and F2 of /ʊ/ by Generational Group.

In terms of tongue height, generation is significant only in that the YF03 cohort shows a significantly lower realization than both the YF80 cohort and OF03 cohorts; whether this suggests an ongoing lowering process of this vowel in SJE is unclear. In any case, the real time evidence suggests no change in /ʊ/ articulation between the YF80 and the OF03 groups.

3.3. The Tense Vowel Variables: /o:/ and /u:/

Two tense vowels are investigated in the current study: /o:/ and /u:/. These variables were included (see Section 2.1.1.2 above) to determine whether the fronting of tense high back vowels (particularly /u:/) that characterizes a number of English varieties was also evident in SJE. These vowels are discussed in turn below. Analysis is based on a total of 288 tokens of /o:/ and /u:/ (see Table 2.5).

As Figures 3.1 and 3.2 above show, /o:/ represents the most backed vowel in the vowel space of the 12-speaker sample investigated in this study. Table 3.8 below presents mean F1 and F2 measurements for /o:/, and statistical significance derived from SPSS ANOVAs with Tukey post-hoc tests. Figure 3.13 plots the mean values by Generational Group.

Table 3.8. Mean values and statistical significance of /o:/ by Generational Group as per ANOVAs performed with Tukey post-hoc tests.

Generational Group	Mean	
	F1	F2
YF80	646	1179
OF03	617	1115
YF03	610	1088
Overall Mean	623	1124
Overall Significance (p)	**.019**	**.004**

Generational Group Comparisons	Significance (p)	
	F1	F2
YF80 *vs.* OF03	(.151)	(.077)*
OF03 *vs.* YF03	(.892)	(.595)
YF03 *vs.* YF80	(.053)*	**.005**

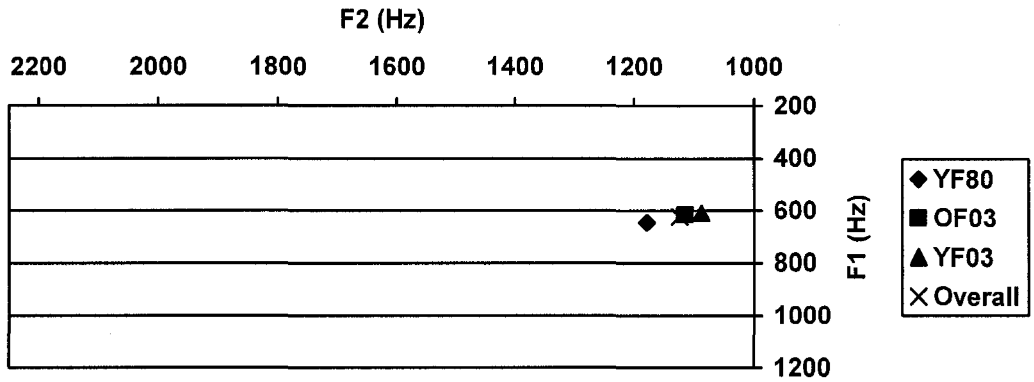


Figure 3.11. Vowel plot of the mean values of F1 and F2 of /o:/ by Generational Group.

Table 3.8 indicates significant Generational Group differences for the F1 and F2 of /o:/. With respect to tongue advancement, the YF80 group is significantly more fronted than the YF03 group, and approaches significance with respect to OF03. As to tongue height, the YF03 group displays somewhat lower realizations than the other two groups, particularly the YF80 cohort. As can be observed from Figure 3.13, the YF80 group has lower and more fronted realizations than both YF03 and OF03; these last two groups show no significant differences in mean realizations.

Table 3.9 below displays the mean F1 and F2 values of /u:/, as well as cross-generational statistical significance as per the SPSS output. Figure 3.14 plots these values by Generational Group.

Table 3.9. Mean values and statistical significance of /u:/ by Generational Group as per ANOVAs performed with Tukey post-hoc tests.

Generational Group	Mean		Generational Group Comparisons	Significance (p)	
	F1	F2		F1	F2
YF80	443	1618	YF80 *vs.* OF03	**.014**	**.000**
OF03	418	1166	OF03 *vs.* YF03	**.014**	**.000**
YF03	443	1414	YF03 *vs.* YF80	(1.000)	**.000**
Overall	435	1399			
Overall Significance (p)	**.021**	**.000**			

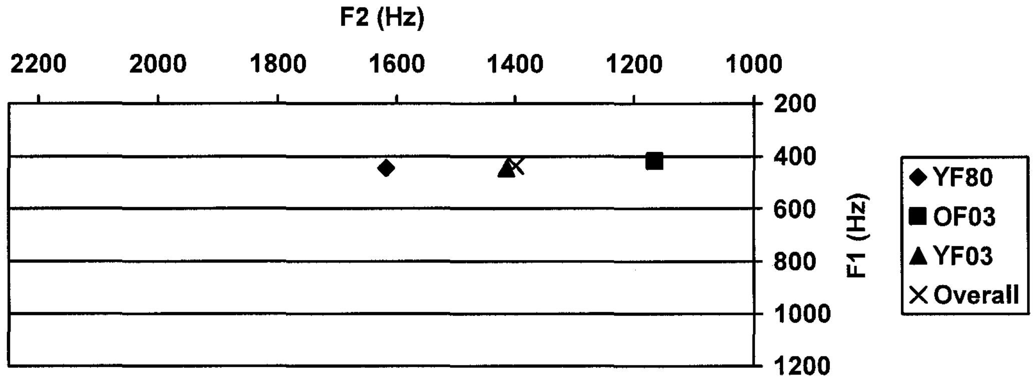


Figure 3.12. Vowel plot of the mean values of F1 and F2 of /u:/ by Generational Group.

As can be observed on the above plot, the /u:/ variable, more so than for any other vowel investigated, shows the greatest range of values across the three Generational Groups along the dimension of tongue advancement. Both tongue advancement and tongue height are significant with respect to Generational Group for this variable. As Figure 3.14 shows, the older females exhibit the most retracted realizations, while the YF03 group occupies an intermediate position. This is opposite to the results we saw for front lax vowel lowering in which the older females were the most advanced with respect to innovative CE-like features. For /u:/, however, it is the younger females in the early 1980s who use a centralized variant that most resembles the supralocal, socially-marked variant discussed in section 2.1.1.2 above. Similarly, as noted just above, this same cohort displays the most fronted realizations of the other tense vowel variable investigated, /o:/.

The variability of /u:/ is evident when examining the standard deviations for this variable. As shown in Table 3.1 at the beginning of this Chapter, the standard deviation for F2 measurements of /u:/ is 336 Hz; this is more than one hundred Hz larger than the next highest standard deviation.

When intra-group comparisons for /u:/ fronting are made , the results show considerable variability across speakers for the two 2003 cohorts. The YF80 group, however, exhibits no significant differences among the four speakers in that cohort in terms of the advancement of /u:/. As can be observed from Table 3.10, with respect to the older female cohort, the speakers can be split in half in terms of significant differences (obtained via SPSS ANOVAs with Tukey post-hoc tests). Speaker $OF03_B$ and Speaker $OF03_C$ have significantly more fronted variants of /u:/ than either Speaker $OF03_A$ or Speaker $OF03_D$. As can be observed in Table 3.10, there are no significant differences within either of these two pairings (i.e. B-C and A-D).

Table 3.10. OF03: Intra-group variation by speaker for the F2 of /u:/.

Speaker	Mean F2	Pair wise Speaker Comparisons	Significance (p)
$OF03_A$	1033	$OF03_A$ *vs.* $OF03_B$	**.000**
		$OF03_A$ *vs.* $OF03_C$	**.009**
$OF03_B$	1329	$OF03_B$ *vs.* $OF03_C$	(.576)
		$OF03_B$ *vs.* $OF03_D$	**.000**
$OF03_C$	1246	$OF03_C$ *vs.* $OF03_D$	**.023**
$OF03_D$	1056	$OF03_D$ *vs.* $OF03_A$	(.984)
Overall Significance (p)	**.000**		

In terms of the younger female 2003 cohort, there is one speaker ($YF80_A$) who shows significantly more advanced variants of /u:/ than the rest of her cohort (though not significantly different from the mean values for $YF03_C$); her realizations resemble those of the YF80 Generational Group. This is summarized in Table 3.11 below. One possible explanation is that this difference is a direct result of the degree of upward social mobility among the speakers.

This result is not surprising. I have known this participant well for many years and can attest to her social ambition. She is known for 'putting on face' and dialect shifting as well. If for instance she is speaking with a fellow student she tends to display more innovative mainland-like linguistic behavior. However, in the company of family or friends from a small rural outport (i.e. Fogo Island, Newfoundland), her speech is heavily peppered with the types of traditional variants this particular audience uses. This speaker is (and was at the time of recording) attending university on the mainland. This may also contribute to her anomalous linguistic behavior. Furthermore, she is majoring in vocal performance. In a career in which performance and presentation are key, it is no surprise this speaker fits Chambers' (1995) label "aspirer".

When this socially ambitious speaker's productions are not included in an examination of /u:/ fronting, the YF03 cohort shows a mean realization of /u:/ that more closely resembles the more retracted OF03 mean realization. If this is the case, we are not presented with a typical age-graded pattern. Instead, the pattern that emerges shows 2003 speakers as using less front variants of /u:/. As noted above, whether this points to a change in the use of /u:/ fronting in SJE over time, points to methodological issues, or indicates something else is unclear. If nothing else, the data do support the idea that /u:/ fronting is an off-the-shelf feature available to SJE speakers, with more upwardly social mobile speakers leading in its adoption (at least in the 2003 data).

Table 3.11. YF03: Intra-group variation by speaker for the F2 of /u:/.

Speaker	Mean F2	Pair wise Speaker Comparisons	Significance (p)
YF03$_{A}$	1638	YF03$_{A}$ *vs.* YF03$_{B}$	**.013**
		YF03$_{A}$ *vs.* YF03$_{C}$	(.642)
YF03$_{B}$	1256	YF03$_{B}$ *vs.* YF03$_{C}$	(.198)
		YF03$_{B}$ *vs.* YF03$_{D}$	(.999)
YF03$_{C}$	1496	YF03$_{C}$ *vs.* YF03$_{D}$	(.256)
YF03$_{D}$	1270	YF03$_{D}$ *vs.* YF03$_{A}$	**.019**
Overall Significance (p)	**.005**		

The overall extent to which /u:/ fronting is occurring in SJE can be further illustrated by comparing it to the back variables /ʊ/ and /o:/. Table 3.12 summarizes the overall F2 means of these three back vowels. As can be observed, /u:/ is much more fronted than either /ʊ/ or /o:/, suggesting that /u:/-fronting is active in SJE, at least to some degree and for some speakers – placing them within mainstream English phonetic patterns.

Table 3.12. Overall F2 means of /ʊ/, /o:/ and /u:/.

Variable	Overall Mean F2
/ʊ/	1141
/o:/	1124
/u:/	1399

3.4. Overview of Generational Group Results

Based on the evidence presented, the lowering and/or retraction process that characterizes front lax vowels in innovative CE appears to be active in SJE, at least to some degree. Yet, strikingly, it is the older females recorded in 2003 who typically use CE-like variants not only more than the younger 2003 female group (the next generation in apparent time) but also more than their younger real-time counterparts, the YF80 cohort. A further discussion of the implications of the current results for age-based models of linguistic change will be presented in the concluding chapter, Chapter 5. The sections immediately following summarize the Generational Group results in terms of apparent-time change (i.e. YF03 vs. OF03 in Section 3.4.1); real-time change (YF80 vs. YF03 in Section 3.4.2); and real-time change within the individual (YF80 vs. OF03 in Section 3.4.3).

3.4.1. Change in Apparent Time

As discussed in Chapter 1, traditional Labovian sociolinguistic techniques generally use apparent-time data to make inferences about real-time change, despite the inherent weaknesses of this approach (see for example Bailey 2002). A comparison of the YF03 and OF03 Generational Group results provides apparent-time evidence with respect to vowel shifting in SJE, which can then be validated by the real-time data, examined in the following two sections.

With respect to /ɑ/, the apparent-time data show the younger Generational Group (YF03) as having more retracted CE-like variants than the OF03 cohort. This suggests two possible explanations: either the use of more front traditional variants of /ɑ/ in SJE is decreasing over time; or, as they age, older speakers become more sensitive to traditional, local variants. Real-time data, discussed below, may help determine which of these two possible explanations better fits the data.

In terms of the front lax vowels /æ,ɛ,ɪ/, the OF03 cohort shows articulations that are more retracted (significantly so for /æ/ and /ɪ/) and lower (significant for /æ/ and /ɛ/) than their younger female 2003 counterparts. In a traditional Labovian sociolinguistic framework, these apparent-time results would be interpreted such that variation between the Generational Groups reflects language change over time. Yet since the younger speakers recorded in 2003 exhibit higher and more fronted realizations of the front lax vowels involved in the CS, it is very highly unlikely that the SJE vowel subsystem has undergone a shift over the last two decades that is the total reverse of what has happened in innovative CE. The more likely conclusion, rather, is that the CS is to some degree active in SJE, but with an unexpected twist, at least in the current data. This interpretation can be confirmed if the real-time evidence shows change over time in the direction of the CS, that is, if the YF03 cohort has more retracted/lowered variants of the front lax vowels than the YF80 cohort (see Section 3.4.2 below).

In terms of /ʌ/, the YF03 group has realizations that are significantly higher than their 2003 older female counterparts; although not significant, the YF03 cohort also shows more retracted realizations then the OF03 cohort. Based on the apparent lowering/centralizing of this vowel in more innovative CE (see Clarke et al. 1995), again, it is unlikely this vowel is shifting in the opposite direction in SJE. What seems more likely, particularly in light of the apparent-time results for the front lax vowels, is that this vowel is shifting for some speakers of SJE and that it is the older females who again are leading this innovation.

The vowel variable /ʊ/ in the apparent-time data shows the younger female cohort as having significantly lower realizations than the OF03 cohort, with the degree of tongue advancement differing little between the two groups. In other words, the younger group does not display the same tendency to centralize /ʊ/ that was evident among Boberg's youngest group of ME speakers (Boberg 2005).

The apparent-time data provide significant differences with respect to /u:/ but not for /o:/. The YF03 Generational Group has more fronted and lowered realizations of /u:/

than does OF03. When compared to real-time results (see Section 3.4.2), these results suggest that /u:/ fronting may be salient and an available feature for speakers of SJE. As section 3.3 suggested, however, this supralocal "off-the-shelf" feature seems one that may be particularly exploited by socially-mobile speakers in St. John's.

3.4.2. Change in Real Time

The inclusion in the SJE sample of two socially-matched groups of females in their twenties, separated by some 20 years in time (YF80 vs. YF03) permits an examination of ongoing change in the lax vowel system of SJE from a real-time perspective.

In terms of /ɑ/, the real-time data show no significant differences between the two younger female cohorts (YF80 and YF03). This suggests no change over time with respect to this vowel in SJE, and provides insight into the apparent-time finding noted in Section 3.4.1 above, namely, that the older speakers recorded in 2003 display more fronted variants than their younger counterparts (YF03). The real-time evidence here for /ɑ/ suggests that as speakers age from young adulthood to middle age, they may become more sensitive to local variants of this vowel variable. This suggests that /ɑ/ fronting may be highly socially-marked for the SJE speakers included in the current analysis.

With respect to the front lax vowels involved in the CS, the real-time data for SJE shows the 2003 younger females as having significantly lower realizations of /æ/, /ɛ/ and

/ɪ/ than their same-age counterparts recorded 20 years earlier. These data indicate that there is change over time in SJE in terms of the adoption of CS-like features. This tends to support the hypothesis advanced in Section 3.4.1: older females are not only participating in, but appear to be leading, the adoption of innovative lax vowel variants (for further confirmation, see Section 3.4.3).

As to /ʌ/, the real-time evidence shows the YF80 group as having significantly lower and more fronted variants than YF03 speakers. That is, there is no evidence of change in SJE in the direction of innovative fronted and lowered CE-like variants. As discussed in Section 3.4.1 above, the apparent-time data showed that the OF03 group also has significantly lower realizations of /ʌ/ than the YF03 group. These findings mirror results presented for the front lax vowels. The most likely interpretation here is that the OF03 group has retained a lower variant of /ʌ/ that they may have acquired as children.

With respect to /ʊ/, the younger female speakers in 2003 have significantly lower realizations than the YF80 group, suggesting that /ʊ/ is lowering over time in SJE (cf. the similar apparent-time conclusion in the previous section).

The apparent-time data presented in 3.4.2 above suggested no change in time for /o:/ in SJE. This is not mirrored in the real-time data. The latter show the YF03 cohort as having articulations of /o:/ significantly more retracted and higher than those for the YF80 group. If anything, there is no evidence of a change over time in the direction of /o:/ fronting, but rather, in the opposite direction. In terms of /u:/ fronting, the YF80 Generational Group also have significantly more fronted realizations than YF03. This supports the idea that for whatever reason, the YF80 group is more sensitive to back vowel fronting – not only for/u:/, but also /o:/ and /ʌ/. Why this should be the case clearly requires further study.

To sum up, while the real-time comparisons of YF80 and YF03 vowel data suggest ongoing change in the front lax vowels of SJE that parallels changes in innovative CE that have been labeled the "Canadian Shift", such is not the case for the back vowels. In fact, the younger females recorded in 2003 appear, if anything, to be moving in a direction opposite to their mainland Canadian counterparts.

3.4.3. Real-time Change in the Individual

Comparison of the YF80 and OF03 cohorts permits, on the basis of a real-time trend approach, the examination of change over time within individual speakers. The results of the two previous sections suggest, for /ɑ/, that this variable may follow an age-graded pattern in SJE. This is confirmed when results from the OF03 group are compared to those of speakers recorded in the early 1980s, both of whom represent the same age group in real time. The fact that the OF03 cohort exhibits variants that are more fronted and lower than those of their 1980s counterparts suggests that as they have aged, the older female group has tended to adopt a pronunciation more characteristic of the traditional local norms.

In terms of the front lax vowels, results also show real-time change in the individual. Here, however, older females have more innovative (i.e. lower and more retracted) realizations than their 1980s counterparts. This further validates the hypothesis that older females are actively participating in CS-like changes in SJE, and continue to do so well into adulthood.

The variable /ʌ/ shows the YF80 group as having significantly more fronted realizations than their older counterparts more than twenty years later. Furthermore, the YF03 cohort has lower realizations of /ʌ/ than either the OF03 or YF80 Generational Groups. This, combined with evidence for this variable from Sections 3.4.1 and 3.4.2, would seem to suggest that /ʌ/ may be lowering (and possibly retracting) over time in SJE and that older females are participating in this change along with younger females.

With respect to the other back vowels, the apparent-time results showed the YF03 group as having significantly more fronted realizations of /u:/ than the 2003 older females (though significantly more retracted realizations of /o:/; /ʊ/ shows little F2 differences between these two groups). This would suggest a change in /u:/ over time along the F2 dimension (tongue advancement). The real-time evidence presented in Section 3.4.2 suggests that, if anything, the tense vowels /o:/ and /u:/ may be retracting rather than fronting in SJE. Change within the individual, as indicated by a comparison of OF03 and YF80 results, seems to support the real time data in that older females in 2003 have significantly more retracted realizations of /o:/ and /u:/. However, what seems more likely is that /u:/ fronting is an age-graded phenomenon, with younger speakers having a greater tendency to make use of this marker of social mobility.

Chapter 4

Results – Phonological Conditioning

This chapter presents results for the language-internal factors that are investigated in the current study, all of which relate to phonological environment. Specifically, this study examines place of articulation (POA), manner of articulation (MOA) and voicing of the both the following and preceding segment – and their effects on vowel changes in SJE. Also, this chapter addresses significant interactions between phonological conditioning and Generational Group.

As outlined in 2.1.2 above, at least two studies have briefly investigated the effects of phonological environment of the innovative realizations identified with the Canadian Shift. Clarke et al. (1995) pointed to the significance of the manner of articulation of the following consonant on the lowering/retraction of front lax vowels, with fricatives favoring this process. The Clarke et al. study also suggested that the innovative realizations of the front lax vowels were promoted by a following voiceless, as opposed to voiced, consonant. D'Arcy (2005), however, suggests that /æ/ retraction in innovative SJE is promoted by a following voiced rather than voiceless segment, and that this process is conditioned by the point of articulation of the following consonant, with lowering/retraction being favored by velars.

With respect to back vowel fronting, Anderson (2004) found following phonological context to play a role in the fronting of tense /u:/. More retracted variants of this back vowel are promoted when followed by a labial or a velar. Conversely, there is a tendency for more fronted variants to be realized when /u:/ is followed by an alveolar.

The ANAE (Labov et al, 2006) distinguished between the effects of a preceding coronal and non-coronal environment on /u:/ fronting. That is, variants of /u:/ that occur following a coronal consonant show greater fronting effects. Fridland and Bartlett (2003) report that back vowel (e.g. /u:/) fronting is promoted by a preceding or following palatal or alveolar.

A listing of the various following and preceding environments investigated in this study was provided in Section 2.1.2 (cf. Tables 2.1 and 2.2). Sections 4.1 and 4.2 below present the results for phonological conditioning (following and preceding environment respectively) and Section 4.3 summarizes these results. Section 4.4 discusses interactions between Generational Group and the various phonological factors investigated. Note that tokens in which the vowel variable occurs either word-initially or word-finally have been excluded from the statistical analysis of the effects of the surrounding phonological environment.

4.1. Results for Following Phonological Environment

As discussed in Chapter 2, three types of following phonological environment are examined in this study: place of articulation (foll-POA), manner of articulation (foll-

MOA) and the voicing of the following segment (foll-Voicing). Results for each environment type are discussed in turn below.

4.1.1. Place of Articulation of the Following Segment

In total, 1142 tokens were used in the analysis of foll-POA, as summarized in Table 4.1. Where possible, a total of 168 tokens for each variable were analyzed. Pre-dorsal tokens are particularly lacking, and none were available for the two back tense variables /o:/ and /u:/. Since an analysis of foll-POA was not anticipated in the original research design, the small number of tokens was unavoidable.

Table 4.1. Data for foll-POA.

Following Place of Articulation	Number of Tokens								
	/ɑ/	/æ/	/ɛ/	/ɪ/	/ʌ/	/ʊ/	/o:/	/u:/	Total
Labial	65	60	61	41	70	8	28	67	400
Fricative	67	70	67	95	50	28	88	99	564
Dorsal	36	38	24	32	24	20	-	-	178
Total	168	168	152	168	144	56	120	166	1142

Table 4.2 below summarizes the overall mean F1 and F2 results obtained via ANOVAs for the eight variables investigated in terms of foll-POA. This is followed by a discussion of the foll-POA results.

Table 4.2. Overall mean F1 and F2 and significance of results for foll-POA.

Variable	F1	Sig. (p)	F2	Sig. (p)
/ɑ/	811	(.877)	1248	**.014**
/æ/	779	**.000**	2046	(.719)
/ɛ/	647	**.003**	2139	(.174)
/ɪ/	497	(.055)*	2175	(.212)
/ʌ/	756	(.784)	1275	(.182)
/ʊ/	502	(.529)	1141	(.296)
/o:/	623	(.475)	1124	**.044**
/u:/	435	(.128)	1399	**.038**

Table 4.2 shows that only three of the vowel variables examined display significant main effects for foll-POA with respect to F1, or tongue height: /æ/, /ɛ/ and /ɪ/. As to F2, significant main effects are found only for the back vowel variables /ɑ/, /o:/ and /u:/. Interestingly, it is the three front lax variables which are involved in the so-called "Canadian Shift". A more detailed examination of foll-POA with respect to /æ/, /ɛ/ and

/ɪ/ may offer insight into the exact nature of how the following place of articulation affects the realization of these front lax vowel variables. Tables 4.3 through 4.5 present mean values and statistical significance of the three types of foll-POA for each of the variables /æ/, /ɛ/ and /ɪ/.

Table 4.3. Mean values and statistical significance of /æ/ by foll-POA as per ANOVAs performed with Tukey post-hoc tests.

Foll-POA	Mean		Foll-POA Pairwise Comparisons	Significance (p)	
	F1	F2		F1	F2
Labial	808	2022	Labial *vs.* Coronal	**.000**	(.419)
Coronal	766	2050	Coronal *vs.* Dorsal	(.711)	(.607)
Dorsal	757	2075	Dorsal *vs.* Labial	**.000**	(.117)

As can be observed from Table 4.3, a pre-labial environment shows significant F1 differences from pre-coronal and pre-dorsal environments, while the latter display no significant differences from each other. Variants of /æ/ that occur before a labial consonant have realizations that are significantly lower than those that occur before a coronal or dorsal. This is in contradiction to D'Arcy's (2005:339) results for /æ/

retraction/lowering in her SJE data, which suggest that a following velar significantly promotes /æ/ retraction/lowering while a following bilabial disfavors this process.

One possible explanation for such a dichotomy in results may be a direct result of differing data sets. Firstly, and more likely, is the small sample size used by both the current and D'Arcy's study. Combined, both studies include the analysis of only 28 speakers, all of whom are female, middle to upper-middle class speakers of SJE. Whether or not these results can be confirmed for the entire speech community remains a subject for further investigation.

Furthermore, D'Arcy (2005) analyzed the speech of pre-adolescent (aged 8-11) and adolescent females (aged 16-17), while the current study's youngest generational group is nearly a decade older. As D'Arcy notes, internal constraints have no effect within her group of local-parent speakers. Perhaps then, different constraints have been acquired by the speakers in the current data that were acquired by the younger adolescent and pre-adolescent speakers in D'Arcy's study.

Table 4.4. Mean values and statistical significance of /ɛ/ by foll-POA as per ANOVAs performed with Tukey post-hoc tests.

Foll-POA	Mean		Foll-POA Pairwise Comparisons	Significance (p)	
	F1	F2		F1	F2
Labial	675	2074	Labial *vs.* Coronal	**.000**	**.020**
Coronal	637	2150	Coronal *vs.* Dorsal	(.994)	(.448)
Dorsal	638	2185	Dorsal *vs.* Labial	**.004**	**.002**

As Table 4.4 shows for /ɛ/, a following labial again promotes significantly lower articulations, while following coronals and dorsals have near identical mean realizations with respect to tongue height. As to F2, though Table 4.2 indicated no significant overall effect for /ɛ/ (p= .174), pre-labial variants also constitute significantly more retracted realizations than either pre-coronal or pre-dorsal /ɛ/ variants, which display similar mean F2 realizations.

Table 4.5. Mean values and statistical significance of /ɪ/ by foll-POA as per ANOVAs performed with Tukey post-hoc tests.

Foll-POA	Mean		Foll-POA Pairwise Comparisons	Significance (p)	
	F1	F2		F1	F2
Labial	527	2132	Labial *vs.* Coronal	**.000**	(.397)
Coronal	480	2173	Coronal *vs.* Dorsal	**.019**	(.204)
Dorsal	509	2245	Dorsal *vs.* Labial	(.322)	**.035**

Table 4.5 indicates that although the F1 results for /ɪ/ again show pre-labial environments to promote greater lowering, results for this vowel differ from those of the previous two lax vowels in that pre-coronal environments display a significantly greater tendency towards higher realizations than do both pre-labial and pre-dorsal environments. As to F2, though once again there is no significant overall effect, a following labial consonant produces significantly more retracted realizations than a following dorsal.

This seems odd in simple articulatory terms since it might be expected that a back consonant (i.e. dorsal) would cause greater retraction in a preceding vowel; yet for the current data, the opposite is the case. In fact, this finding is repeated in all three of the front lax vowel variables investigated. Each of /æ/, /ɛ/ and /ɪ/ exhibits mean realizations in which a pre-labial environment promotes variants that are more retracted than pre-coronal environments, which likewise are more retracted than pre-dorsal variants.

Only three variables show overall significance for F2, as per Table 4.2: /ɑ/, /o:/ and /u:/. None of these three variables shows a significant effect for vowel height (F1). Individual results for /ɑ/, /o:/ and /u:/ are summarized in Tables 4.6, 4.7 and 4.8 respectively. Note that for both /u:/ and /o:/, the pre-dorsal environment could not be examined, because of absence of tokens (cf. Table 4.1).

Table 4.6. Mean values and statistical significance of /ɑ/ by foll-POA as per ANOVAs performed with Tukey post-hoc tests.

Foll-POA	Mean		Foll-POA Pairwise Comparisons	Significance (p)	
	F1	F2		F1	F2
Labial	811	1256	Labial *vs.* Coronal	(.995)	(.790)
Coronal	810	1272	Coronal *vs.* Dorsal	(.951)	**.013**
Dorsal	815	1187	Dorsal *vs.* Labial	(.973)	(.057)*

Table 4.7. Mean values and statistical significance of /o:/ by foll-POA as per ANOVAs performed with Tukey post-hoc tests.

Foll-POA	Mean		Foll-POA Pairwise Comparisons	Significance (p)	
	F1	F2		F1	F2
Labial	626	1080	Labial *vs.* Coronal	(.475)	**.044**
Coronal	621	1129	Coronal *vs.* Dorsal	-	-
Dorsal	-	-	Dorsal *vs.* Labial	-	-

Table 4.8. Mean values and statistical significance of /u:/ by foll-POA as per ANOVAs performed with Tukey post-hoc tests.

Foll-POA	Mean		Foll-POA Pairwise Comparisons	Significance (p)	
	F1	F2		F1	F2
Labial	429	1365	Labial *vs.* Coronal	(.128)	**.038**
Coronal	438	1415	Coronal *vs.* Dorsal	-	-
Dorsal	-	-	Dorsal *vs.* Labial	-	-

Table 4.6 indicates that for /ɑ/, a following dorsal consonant promotes realizations that are significantly more retracted than either pre-coronal or pre-labial variants. As to the back tense vowels, the data reveal that variants of /u:/ which precede a labial consonant are significantly more retracted than those followed by a coronal consonant. This same pattern is echoed in the data for the vowel variable /o:/. Once again, that is, a phonetically unexpected result is found in that a pre-labial position tends to promote greater retraction than pre-coronal.

4.1.2. Manner of Articulation of the Following Segment

In total, 1148 tokens were used in the analysis of foll-MOA, as summarized in Table 4.9. Since the original research design did not include provision for the examination of foll-MOA for the /ʊ/ variable, tokens are minimal or non-existent for this vowel outside of a pre-stop environment.

Table 4.9. Data for foll-MOA.

Following Manner of Articulation	Number of Tokens								
	/ɑ/	/æ/	/ɛ/	/ɪ/	/ʌ/	/ʊ/	/o:/	/u:/	Total
Stop	60	58	64	60	58	48	44	62	454
Fricative	60	62	56	60	62	8	36	58	402
Nasal	48	48	44	48	24	-	40	40	292
Total	168	168	164	168	144	56	120	160	1148

Table 4.10 below summarizes the overall mean F1 and F2 results for foll-MOA obtained via ANOVAs (with Tukey post-hoc tests) for the eight vowel variables investigated. This is followed by a discussion of foll-MOA results.

Table 4.10. Overall mean F1 and F2 results and significance for foll-MOA.

Variable	F1	Sig. (p)	F2	Sig. (p)
/ɑ/	497	(.629)	2174	(.928)
/æ/	642	**.000**	2139	**.000**
/ɛ/	779	**.043**	2046	**.001**
/ɪ/	811	**.000**	1248	**.013**
/ʌ/	756	(.458)	1276	(.229)
/ʊ/	502	(.529)	1141	(.296)
/o:/	623	(.461)	1124	(.322)
/u:/	435	(.103)	1399	(.450)

Foll-MOA proves significant for the three front lax vowels /ɪ/, /ɛ/ and /æ/ in terms of both tongue height (F1) and advancement (F2). Table 4.11 presents results for the variable /æ/. As can be observed, a following fricative promotes more retracted and lower variants of /æ/.

Table 4.11. Mean values and statistical significance of /æ/ by foll-MOA as per ANOVAs performed with Tukey post-hoc tests.

Following Manner of Articulation	Mean	
	F1	F2
Stop	793	2007
Fricative	810	1991
Nasal	723	2163
Overall Mean	779	2046
Overall Significance (p)	**.000**	**.000**

Foll-MOA Pairwise Comparisons	Significance (p)	
	F1	F2
Stop *vs.* Fricative	(.275)	(.802)
Fricative *vs.* Nasal	**.000**	**.000**
Nasal *vs.* Stop	**.000**	**.000**

Results for /ɪ/ are summarized in Table 4.12 below. Tongue height is significant (p=.000) for /ɪ/, but for this vowel, a following nasal promotes significantly lower articulations than do either previous fricatives or stops. For /ɛ/, however, Table 4.13 indicates that a pre-nasal environment does not promote the lowest realizations, rather –

as is the case for /æ/ – these occur in pre-fricative environments. As to F2, for both /ɪ/ and /ɛ/, following nasals promote the most fronted realizations.

Table 4.12. Mean values and statistical significance of /ɪ/ by foll-MOA as per ANOVAs performed with Tukey post-hoc tests.

Following Manner of Articulation	Mean		Foll-MOA Pairwise Comparisons	Significance (p)	
	F1	F2		F1	F2
Stop	493	2161	Stop *Vs.* Fricative	(.323)	(.861)
Fricative	480	2142	Fricative *Vs.* Nasal	**.000**	(.059)*
Nasal	524	2233	Nasal *Vs.* Stop	**.007**	(.170)
Overall Mean	497	2175			
Overall Significance (p)	**.000**	**.013**			

Table 4.13. Mean values and statistical significance of /ɛ/ by foll-MOA as per ANOVAs performed with Tukey post-hoc tests.

Following Manner of Articulation	Mean	
	F1	F2
Stop	635	2126
Fricative	662	2018
Nasal	647	2312
Overall Mean	647	2139
Overall Significance (p)	**.043**	**.001**

Foll-MOA Pairwise Comparisons	Significance (p)	
	F1	F2
Stop *Vs.* Fricative	**.017**	**.000**
Fricative *Vs.* Nasal	(.456)	**.000**
Nasal *Vs.* Stop	(.365)	**.000**

Neither /ʌ/ nor /ʊ/ exhibits significant effects for foll-MOA with respect to either tongue height or advancement. Despite this, the variant distributional pattern associated with /ʌ/ reflects general results found for other lax vowels as discussed above, in that a following fricative promotes the most retracted realizations. However, results for /ʌ/

with respect to height mirror results for /ɪ/ in that it is a pre-nasal position that promotes the lowest variants. This is contradictory to results for /æ/ and /ɛ/, as well as predictions based on the Clarke et al. (1995) study which suggest that a following fricative promotes vowel shifting in the direction associated with the CS, here specifically lowering.

Phonological conditioning of the MOA of the following segment was also examined for the two tense vowel variables /o:/ and /u:/. Results for these variables are given in Tables 4.14 and 4.15 respectively.

Table 4.14. Mean values and statistical significance of /o:/ by foll-MOA articulation as per ANOVAs performed with tukey post-hoc tests.

Following Manner of Articulation	Mean	
	F1	F2
Stop	614	1149
Fricative	620	1156
Nasal	633	1075
Overall Mean	623	1124
Overall Significance (p)	(.461)	(.322)

Foll-MOA Pairwise Comparisons	Significance (p)	
	F1	F2
Stop *vs.* Fricative	(.928)	(.971)
Fricative *vs.* Nasal	(.640)	**.015**
Nasal *vs.* Stop	(.390)	**.023**

Table 4.15. Mean values and statistical significance of /u:/ by foll-MOA as per ANOVAs performed with tukey post-hoc tests.

Following Manner of Articulation	Mean	
	F1	F2
Stop	435	1429
Fricative	426	1349
Nasal	445	1421
Overall Mean	435	1399
Overall Significance (p)	(.103)	(.450)

Foll-MOA Pairwise Comparisons	Significance (p)	
	F1	F2
Stop *vs.* Fricative	(.475)	(.226)
Fricative *vs.* Nasal	(.072)*	(.343)
Nasal *vs.* Stop	(.490)	(.988)

As was the case with the back lax vowels, no significant main effects for tongue height emerged for either /o:/ or /u:/. Yet, as in the case of /ɪ/ and /ʌ/, pre-nasal variants again show the lowest realizations for both /o:/ and /u:/.

With respect to tongue advancement (F2), though there are likewise no significant main effects, /o:/ shows significant pairwise differences for foll-MOA (Table 4.14). A following nasal consonant promotes more retracted realizations than does a following fricative or oral stop. As can be observed from Table 4.15, /u:/ exhibits no significant pairwise differences with respect to the MOA of the following segment. However, unlike results for /o:/, /u:/ results indicate that fricatives promote more retracted realizations since they show a mean F2 that is somewhat lower than those of the other two following phonological environments examined.

4.1.3. Voicing of the Following Segment

A total of 1156 tokens were examined in the analysis of foll-Voicing, as summarized in Table 4.16. When available, 168 tokens for each variable were analyzed, equally distributed in so far as was possible between following voiceless and following voiced environments. As previously pointed out, tokens are particularly lacking for the vowel variable /ʊ/.

Table 4.16. Data for foll-Voicing.

Following Voicing	Number of Tokens								
	/ɑ/	/æ/	/ɛ/	/ɪ/	/ʌ/	/ʊ/	/o:/	/u:/	Total
Voiced	60	78	64	76	63	36	52	60	489
Voiceless	108	90	100	92	81	20	68	108	667
Total	168	168	164	168	144	56	120	168	1156

Table 4.17 presents the overall mean F1 and F2 results obtained via ANOVAs for the eight variables investigated in terms of foll-Voicing, while detailed results are provided in Table 4.18. As noted in Chapter 2, since only two environments are examined, Tukey post-hoc tests were not performed on these data.

Table 4.17. Mean F1 and F2 results and significance for foll-Voicing.

			/ɑ/	/æ/	/ɛ/	/ɪ/	/ʌ/	/ʊ/	/o:/	/u:/
Overall	F1	Mean	811	779	647	497	756	502	623	434
		p	(.902)	**.000**	**.002**	(.539)	(.065)*	(.264)	(.871)	(.686)
	F2	Mean	1248	2046	2138	2175	1276	1141	1124	1401
		p	(.080)*	**.000**	**.000**	(.767)	(.588)	(.448)	**.001**	(.174)
Following Voiceless Segment	F1	Mean	813	797	670	501	767	509	624	431
	F2	Mean	1222	1999	2026	2169	1284	1131	1171	1425
Following Voiced Segment	F1	Mean	810	747	633	494	748	491	622	437
	F2	Mean	1262	2138	2211	2180	1269	1160	1124	1378

With respect to F1 mean realizations based on the voicing quality of the following segment, two vowels show significant differences (/æ/ and /ɛ/), while one vowel variable, /ʌ/, shows foll-Voicing as approaching significance (p=.065). Both the front lax vowels /æ/ and /ɛ/ have variants with significantly lower realizations when followed by a voiceless consonant; the same trend is evident for /ʌ/.

With respect to F2, /æ/ and /ɛ/ again show significance in terms of voicing of the following segment. Both /æ/ and /ɛ/ show a following voiceless consonant as promoting lower and more retracted variants. Though not significant, this pattern is repeated for /ɪ/. This echoes Clarke et al's (1995) phonological results for mainland CE, suggesting that, if speakers of SJE are adopting mainland-like CE variants seen in Clarke et al's 1995 study, they are adopting them with similar constraints, or phonological distributions. The vowel variable /o:/, which also exhibits significance (or near significance) in terms of foll-Voicing, shows that a following voiceless consonant favors articulations in which the tongue position is more fronted. This pattern is repeated for the other back lax vowels /ʊ/ and /ɑ/, though the results did not prove significant.

4.2. Results for Preceding Phonological Environment

As for the following phonological environment, three types of environments were examined for preceding phonological environment: preceding place of articulation (pre-

POA), preceding manner of articulation (pre-MOA) and the voicing of the preceding segment (pre-Voicing). Results for each environment type are discussed in turn below.

4.2.1 Place of Articulation of the Preceding Segment

In total, 1102 tokens were used in the analysis of pre-POA, as summarized in Table 4.18. Where the data allowed, 168 tokens for each variable were analyzed, equally distributed among the three types of preceding places of articulation (labial, coronal and dorsal). As in the case of following phonological environment, tokens are particularly lacking for dorsal contexts, especially with respect to the back vowels.

Table 4.18. Data for pre-POA.

Preceding Place of Articulation	Number of Tokens								
	/ɑ/	/æ/	/ɛ/	/ɪ/	/ʌ/	/ʊ/	/o:/	/u:/	Total
Labial	60	68	61	58	20	8	32	28	335
Coronal	72	52	67	61	107	32	68	132	591
Dorsal	24	48	24	24	12	16	20	8	176
Total	156	168	152	143	139	56	120	168	1102

Table 4.19 presents the overall mean F1 and F2 results obtained via ANOVAs for the eight variables investigated in terms of pre-POA.

Table 4.19. Overall mean F1 and F2 results and significance for pre-POA.

Variable	F1	Sig. (p)	F2	Sig. (p)
/ɑ/	811	(.590)	1248	(.253)
/æ/	779	(.963)	2046	(.541)
/ɛ/	647	(.756)	2056	**.000**
/ɪ/	497	(.212)	2175	(.451)
/ʌ/	756	**.032**	1276	(.658)
/ʊ/	502	(.059)*	1141	(.492)
/o:/	623	(.564)	1124	**.039**
/u:/	434	(.116)	1401	**.000**

The variables /ʌ/ and /ʊ/ show that pre-POA is significant, or approaches significance, with respect to tongue height (F1). As can be observed from Tables 4.20 and 4.21, the dorsal environment promotes the highest variants of both /ʌ/ and /ʊ/.

Table 4.20. Mean values and statistical significance of /ʌ/ by pre-POA as per ANOVAs performed with Tukey post-hoc tests.

Preceding Place of Articulation	Mean		Foll-POA Pairwise Comparisons	Significance (p)	
	F1	F2		F1	F2
Labial	738	1248	Labial *vs.* Coronal	(.262)	(.639)
Coronal	762	1286	Coronal *vs.* Dorsal	(.055)*	(.963)
Dorsal	718	1272	Dorsal *vs.* Labial	(.645)	(.922)
Overall Mean	756	1276			
Overall Significance (p)	**.032**	(.658)			

Table 4.21. Mean values and statistical significance of /ʊ/ by pre-POA as per ANOVAs performed with Tukey post-hoc tests.

Preceding Place of Articulation	Mean		Foll-POA Pairwise Comparisons	Significance (p)	
	F1	F2		F1	F2
Labial	519	1125	Labial *vs.* Coronal	(.936)	(.797)
Coronal	512	1159	Coronal v*s.* Dorsal	(.072)*	(.491)
Dorsal	474	1112	Dorsal *vs.* Labial	(.147)	(.973)
Overall Mean	502	1132			
Overall Significance (p)	(.059)*	(.492)			

As to tongue advancement (F2), pre-POA is significant for the variables /ɛ/, /o:/ and /u:/. A clear pattern emerges whereby the front and back vowel variables are conditioned in different manners. As can be observed from Table 4.22, for /ɛ/ a preceding labial consonant promotes the most fronted realizations. Conversely, the most retracted variants of the back vowel variables /o:/ and /u:/ are found following a labial consonant (Tables 4.23 and 4.24).

Table 4.22. Mean values and statistical significance of /ɛ/ by pre-POA as per ANOVAs performed with Tukey post-hoc tests.

Preceding Place of Articulation	Mean		Foll-POA Pairwise Comparisons	Significance (p)	
	F1	F2		F1	F2
Labial	642	2221	Labial *vs.* Coronal	(.736)	**.000**
Coronal	652	2056	Coronal *vs.* Dorsal	(.976)	(.066)*
Dorsal	662	2109	Dorsal *vs.* Labial	(.931)	(.217)
Overall Mean	647	2046			
Overall Significance (p)	(.756)	**.003**			

Table 4.23. Mean values and statistical significance of /o:/ by pre-POA as per ANOVAs performed with Tukey post-hoc tests.

Preceding Place of Articulation	Mean		Foll-POA Pairwise Comparisons	Significance (p)	
	F1	F2		F1	F2
Labial	628	1078	Labial *vs.* Coronal	(.863)	(.078)*
Coronal	620	1137	Coronal *vs.* Dorsal	(.923)	(.801)
Dorsal	627	1157	Dorsal *vs.* Labial	(.999)	(.074)*
Overall Mean	623	1124			
Overall Significance (p)	(.564)	**.039**			

Table 4.24. Mean values and statistical significance of /u:/ by pre-POA as per ANOVAs performed with tukey post-hoc tests.

Preceding Place of Articulation	Mean		Foll-POA Pairwise Comparisons	Significance (p)	
	F1	F2		F1	F2
Labial	441	1205	Labial *vs.* Coronal	(.766)	**.000**
Coronal	435	1443	Coronal *vs.* Dorsal	(.333)	(.662)
Dorsal	412	1363	Dorsal *vs.* Labial	(.227)	(.261)
Overall Mean	434	1401			
Overall Significance (p)	(.116)	**.000**			

One possible explanation for this dichotomy is that a preceding labial promotes neither fronted nor retracted variants, but rather pushes vowels into the peripheral areas of the vocal tract (for a discussion of peripherality, see for example Labov 1994:170-177). This would explain why a following labial would promote the most fronted variants for front /ɛ/ and the most retracted for back vowels such as /ʌ/. No other explanation relating to the actual phonetic articulation of labial consonants is immediately apparent. This finding is in contrast to that of Anderson (2004), where preceding and following labials seem to always promote fronting. Whether this can be attributed to a difference between CE varieties and Southern U.S. varieties, or is merely a reflection of small sample size in the current study, is unclear and requires further investigation into the constraints on back vowel fronting for both U.S. and CE varieties.

4.2.2 Manner of Articulation of the Preceding Segment

Nearly 800 tokens (n=790) were included in the analysis of preceding manner of articulation, as summarized in Table 4.25. Tokens in which the vowel occurred following a liquid (/l/ and /r/) were omitted, as were those in which the vowel occurred word-initially.

Table 4.25. Data for pre-MOA.

Preceding Manner of Articulation	Number of Tokens								
	/ɑ/	/æ/	/ɛ/	/ɪ/	/ʌ/	/ʊ/	/o:/	/u:/	Total
Stop	81	80	49	24	28	8	40	43	353
Fricative	17	44	70	67	28	32	12	18	288
Nasal	20	-	24	11	36	16	12	30	149
Total	118	124	143	102	92	56	64	91	790

Table 4.26 presents the overall mean F1 and F2 results obtained via ANOVAs for the eight vowel variables, with more detailed results provided in Appendix G. As can be observed, pre-MOA produces few significant effects with respect to tongue height: only one variable, /ɪ/, shows significant F1 differences.

Table 4.26. Overall Mean F1 and F2 results and significance for pre-MOA.

Variable	F1	Sig. (p)	F2	Sig. (p)
/ɑ/	811	(.929)	1248	**.018**
/æ/	779	(.110)	2046	(.220)
/ɛ/	647	(.615)	2056	(.977)
/ɪ/	497	**.002**	2175	(.447)
/ʌ/	756	(.104)	1276	(.388)
/ʊ/	502	(.271)	1141	(.176)
/o:/	623	(.957)	1124	(.086)
/u:/	441	(.755)	1447	**.008**

Table 4.27 summarizes the statistical results for /ɪ/. As can be observed, when preceded by a stop, /ɪ/ exhibits the highest realizations. This trend is repeated for most other variables, though the differences are not significant.

Table 4.27. Mean values and statistical significance of /ɪ/ by pre-MOA as per ANOVAs performed with Tukey post-hoc tests.

Preceding Manner of Articulation	Mean		Pre-MOA Pairwise Comparisons	Significance (p)	
	F1	F2		F1	F2
Stop	455	2278	Stop *vs*. Fricative	**.001**	(.522)
Fricative	516	2164	Fricative *vs*. Nasal	(.995)	(.668)
Nasal	513	2233	Nasal vs. Stop	(.062)*	(.998)
Overall Mean	497	2175			
Overall Significance (p)	**.002**	(.447)			

As to F2, tongue advancement proved to be significant with respect to pre-MOA for the variables /ɑ/ and /u:/. As can be seen from Table 4.28, a fricative promotes the most retracted variants of /ɑ/. Yet as Table 4.29 shows, preceding nasals promote the most retracted variants of /u:/ while a preceding stop promotes the most fronted variants.

Table 4.28. Mean values and statistical significance of /ɑ/ by pre-MOA as per ANOVAs performed with Tukey post-hoc tests.

Preceding Manner of Articulation	Mean	
	F1	F2
Stop	810	1277
Fricative	803	1162
Nasal	815	1300
Overall Mean	811	1248
Overall Significance (p)	(.929)	**.018**

Pre-MOA Pairwise Comparisons	Significance (p)	
	F1	F2
Stop v*s*. Fricative	(.960)	**.023**
Fricative v*s*. Nasal	(.922)	**.028**
Nasal v*s*. Stop	(.836)	(.974)

Table 4.29. Mean values and statistical significance of /u:/ by pre-MOA as per ANOVAs performed with Tukey post-hoc tests.

Preceding Manner of Articulation	Mean	
	F1	F2
Stop	437	1607
Fricative	440	1469
Nasal	440	1356
Overall Mean	441	1477
Overall Significance (p)	(.755)	**.008**

Pre-MOA Pairwise Comparisons	Significance (p)	
	F1	F2
Stop *vs.* Fricative	(.976)	(.308)
Fricative *vs.* Nasal	(.915)	(.488)
Nasal *vs.* Stop	(.735)	**.006**

4.2.3 Voicing of the Preceding Segment

A total of 1139 tokens were used in the analysis of pre-Voicing, as summarized in Table 4.30. When available, 168 tokens for each variable were analyzed; once again, the number of tokens was particularly low for the /ʊ/ vowel. Where possible, the tokens were equally balanced between preceding voiced and preceding voiceless environments. As was the case for foll-POA, Tukey post-hoc tests were not required.

Table 4.30. Data for pre-Voicing.

Following Voicing	Number of Tokens								
	/ɑ/	/æ/	/ɛ/	/ɪ/	/ʌ/	/ʊ/	/o:/	/u:/	Total
Voiced	69	60	64	76	48	32	44	41	438
Voiceless	87	108	100	92	91	24	72	127	701
Total	156	168	164	168	139	56	116	168	1139

Table 4.31 presents the overall mean F1 and F2 results obtained via ANOVAs for the eight vowel variables.

Table 4.31. Overall Mean F1 and F2 results and significance for pre-Voicing.

	Preceding Voiceless Segment		Preceding Voiced Segment	
Variable	F1	Sig. (p)	F2	Sig. (p)
/ɑ/	811	(.813)	1248	(.095)
/æ/	779	(.138)	2046	(.312)
/ɛ/	647	(.980)	2056	**.012**
/ɪ/	497	(.137)	2175	**.027**
/ʌ/	756	(.362)	1276	**.031**
/ʊ/	502	(.809)	1141	(.499)
/o:/	623	(.168)	1124	(.061)*
/u:/	434	(.274)	1401	**.000**

As this table shows, the voicing quality of the previous consonant produces no significant differences in any of the vowels with respect to tongue height. However, with respect to tongue advancement, /o:/ shows an almost significant value of p=.061, while /ɪ/, /ɛ/, /ʌ/ and /u:/ are all within a significance range of p<.05.

As Table 4.32 indicates, results for the front lax vowel /ɪ/ and the back vowels /ʊ/, /o:/ and /u:/ indicate that voicing conditions the quality of the vowel in different ways. The front lax vowel /ɪ/ has realizations that tend to be more retracted when preceded by a voiceless consonant. For the back vowels, as well as /ɛ/, however a preceding voiceless consonant promotes more fronted articulations.

Table 4.32. Mean values by pre-Voicing for /ɪ/, /ɛ/, /ʌ/, /o:/ and /u:/.

	/ɪ/		/ɛ/		/ʌ/		/o:/		/u:/	
	F1	F2	F1	F2	F1	F2	F1	F2	F1	F2
Voiceless	813	1222	648	2213	761	1326	624	1171	442	1629
Voiced	811	1267	650	2090	752	1255	622	1088	432	1325

This echoes results found for a preceding labial consonant in Section 4.2.1 in that the phonological conditioning is not one of simply promoting more fronted or more retracted realizations. Rather than favouring more peripheral realizations as was the case for preceding labial consonants, pre-Voicing seems to promote vowel centralization, with the exception of /ɛ/. Generally, vowel variables that follow a voiceless segment exhibit a more centralized tongue position than those that follow a voiced segment. There seems to be no obvious phonetic reason, however, as to why voiceless consonants would have this effect.

4.3. Summary of Phonological Conditioning Results

The following sections summarize the effects of phonological environment as discussed above. Section 4.3.1 presents a summary for POA, Section 4.3.2 for MOA and Section 4.3.3 for Voicing. Both following and preceding environments are included. Overall, following environments proved to affect vowel realizations to a greater degree than did previous environments, at least in terms of MOA and Voicing.

4.3.1. Summary of Results for Place of Articulation

In terms of the POA of the following segment, a pattern emerged with respect to both tongue advancement and height. That is, a following labial consonant promotes lower realizations (at least with respect to the front lax vowels) and generally promotes more retracted realizations. However, this result must be treated with some caution as, given the absence of pre-dorsal environment tokens for /o:/ and /u:/, foll-POA could not be investigated for the tense back vowels. Furthermore, /ɑ/ did not show a similar distribution; rather, following dorsal segments promoted the most retracted variants of /ɑ/. Whether this might indicate a potential difference between front and back vowels with respect to their conditioning by a following labial consonant clearly requires further investigation.

As to the POA of the preceding segment, results are not as transparent. The only significant differences to emerge were for /ʊ/ and /ʌ/, which showed dorsals as promoting the highest variants. As to tongue advancement, front vowels (and /ɛ/ in particular) show a preceding labial consonant as promoting more fronted variants. The opposite is the case for back vowels (namely /o:/ and /u:/). Thus, a preceding labial environment appears to be promoting a more spread-out vowel distribution in SJE, whereby vowels are pronounced closer to the peripheries of the vocal tract.

The tongue is not involved in the production of a labial consonant. As a result, in the case of vowels that are preceded by bilabials such as /p/ and /b/, the vowel gesture begins approximately halfway through the realization of that preceding segment (Rogers, 1991). This is one possible explanation for the spreading of the vowel variables when they follow such a segment. That is, there is more time for the tongue to move into either a more retracted position with respect to the back vowels or a more front position in terms of the front vowels than there is in contexts in which the tongue is an active articulator of the preceding segment.

It is unclear if this environmental effect is a result of the relatively small sample size used in the current study, or if it is a true phonological (or structural) conditioning factor in SJE. In any respect, this is a finding that should not only be investigated further in future work on SJE, but also in research involving other varieties of English.

4.3.2. Summary of Results for Manner of Articulation

In terms of foll-MOA, previous studies on CE (e.g. Clarke et al. 1995), and also for /æ/ in SJE (D'Arcy 2005), have shown that following nasals disfavor lax vowel lowering, while fricatives promote it. This holds generally true for the lax vowels in the current study, especially /ɪ/ and /ɛ/. The opposite effect, however, is found for the back vowel variables /ʌ/, /o:/ and /u:/, where following nasals tend to promote lower variants. It seems likely, then, that foll-MOA affects vowels in different regions of the vocal tract in different ways, as did a preceding labial discussed in the previous section.

With respect to pre-MOA, generally, a preceding stop promotes the highest realizations and a preceding fricative favors more retracted realizations. Though these tendencies are significant only in terms of /ɪ/ and /ɑ/ respectively, the same basic distribution is repeated for nearly all vowel variables examined.

4.3.3. Summary of Results for Voicing

Clarke et al. (1995) found voicing to be significant for the front lax vowels in that a following voiceless consonant promoted lower (and also more retracted) realizations. Current results support this finding. Unlike the SJE results for /æ/ of D'Arcy (2000, 2005), retraction of /æ/ in the current analysis is favored when followed by a voiceless segment, rather than a voiced. Further, /æ/ is also more retracted when preceded by a voiceless consonant. Like /æ/, the variable /ɛ/ also shows more retracted realizations when it is followed by a voiceless segment. However, in terms of pre-Voicing, a voiceless consonant promotes more fronted variants for the back vowel variables /o:/ and /u:/. The reason for this dichotomy is not clear; it may very well be a result of the low number of tokens available. Further analysis on more data is required.

Results for pre-Voicing generally showed few significant differences and no real pattern is observable. A preceding voiceless consonant promotes more retracted realizations of /ɪ/, yet more fronted variants of /ʌ/, /o:/ and /u:/. Again, there seems to be a centralizing tendency with respect to a preceding voiceless consonant.

4.4. Interactions Between Generational Group and Phonological Environment

This section briefly discusses the chief significant interactional effects between Generational Group and the six phonological variables included in this study. Neither preceding nor following voicing is treated below, since only two types of voicing qualities (voiceless and voiced) were examined in the present study.

Generational Group and Phonological Environment show many significant interactions, especially with respect to the front lax vowel /ɛ/ and the tense back vowel /u:/. Table 4.33 summarizes the interactional effects for the front lax vowel variables, with effects for the back lax vowels and the back tense vowels presented in Tables 4.34 and 4.35 respectively.

Table 4.33. Significant interactions between Generational Group and phonological environment: The front lax vowel variables.

		/æ/		/ɛ/		/ɪ/	
		F1	F2	F1	F2	F1	F2
Preceding Environment	Generational Group x pre-POA	(.260)	(.128)	(.106)	**.000**	**.026**	(.114)
	Generational Group x pre-MOA	(.356)	**.011**	(.190)	(.060)*	(.160)	(.434)
Following Environment	Generational Group x foll-POA	(.856)	(.751)	**.003**	**.002**	(.201)	(.056)*
	Generational Group x foll-MOA	**.006**	(.333)	**.013**	**.031**	**.004**	(.366)

Table 4.34. Significant interactions between Generational Group and phonological environment: The back lax vowel variables.

		/ɑ/		/ʌ/		/ʊ/	
		F1	F2	F1	F1	F2	F1
Preceding Environment	Generational Group x pre-POA	(.424)	(.071)*	**.012**	(.089)	(.839)	(.925)
	Generational Group x pre-MOA	(.791)	**.043**	(.856)	(.866)	-	-
Following Environment	Generational Group x foll-POA	(.716)	(.310)	(.972)	(.296)	(.440)	(.449)
	Generational Group x foll-MOA	(.366)	(.342)	**.000**	(.802)	(.362)	-

Table 4.35. Significant interactions between Generational Group and phonological environment: The back tense vowel variables.

		/o:/		/u:/	
		F1	F2	F1	F2
Preceding Environment	Generational Group x pre-POA	(.917)	(.087)	(.390)	**.027**
	Generational Group x pre-MOA	(.937)	**.034**	(.971)	**.013**
Following Environment	Generational Group x foll-POA	(.119)	(.219)	(.160)	**.000**
	Generational Group x foll-MOA	(.763)	(.169)	(.617)	(.614)

As can be observed from the above tables, Generational Group shows significant interactions with each of the four phonological contexts. In terms of place of articulation, Generational Group significantly interacts with pre-POA for the F1 of /ɪ/ and /ʌ/ as well as the F2 of /ɛ/ and /u:/, and with foll-POA for the F1 and F2 of /ɛ/ as well as the F2 of /u:/. With respect to manner of articulation Generational Group interacts significantly with pre-MOA for the F2 of /æ/, /ɑ/, /o:/ and /u:/; and with foll-MOA for the F1 of the front lax vowels /æ/, /ɛ/ and /ɪ/, as well as the F1 of /ʌ/ and the F2 of /æ/. Further discussion of these interactions is presented in the sections that follow.

4.4.1. Significant Interactions Between Generational Group and Place of Articulation

As noted above, interactions between Generational Group and place of articulation are especially evident for the variables /ɛ/ and /u:/. Tables 4.36 and 4.37 present more detailed results for the interactions between Generational Group and pre-POA for these two variables while Tables 4.38 and 4.39 present those between Generational Group and foll-POA.

Table 4.36. Interactions between Generational Group and pre-POA for the F2 of /ɛ/.

Generational Group	Pre-POA	Mean	Std. Deviation	n
YF03	Labial	2196	132.305	24
	Coronal	2092	179.059	20
	Dorsal	2271	170.720	8
	Overall	2167	167.637	52
YF80	Labial	2383	163.243	13
	Coronal	2082	86.495	27
	Dorsal	1992	223.717	12
	Overall	2136	206.922	52
OF03	Labial	2160	223.487	24
	Coronal	1985	213.380	20
	Dorsal	2228	224.511	12
	Overall	2112	237.722	56
Overall	Labial	2221	196.500	61
	Coronal	2056	165.813	67
	Dorsal	2150	240.958	32
	Overall	2138	206.925	160

Recall that pre-POA and Generational Group showed significant interactions with respect to the F2 of /ɛ/. As can be observed from Table 4.36, both the YF03 and OF03 cohorts show a preceding dorsal promoting the most fronted variants and a coronal the most retracted variants of /ɛ/. This is not the case for the YF80 group, who show labials as promoting the most fronted variants and dorsals the most retracted. Given the relatively low numbers of preceding dorsal tokens for all groups, however, it would be premature to conclude that a real-time change in constraint ranking for pre-POA has occurred in SJE.

Since there are no tokens in which the vowel variable /u:/ is preceded by dorsal segment for the YF80 group (see Table 4.37), this is the most likely reason as to why significant interactions arose between Generational Group and pre-POA. However, a closer examination of preceding labial and coronal consonants reveals that, like the findings for the variable /ɛ/, the two 2003 cohorts exhibit similar results while the YF80 group differs. Both YF03 and OF03 show preceding coronals as promoting more fronted realizations of /u:/ than do preceding labials, while the opposite is the case for the YF80 Generational Group.

Table 4.37. Interactions between Generational Group and pre-POA for the F2 of /u:/.

Generational Group	Pre-POA	Mean	Std. Deviation	n
YF03	Labial	1388	218.324	12
	Coronal	1416	396.748	40
	Dorsal	1479	173.521	4
	Overall	1414	351.069	56
YF80	Labial	1120	88.730	4
	Coronal	1657	236.053	52
	Dorsal[16]	-	-	-
	Overall	1618	267.496	56
OF03	Labial	1050	193.114	12
	Coronal	1193	192.920	40
	Dorsal	1248	315.009	4
	Overall	1166	207.872	56
Overall	Labial	1205	249.150	28
	Coronal	1443	342.129	132
	Dorsal	1363	265.667	8
	Overall	1399	335.758	168

[16] No data were available in the word list for variants following a dorsal consonant for the YF80 cohort.

As to the foll-POA, recall that, again, both /ɛ/ and /u:/ show significant interactions with Generational Group in terms of tongue advancement (F2); for /ɛ/, a significant interaction also occurs for tongue height.

With respect to the F1 of /ɛ/, it is the YF03 cohort which shows a different hierarchy, in that a following labial promotes the highest realizations, while for the YF80 and OF03 Generational Groups, labials promote the lowest (see Table 4.38). Since /ɛ/ lowering appears to be a change in progress in St. John's (see Chapter 3), it is possible that it is also undergoing a change with respect to its phonological conditioning factors.

As to tongue advancement of /ɛ/, results are similar to those found for pre-POA, in that the two 2003 female cohorts (YF03 and OF03) exhibit similar results. As Table 4.38 shows, the following environment does not appear to affect the F2 for these two Generational Groups; for the YF80 cohort, however, a following labial promotes more retracted realizations than either a following coronal or dorsal.

Table 4.38. Interactions Between Generational Group and foll-POA for the F1 and F2 /ɛ/.

	Generational Group	Foll-POA	Mean	Std. Deviation	n
F1	YF03	Labial	660	47.445	16
		Coronal	665	55.360	28
		Dorsal	684	40.991	12
		Overall	668	50.313	56
	YF80	Labial	642	40.081	12
		Coronal	545	63.362	23
		Dorsal	571	62.489	17
		Overall	576	69.032	52
	OF03	Labial	716	59.406	16
		Coronal	684	61.128	28
		Dorsal	688	55.083	12
		Overall	694	60.025	56
	Overall	Labial	675	58.600	44
		Coronal	637	83.920	79
		Dorsal	638	78.432	41
		Overall	647	77.919	164
F2	YF03	Labial	2170	168.585	16
		Coronal	2162	148.850	28
		Dorsal	2178	199.810	12
		Overall	2168	163.264	56
	YF80	Labial	1895	86.552	12
		Coronal	2186	207.841	23
		Dorsal	2240	115.336	17
		Overall	2136	206.922	52
	OF03	Labial	2112	277.431	16
		Coronal	2110	253.624	28
		Dorsal	2115	140.347	12
		Overall	2112	237.722	56
	Overall	Labial	2074	227.252	44
		Coronal	2150	207.623	79
		Dorsal	2185	156.518	41
		Overall	2139	204.925	164

As can be observed from Table 4.39, no tokens were available for variants of /u:/ that precede a dorsal consonant. Furthermore, a closer examination of following coronals and labials offer no differences to explain the significant interaction expressed in Table 4.35. However, inspection of the mean standard deviations does point to differing patterns of distribution of /u:/ among the Generational Groups. That is, the overall mean standard deviation is much higher for the YF03 than for any other group; the YF80 cohort also shows a greater mean standard deviation than their older female counterparts. This pattern is especially striking for variants that occur preceding a labial consonant where the YF03 cohort shows a mean standard deviation almost twice that of the 2003 older female cohort. This suggests that /u:/ is less stable in the speech of the younger speakers; since /u:/ fronting appears to be an age-graded pattern, this is perhaps not surprising.

Table 4.39. Interactions Between Generational Group and foll-POA for the F2 of /u:/.

Generational Group	Foll-POA	Mean	Std. Deviation	n
YF03	Labial	1320	321.241	20
	Coronal	1466	360.260	36
	Dorsal	-	-	-
	Overall	1414	351.069	56
YF80	Labial	1563	264.895	27
	Coronal	1660	265.331	27
	Dorsal	-	-	-
	Overall	1612	267.149	54
OF03	Labial	1142	169.957	20
	Coronal	1179	227.395	36
	Dorsal	-	-	-
	Overall	1166	207.872	56
Overall	Labial	1365	312.038	67
	Coronal	1415	348.452	99
	Dorsal	-	-	-
	Overall	1395	334.172	166

4.4.2. Significant Interactions Between Generational Group and Manner of Articulation

Generational Group significantly interacts with both pre- and foll-MOA. In terms of pre-MOA, significant interactions arise for the F2 of the low lax vowels /æ/ and /ɑ/, as well as of the high back tense vowels /o:/ and /u:/. Tables 4.40 and 4.41 present the interaction effects for /æ/ and /ɑ/. In terms of /æ/, findings may result from the limitations of the data set in that no /æ/ tokens preceded by a nasal were available.. What can be observed, however, is that both the younger female Generational Groups exhibit the most retracted realizations of /æ/ when it is preceded by a stop, while the opposite is true for the OF03 group. With respect to /ɑ/, the YF03 cohort differ from the YF80 and OF03 groups in that this cohort has realizations of /ɑ/ that are most retracted after a nasal consonant (with no difference between a preceding stop and fricative). The YF80 and OF03 cohorts show fricatives as promoting the most retracted variants and nasals the most fronted. Again, whether this represents real-time change in phonological conditioning patterns is an issue that requires further investigation.

Table 4.40. Interactions between Generational Group and pre-MOA for the F2 of /æ/.

Generational Group	Pre-MOA	Mean	Std. Deviation	n
YF03	(Oral) Stop	2088	179.382	24
	Fricative	2149	140.988	16
	Nasal	-	-	-
	Total	2112	165.991	40
YF80	(Oral) Stop	2086	102.086	32
	Fricative	2089	102.680	12
	Nasal	-	-	-
	Total	2087	101.058	44
OF03	(Oral) Stop	2030	199.533	24
	Fricative	1999	184.283	16
	Nasal	-	-	-
	Total	2018	191.752	40
Total	(Oral) Stop	2070	160.427	80
	Fricative	2078	160.310	44
	Nasal	-	-	-
	Total	2073	159.788	124

Table 4.41. Interactions between Generational Group and pre-MOA for the F2 of /ɑ/.

Generational Group	Pre-MOA	Mean	Std. Deviation	n
YF03	(Oral) Stop	1223	87.221	29
	Fricative	1223	78.328	5
	Nasal	1173	100.219	8
	Overall	1213	88.928	42
YF80	(Oral) Stop	1255	232.038	24
	Fricative	1042	92.705	8
	Nasal	1303	229.822	4
	Overall	1213	224.474	36
OF03	(Oral) Stop	1352	122.627	28
	Fricative	1325	28.976	4
	Nasal	1425	76.490	8
	Overall	1364	112.054	40
Overall	(Oral) Stop	1277	162.436	81
	Fricative	1162	142.824	17
	Nasal	1300	166.155	20
	Overall	1264	164.800	118

Tables 4.42 and 4.43 summarize significant interactions for /o:/ and /u:/ respectively. The two younger female cohorts show /o:/ as having the most fronted variants when the variable is preceded by a fricative; yet fricatives promote the most retracted variants for the older female Generational Group. Again, an age-grading-like pattern emerges. However, this is not echoed in the results for /u:/, as no clear pattern of distribution is observable.

Table 4.42. Interactions between Generational Group and pre-MOA for the F2 of /o:/.

Generational Group	Pre-POA	Mean	Std. Deviation	n
YF03	(Oral) Stop	1077	110.349	16
	Fricative	1218	72.642	4
	Nasal	1067	92.005	4
	Overall	1099	112.670	24
YF80	(Oral) Stop	1125	173.685	12
	Fricative	1324	283.062	4
	Nasal	1146	175.847	4
	Overall	1169	203.538	20
OF03	(Oral) Stop	1146	107.344	12
	Fricative	992	38.871	4
	Nasal	1070	117.281	4
	Overall	1100	114.308	20
Overall	(Oral) Stop	1112	131.695	40
	Fricative	1178	211.353	12
	Nasal	1095	126.297	12
	Overall	1121	148.736	64

Table 4.43. Interactions between Generational Group and pre-MOA for the F2 /u:/.

Generational Group	Pre-MOA	Mean	Std. Deviation	n
YF03	(Oral) Stop	1473	135.326	8
	Fricative	1370	337.357	4
	Nasal	1591	455.965	11
	Overall	1511	350.956	23
YF80	(Oral) Stop	1760	169.086	27
	Fricative	1683	186.510	10
	Nasal	1352	302.894	7
	Overall	1678	242.785	44
OF03	(Oral) Stop	1222	243.588	8
	Fricative	1034	213.023	4
	Nasal	1142	242.844	12
	Overall	1151	237.448	24
Overall	(Oral) Stop	1607	278.162	43
	Fricative	1469	346.956	18
	Nasal	1356	391.078	30
	Overall	1497	347.448	91

As to foll-MOA, most noteworthy are the front lax vowels which are involved in the CS: /æ/, /ɛ/ and /ɪ/ show significant interactions with respect to tongue height, and /ɛ/ also displays a significant interaction for tongue advancement. Tables 4.44, 4.45 and 4.46 present interaction results for these three vowels. As can be observed from Table 4.44, no clear pattern of distribution emerges for /æ/. This is also the case for the vowel variable /ɪ/, presented in Table 4.46. However, a pattern does emerge for /ɛ/. As Table 4.45 shows, both the younger Generational Groups exhibit articulations of /ɛ/ that are highest when followed by a dorsal consonant while this following phonological context promotes the lowest realizations in the OF03 cohort. Once again the results seem to suggest some sort of age-graded distribution, though low numbers of pre-dorsal tokens may also have a confounding effect.

Table 4.44. Interactions between Generational Group and foll-MOA for the F1 of /æ/.

Generational Group	Foll-MOA	Mean	Std. Deviation	n
YF03	Labial	684	55.496	20
	Coronal	662	49.357	20
	Dorsal	654	41.020	16
	Overall	668	50.313	56
YF80	Labial	563	64.983	24
	Coronal	611	76.267	16
	Dorsal	553	51.311	12
	Overall	576	69.032	52
OF03	Labial	671	51.689	20
	Coronal	702	50.066	20
	Dorsal	711	74.620	16
	Overall	694	60.025	56
Overall	Labial	635	80.099	64
	Coronal	662	68.120	56
	Dorsal	647	84.735	44
	Overall	647	77.919	164

Table 4.45. Interactions between Generational Group and foll-MOA for the F1 and F2 of /ɛ/.

	Generational Group	Foll-MOA	Mean	Std. Deviation	n
F1	YF03	Labial	684	55.496	20
		Coronal	661	49.357	20
		Dorsal	654	41.020	16
		Overall	668	50.313	56
	YF80	Labial	563	64.983	24
		Coronal	611	76.267	16
		Dorsal	553	51.311	12
		Overall	576	69.032	52
	OF03	Labial	671	51.689	20
		Coronal	702	50.066	20
		Dorsal	711	74.620	16
		Overall	694	60.025	56
	Overall	Labial	635	80.099	64
		Coronal	662	68.120	56
		Dorsal	647	84.735	44
		Overall	647	77.919	164
F2	YF03	Labial	2130	130.839	20
		Coronal	2088	115.267	20
		Dorsal	2315	160.027	16
		Overall	2168	163.264	56
	YF80	Labial	2169	135.592	24
		Coronal	1923	95.792	16
		Dorsal	2354	165.632	12
		Overall	2136	206.922	52
	OF03	Labial	2070	201.755	20
		Coronal	2023	244.990	20
		Dorsal	2276	194.671	16
		Overall	2112	237.722	56
	Overall	Labial	2126	160.876	64
		Coronal	2018	179.444	56
		Dorsal	2312	173.641	44
		Overall	2139	204.925	164

Table 4.46. Interactions between Generational Group and foll-MOA for the F1 of /ɪ/.

Generational Group	Foll-MOA	Mean	Std. Deviation	n
YF03	Labial	528	47.500	20
	Coronal	510	70.891	20
	Dorsal	537	55.100	16
	Overall	524	58.932	56
YF80	Labial	450	35.250	20
	Coronal	444	28.662	20
	Dorsal	452	35.018	16
	Overall	449	32.533	56
OF03	Labial	502	56.230	20
	Coronal	486	63.946	20
	Dorsal	584	98.364	16
	Overall	519	82.937	56
Overall	Labial	493	56.568	60
	Coronal	480	62.839	60
	Dorsal	524	86.693	48
	Overall	497	70.453	168

4.4.3. Summary of Significant Interactions Between Generational Group and Phonological Environment

In terms of place of articulation, the most striking interactional effects occurred for /ɛ/ and /u:/; interactional effects for manner of articulation were not evident among the front lax vowels. As to /ɛ/, significant interactions between Generational Group and both place and manner of articulation may not come as a surprise, as this vowel is involved in the CS and was noted by Boberg (2005) as being the most active part of the shift in Montreal. In addition, if speakers of SJE are participating in Clarke et al's (1995) so-called "Canadian Shift", then it stands to reason that the phonological constraints that affect the front lax vowel variables might also show evidence of change over time.

Likewise, the involvement of /u:/ in a number of significant interactions may possibly relate to its relative instability. As pointed out in Chapter 1, /u:/ fronting can be viewed as an "off the shelf" socially-motivated sound change. Since younger speakers are typically more innovative in their speech than older speakers, perhaps this variable is more socially-marked for the younger Generational Groups than the older female cohort in the current study. This is similar to results found by Ash (1996) with respect to /u:/ fronting in the Midwest area of the United States, where /u:/ fronting, overall, was shown to decrease with increasing age, suggesting a change in progress, as discussed in Section 2.1.1.2. However, the fact that the 1980s Generational Group show a more fronted mean realization of /u:/ than that 2003 Generational Group is so not easily explained. One possible explanation is that /u:/ fronting does not carry the same degree of social markedness in 2003 as it did in the early 1980s. Further research into the use of this feature in SJE is clearly needed to determine if this finding is simply an artifact of the small sample size employed.

Chapter 5

Conclusions

Based on the evidence presented in Chapter 3, the CS appears to be active to some degree among the middle-class female SJE speakers in the current study (see Section 5.1 below), though the vowel system of SJE remains very different from the vowel system of younger speakers of mainland Canadian English (cf. Section 3.1). This is at odds with the ANAE's (Labov et al, 2006) results, which show Newfoundland as not participating at all in the CS[17].

Strikingly, it is the older female 2003 Generational Group which typically uses what appear to be more innovative CE-like variants not only than the younger female group recorded in 2003 (i.e. in apparent time), but also than their 1980s younger counterparts recorded in the early 1980s (i.e. in real time). Section 5.2 below discusses this finding in terms of the age-based models of linguistic change outlined in Chapter 1.

Chapter 4 presented results for the conditioning effects of phonological environment (both preceding and following). The data showed that phonological context plays a role in SJE with respect to vowel variation – both in the retraction of the front lax vowels (as in the "Canadian Shift") and in back vowel fronting, especially /u:/ fronting.

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[17] The ANAE (Labov et al. 2006: 130) adopts a quantitative definition of the CS, as follows: "the backing of /o/ is defined as an F2 of /o/ less than 1275, the backing of /ae/ by an F2 of less than 1825, and the lowering of /e/ by an F1 of greater than 650". By this strict definition, none of the SJE speakers in the current study would qualify as participants in the CS (see for example Figure 3.2, Chapter 3). As this study has shown, however, the OF03 cohort displays significantly more retracted and/or lowered variants of the front lax vowels than do the two younger groups investigated, and this finding is attributed to the supralocal effects of innovative CE.

Section 5.3 provides a brief recapitulation of how phonological environment appears to affect the SJE vowel subsystem.

The generalized findings based upon the current SJE data must however be approached with caution. Results are based on a very small sub-section of the population, namely twelve middle-class female speakers. Though this represents a group that is likely to be influenced by supralocal linguistic change, it can not simply be assumed that the findings are applicable to other speakers of SJE, or to the speech community as a whole. In addition, certain analyses were not foreseen during the data collection process. For example, the analysis of preceding phonological environment was not originally included in the research design. Consequently, tokens involving a range of preceding phonological environments were not as frequently represented in the data. These limitations may have skewed the results for preceding context.

5.1. The Canadian Shift in SJE?

The OF03 cohort has realizations of /ɑ/ that are lower and more fronted than those displayed by the younger generations. Thus, they appear to be more sensitive than the younger groups to traditional Newfoundland variants of the low-back merged vowel. Despite this possible sensitivity to local norms, the OF03 generation shows a surprisingly greater degree of adoption of the more prestigious CE-like norms than either of the younger Generational Groups, with respect to the front lax vowels. That is, they show lower and/or more retracted articulations of the front lax vowels /æ/, /ɛ/ and /ɪ/.

My data for the front lax vowel subsystem seem to support both of the views of the CS advanced by Clarke et al. (1995) and Boberg (2005). The same lowering and retraction of /æ/ found in both Clarke et al. (1995) and Boberg (2005) are attested in SJE. However, my results are ambivalent as to whether a primarily lowering or a primarily retraction process is affecting the front lax vowels. For example, with respect to the variable /ɛ/, the older females show significantly lower realizations, while tongue advancement does not prove to differ significantly in terms of Generational Group. With regard to the variable /ɪ/, the older females exhibit the most retracted variants. Thus, my SJE data seem to suggest that both tongue height and tongue advancement may be involved in the CS. This supports a point of view that speakers may use different phonetic or phonological means to achieve the same results, in this case the result being realizations of front vowel variables that are associated with the CS.

The mean standard deviations for the F2 of the vowel variables are consistently much greater than those for F1. Perhaps not surprisingly, the largest standard deviations, with respect to the lax vowels, occur for those variables that are traditionally most different between Newfoundland varieties and mainland Canadian varieties of English, i.e. the lax vowels /ɑ/ and /æ/. The greater degree of variation with respect to tongue advancement suggests instability of the lax vowel system along this dimension, and a possible result of the supralocal influences of innovative mainland Canadian English in the form of the CS. If this is the case, then the SJE data lends support to Boberg's view of the CS, in that tongue advancement is the primary direction in which the shift is active. This same instability along the F2 dimension is seen both of the tense back vowels, and for /u:/ more so than any other vowel examined. These results, then, suggest that /u:/ is unstable in SJE, most likely as a result of the salience of fronted /u:/ as a potential supralocal marker.

With respect to back vowel fronting, the YF80 cohort shows realizations of /o:/ and /u:/ that are more fronted than those of either 2003 Generational Group. Yet the apparent time data (YF03 and OF03) show that younger females have mean realizations of /u:/ that are significantly more fronted than those of the older females. This resembles the typical age-graded pattern, in that younger speakers maybe more sensitive to /u:/ fronting than older speakers. This pattern is not one that emerged in the SJE data with respect to the front lax vowel shifting associated with the CS. The finding that the YF80 cohort has more fronted realizations of /u:/ than the YF03 group might possibly suggest a decrease in the salience of /u:/ fronting in SJE over time, indicating that the variable has reached a saturation point and has possibly lost some of its social meaning. However, given the small sample size, more evidence is clearly needed.

5.2. Age-based Models of Linguistic Change

The following sections discuss the implications of the SJE results for age-based models of linguistic change. Section 5.2.1 deals with the front vowel variables, while 5.2.2 relates to the back vowels.

5.2.1. The Front Vowel Variables

Significant apparent-time generational differences (i.e. differences between the YF03 and OF03 groups) are abundant. However, with the inclusion of a 1980s younger female cohort, the nature of such differences can be investigated in more detail, supplying evidence for communal change in SJE. Boberg's late adoption model of change is one way in which this data can be explained. That is, the SJE phonological data show that the older females are not only helping to accelerate innovative features – similar to the older ME speakers investigated by Boberg (2004a) with respect to lexical data – but often show more innovative realizations than their younger female counterparts. However, as noted previously, care must be taken when interpreting the current data due to a relatively small sample size.

The results seem to suggest that the older female speakers may have been influenced by supralocal norms for /æ/ retraction, while the younger females have not. Such a finding is unusual. It cannot be readily explained in terms of existing age-based models of linguistic change, such as the relationships between the individual and the community hypothesized by Labov (1994). Although Labov's age-grading allows for change in the individual alongside stability in the community, it predicts that younger speakers will display more innovative forms than older speakers. Boberg's (2004a) model of late adoption, likewise, does not readily fit the SJE /æ/ data. This model can account for the adoption of innovative forms by older speakers, yet does not provide an explanation as to why older speakers would actually exhibit more innovative forms than younger groups within the same speech community.

One possible explanation for the apparently innovative forms on the part of the OF03 cohort may be that two of the four participants in this Generational Group each lived in Ontario for one to two years during early adulthood. Furthermore, another member of this cohort travels worldwide regularly, while the fourth travels regularly to Ontario and British Columbia to visit close relatives. This differs from the YF03 cohort in that only one speaker in this group has lived outside St. John's. She is also the only one of the cohort to travel extensively outside of the province of Newfoundland. It seems reasonable then, to assume that the OF03 cohort has had more exposure to supralocal, mainland-like norms, which could account – at least to some degree – for their more CE-like variants for the front lax vowels.

In this respect, the varying models of age-based linguistic change presented in Chapter 3 cannot fully account for the current data. Furthermore, evidence from the current study runs contrary to the idea that younger generations are the sole, or even primary, means by which language change is introduced into a speech community. For example, D'Arcy (2005) found that for her SJE data, adolescence is the locus of phonological change. The current data suggest that the social embedding of phonological change in SJE is much more complex. Although innovative forms are typically associated with younger speakers, they can also be adopted, accelerated and advanced by older speakers.

By way of example, a comparison of the two younger cohorts (YF80 and YF03), i.e. the real-time evidence, shows /æ/ to be lowering over time in SJE. The older female cohort, however, appears to be leading the adoption of innovative CE-like norms for /æ/ and, furthermore, to have advanced this process over the course of their adult lifetime. That is, the OF03 group shows significantly lower realizations than the YF80 group; they also display significantly more retracted realizations (though a comparison of the F2 means for the YF80 and YF03 groups suggests that retraction of /æ/ is not an ongoing or real-time change in SJE).

As to /ɛ/ lowering, the real-time evidence suggests an ongoing change, since the YF03 cohort displays significantly lower mean values than does the YF80 group. Yet, once again, it is the older females who display significantly lowest mean values for /ɛ/. Thus, here too, the evidence runs counter to the typical generational pattern of linguistic variation, which posits younger speakers as being the primary innovators of language change in a speech community.

Retraction of /ɪ/ is not evident in the real-time data; however, this is not the case with respect to tongue height. The real-time evidence shows the YF03 group as having significantly lower F1 realizations of /ɪ/ than their 1980 counterparts. This suggests that there may be language change in progress in the form of lowering in SJE, as is the case of /ɛ/. Since the OF03 cohort also shows significantly lower realizations of /ɪ/ than the YF80 group, this also provides real-time evidence for change in the individual.

5.2.2. The Back Lax Vowel Variables

Fronting and lowering of /ʌ/ are suggested by Clarke et al. (1995) to be characteristic of innovative CE; this also characterizes the younger WE speakers analyzed by Hagiwara (2006). The current data, however, do not reflect these findings. The YF80 group has significantly higher and more fronted realizations of /ʌ/ than the other cohorts. Likewise, the YF03 cohort has significantly higher realizations of /ʌ/ than their adult counterparts, the OF03 Generational Group. However, the former group have much more retracted variants than either the YF80 or OF03 speakers. Thus, both real-time and apparent-time evidence point to the shifting of /ʌ/ to a higher and more retracted variant as an on-going change rather than towards more central realizations. That is, this vowel, if anything, appears to be retracting and raising in SJE, the opposite of what appears to be happening in innovative mainland varieties of English as presented by Clarke et al. (1995).

There are no significant differences in /ʊ/ articulation between YF80 and the OF03 groups, that is, no real-time change across speakers representing early adulthood to middle age. Apparent-time evidence shows the YF03 cohort to have mean realizations of /ʊ/ that are significantly higher than either of the other two cohorts. No significant differences were found with respect to tongue advancement. This could be interpreted as a lack of salience of any socially significance of lax /ʊ/ fronting among more upwardly mobile segments of the SJE speech community.

5.3. The Phonological Conditioning of Vowel Variation in SJE

Of the various types of environments investigated, it is the MOA of the following segment that proves to be the most significant in terms of phonologically conditioning the realizations of the front lax vowels involved in the CS, as well as the back vowels investigated. Two clear patterns emerge. The first pattern, which involves the low to low-mid front lax vowels /ɑ/, /æ/ and /ɛ/, shows that nasals disfavor lax vowel lowering, while fricatives promote it. The second pattern – involving the high to mid back vowels /ʌʌ/, /o:/ and /u:/, along with the high front vowel /ɪ/ – shows the opposite effect, i.e. following nasals tend to promote lower variants. It seems likely, then, that foll-MOA affects vowels in different regions of the vocal tract in different ways, as did a preceding labial discussed above in Section 4.3.1.

It is quite possible that there are phonetic (or articulatory) explanations for such an effect. One such reason may be due to the velopharyngeal opening (and thus a change in size/shape of the vocal tract) which is associated with the production of a nasal consonant (Stevens 1998: 487-488). Although Stevens (513) points out that there is an abrupt change in the spectrum in the vicinity of the second formant of the following vowel when a nasal consonant is released into a vowel, he does not discuss the effects of a nasal on a preceding vowel.

With respect to pre-POA, a clear pattern emerged in which labials generally promote fronting among front vowels and retraction among back vowels. This shifting to the periphery of the vocal space is not borne out in terms of foll-POA, which also proved significant for SJE. In this phonological context, a labial tends to promote more retracted realizations of the vowel under investigation.

Generally, voicing of the following segment revealed results confirming Clarke et al. (1995) – and thus opposing D'Arcy's (2005) results. In the current data, where significant, a following voiceless consonant tends to promote lower and more retracted realizations of the front lax vowels, though some generational interactions emerged.

References

Anderson, Bridget. 2004. An acoustic study of southeastern Michigan Appalachian and African American southern migrant vowel systems. Unpublished PhD dissertation, University of Michigan.

---------------------- and Becky Childs. 2003. Rounding, coarticulation, and fronting for /u/ and /ʊ/ among Texana, NC and Detroit African American speakers. Paper presented at NWAV 32, Philadelphia.

----------------------, William Kretzschmar, and Mark Arehart. 2003. The marriage of sociolinguistics and phonetics: The honeymoon is over. Paper presented at NWAV 32, Philadelphia.

Ash, Sharon. 1996. Freedom of Movement: /uw/-Fronting in the Midwest. In *Sociolinguistic Variation: Data, Theory, and Analysis: Selected Papers from NWAV 23 at Stanford,* ed. Jennifer Arnold, Renee Blake, Brad Davidson, Scott Schwenter and Julie Soloman, 3-25. Stanford: Center Study Language and Information.

Bailey, Guy. 2002. Real and apparent time. In *The handbook of language variation and change*, ed. J. K. Chambers, Peter Trudgill, and Natalie-Schilling Estes, 312-332. Oxford: Blackwell Publishers.

Boberg, Charles. 2004a. Real and apparent time in language change: Late adoption of changes in Montreal English. *American Speech* 79: 250-269.

------------------. 2004b. Region and gender in the phonetics of Canadian English: A first look. Paper presented at NWAV 33, Michigan.

------------------. 2005. The Canadian shift in Montreal. *Language Variation and Change* 17: 133-154.

Cedergren, Henrietta 1984. Panama revisited: Sound change in real time. Paper presented at NWAV 11, Philadelphia.

Chambers, J.K 1995. *Sociolinguistic theory: Linguistic variation and its social significance*. Oxford: Blackwell Publishers.

-----------------. 2004. Canadian dainty: The rise and decline of Briticisms in Canada. In *Legacies of colonial English*, ed. Raymond Hickey, 224-241. Cambridge: Cambridge University Press.

Clarke, Sandra. 1991. Phonological variation and recent language change in St. John's English. In *English around the world: sociolinguistic perspectives*, ed. Jenny Cheshire, 108-122. Cambridge: Cambridge University Press.

------------------. 2004. Newfoundland English: Phonology. In *A handbook of varieties of English, volume 1: Phonology*, ed. Edgar W. Schneider, Bernd Kortmann, Kate Burridge, Rajend Mesthrie, and Clive Upton, 355-370. Berlin/New York: Mouton de Gruyter.

------------------, Ford Elms and Amani Youssef. 1995. The third dialect of English: Some Canadian evidence. *Language Variation and Change* 7: 209-227.

Conn, Jeff and Uri Horesh. 2001. Assessing the acquisition of dialect variables by migrant adults in Philadelphia: A case study. Paper presented at NWAV 30, Raleigh.

D'Arcy, Alexandra. 2000. Beyond mastery: a study of dialect acquisition. Unpublished MA thesis, Memorial University of Newfoundland.

----------------------. 2005. The development of linguistic constraints: Phonological innovations in St. John's. *Language Variation and Change* 17: 327-355.

De Decker, Paul M. 2002. Hangin' & retractin': Adolescent social practice and phonetic variation in an Ontario small town. *Pennsylvania working papers in linguistics* 8: 59-73.

Esling, John and Henry J. Warkentyne. 1993. Retracting of /æ/ in Vancouver English. In *Focus on Canada,* ed. Sandra Clarke, 229-246. Amsterdam: Benjamins.

Evans, Betsy and Dennis Preston. 2001. When it's not nice to be normal: What's missing from normalized data? *Pennsylvania working papers in linguistics* 7: 59-65.

Fought, Carmen. 1999. A majority sound change in a minority community: /u/-fronting in Chicano English. *Journal of Sociolinguistics* 3: 5-23.

Feagin, Crawford. 1979. *Variation and change in Alabama English: A sociolinguistic study of the white community.* Washington, DC: Georgetown University Press.

Fridland, Valerie. 2000. The Southern shift in Memphis, Tennessee. *Language Variation and Change* 11: 267-285.

------------------- and Kathy Bartlett. 2003. The social and linguistic conditioning of back vowel fronting across ethnic groups in Memphis. Paper presented at NWAV 32, Philadelphia.

Hagiwara, Robert. 2006. Vowel production in Winnipeg. *Canadian Journal of Linguistics* 51: 127-142.

Hall-Lew, Lauren. 2004. The Western Vowel Shift in Northern Arizona. <http://www.stanford.edu /~dialect/QP.pdf>. Accessed January 2006.

Hinton, Leanne, Birch Moonwomon, Sue Bremner, Herb Luthin, Mary Van Clay, Jean Lerner and Hazel Corcoran. 1987. It's not just the Valley Girls: a study of California English. *Proceedings of the Annual Meeting of the Berkeley Linguistics Society* 13: 117-128.

Hoffman, Michol. 1999. Really expansive: the progress of lax vowel lowering in a chain shift. Paper presented at NWAV 28, Toronto.

Kerswill, Paul. 2003. Dialect levelling and geographical diffusion in British English. In *Social Dialectology: In honour of Peter Trudgill*, ed. Jenny Cheshire and David Britain, 223-243. Philadelphia: Benjamins.

Labov, William. 1963. The social motivation of a sound change. *Word* 19: 273-309.

-------------------. 1972. *Sociolinguistic patterns*. Philadelphia: University of Pennsylvania Press.

-------------------. 1991. The three dialects of English. In *New ways of analyzing sound change*, ed. Penelope Eckert, 1-44. San Diego: Academic.

------------------. 1994. *Principles of linguistic change, volume 1: Internal factors.* Oxford: Blackwell.

------------------. 2003. *Plotnik 07 Documentation.* Manual accompanying Plotnik v.7 software.

----------------- and Charles Boberg. 1995. Workshop on the acoustic measurement of English vowels. Workshop presented at NWAV 24, Philadelphia.

-----------------, Sharon Ash and Charles Boberg. 2006. *The atlas of North American English.* Berlin: Mouton de Gruyter.

Milroy, Leslie. 1980. *Language and social networks.* Oxford: Blackwell.

-----------------. 1987. *Observing and analysing natural language.* Oxford: Blackwell

-----------------. 2004. "The accents of the valiant": Why are some sound changes more accessible than others? Paper presented at the Sociolinguistics Symposium 15: Culture, contact and change, Newcastle.

----------------- and James Milroy. 1992. Social network and social class: Toward an integrated sociolinguistic model. *Language in Society* 21: 1-26.

Nahkola, Kari and Marja Saanilahti. 2004. Mapping language changes in real time: A panel study on Finnish. *Language Variation and Change* 16: 75-92.

Pope, Jenny. 2003. Results and implications of a real time study: Forty years of language variation on Martha's Vineyard. Paper presented at NWAV 32, Philadelphia.

Rogers, Henry. 1991. *Theoretical and practical phonetics.* Mississauga: Copp Clark Pitman.

Statistics Canada. 2004. < http://www40.statcan.ca/l01/cst01/>. Accessed September, 2005.

Stevens, Kenneth. 1998. *Acoustic phonetics.* Cambridge: The MIT Press.

Stockwell, Robert and Donka Minkova. 1997. *Studia Anglica Posnaniensia* 31: 283-303.

Turell, M. Teresa. 2003. Apparent and real time in studies of linguistic change and variation. *Noves SL.* Tardor 2003. <http://cultura.gencat.net/llengcat/noves/hm03tardor/docs/a_turell.pdf>. Accessed April, 2004.

Watt, Dominic J.L. 2000. Phonetic parallels between the close-mid vowels of Tyneside English: Are they internally or externally motivated? *Language Variation and Change* 12: 69-101.

Appendix A

Participant Background Information Form –

Younger Females

Please complete the following as accurately as possible. If you feel uncomfortable answering any of these questions, please leave them blank.

1. Your name: ____

2. Your age: ____

3. Your place of birth (e.g. St. John's, Newfoundland):

   ____

4. Have you always lived in this place? (Yes or No): ________________

   If NO: Where else have you lived and for how long?

   ____

   ____

5. Your level of education (check one):
   - ❑ Some high school
   - ❑ High school diploma
   - ❑ Some college/university
   - ❑ College/university degree

6. Your occupation: ______________________________

7. Mother's level of education: ______________________________

8. Mother's occupation: ______________________________

9. Father's level of education: ______________________________

10. Father's occupation: ______________________________

Appendix B

Participant Background Information Form – Older Females

Please complete the following as accurately as possible. If you feel uncomfortable answering any of these questions, please leave them blank.

11. Your name: ____

12. Your age: ____

13. Your place of birth (City, Province): ____________________________

14. Have you always lived in this place? (Yes or No): __________________

    If NO: Where else have you lived and for how long?

    ____

    ____

15. Your level of education (check one):
    - ❑ Some high school
    - ❑ High school diploma
    - ❑ Some college/university
    - ❑ College/university degree

16. Your occupation: ______________________________

17. Spouse's level of education (check one):

- ❑ Some high school
- ❑ High school diploma
- ❑ Some college/university
- ❑ College/university degree

18. Spouse's occupation: ______________________________

Appendix C

Certificate of Informed Consent

You are participating in a study conducted by Pauline Hollett, a graduate student at Memorial University of Newfoundland. The purpose of this study is to investigate the St. John's dialect of English. Various sounds will be extracted from the recordings and undergo computerized acoustic analysis by the researcher. Data obtained will be primarily used to complete a Master's thesis.

Your signature on each section of this form indicates your informed consent to that component of the study. You are free to choose to sign only some parts and not others.

If you have any further questions regarding this study, you may contact Dr. Sandra Clarke at clarkes@mun.ca or by telephone at 737-7362. If you have any ethical concerns about the research that are not dealt with by the researcher, you may contact the Chairperson of the Interdisciplinary Committee on Ethics in Human Research at icehr@mun.ca or by telephone at 737-8368.

Participants Name: ____

I have been advised of the purpose of the research for which you have interviewed me and:

1. I am fully aware that the interviews are being tape-recorded, and that I have the right to request erasure of any portion of the taped interview that I am uncomfortable with.

Participant's Signature: ______________________________

Date: ______________________________

2. I understand that all information provided will be kept strictly confidential, and that my identity will be known only by the present investigator, Pauline Hollett. It is also understood that my participation is voluntary.

Participant's Signature: ______________________________

Date: ______________________________

3. I grant you permission to use interview material for your current research and for the resulting thesis.

Participant's Signature: ______________________________

Date: ______________________________

4. I further grant you permission to use the interview material for any other purposes, i.e. discussions, presentations, or any published or unpublished works in addition to the thesis.

Participant's Signature: ____

Date: ____

5. I grant you permission to deposit the tape-recorded material with the Department of Linguistics, Memorial University of Newfoundland, and thereby granting access to this material for other research. If you choose to opt out of this portion of the research, material will remain in the secure possession of the interviewer and, upon request will be destroyed.

Participant's Signature: ____

Date: ____

Interviewer's/Researcher's Signature: _____________________________

Date: ____

Appendix D

Word List for 2003 Interviews

1. Zipper
2. Boot
3. Love
4. Aisle
5. Tour
6. Wrote
7. Food
8. Dream
9. Rub
10 Faith
11. Look
12. About
13. Ploy
14. Barrel
15. Catfood
16. Met
17. Giggle
18. Cod
19. Kick
20. Coastal
21. Hardly
22. Hope
23. Lube
26. Noose
27. Bought
28. Length
29. Fact
30. Drove
31. Luck
32. Head
33. Nut
34. Flip
35. Bet
36. Finger
37. Udder
38. Huge
39. Match
40. Straw
41. Notch
42. Goose
43. Dream
44. Lift
45. Ghosts
46. Check
47. Faith
48. Pam
51. Family
52. Button
53. Lock
54. Muzzle
55. Peddle
56. Cot
57. Hutch
58. Bang
59. Group
60. Robe
61. Kept
62. Wit
63. Asks
64. Cut
65. Wrong
66. Aloof
67. Chrome
68. Loot
69. Dressing-gown
70. Always
71. Dodge
72. Badge
73. Salt

24. June
25. Sip
76. Thrilled
77. Plaster
78. Bothered
79. Leg
80. Posts
81. Method
82. Attic
83. Dutiful
84. Stood
85. Steal
86. Roads
87. Trod
88. Pool
89. Nothing
90. Pail
91. Aisle
92. If
93. Achieve
94. Glad
95. Bathe
96. Lint
97. Give
98. Rolaids
99. Groove

49. Left
50. Poke
101. Eggcup
102. Bathroom
103. School
104. Lit
105. Cows
106. Fetching
107. Bag
108. Cruise
109. Which
110. Something
111. Caused
112. Tide
113. Shoe
114. higher
115. Buy
116. Wizard
117. Pen
118. Seem
119. Leash
120. Barrel
121. Fish
122. Coil
123. Breathe
124. Great

74. Smooch
75. Him
126. Novel
127. Noon
128. Miss
129. Fog
130. Lap
131. Snuggle
132. Bloom
133. Vinegar
134. Deaf
135. Pole
136. Lush
137. Run
138. Though
139. With
140. Flew
141. Edging
142. Ran
143. Beet
144. Good
145. Merry
146. Put
147. Train
148. Beg
149. Lawn

100. Tugboat
151. Listening
152. Handle
153. Supper
154. Author
155. Lane
156. Felt
157. Always
158. Stocking
159. Thigh
160. Look
161. Half
162. Joint
163. Measure
164. Right
165. Beige
166. About
167. Board
168. Bitter
169. Hardly
170. Thaw
171. Button
172. Every
173. Mouth
174. Took
175. Moth-eaten
125. Wasps
176. Jazz
179. Unloading
180. Putt
181. Prude
182. Howled
183. Pop
184. Sixth
185. Match
186. Tight
187. Gull
188. Mate
189. Pillow
190. Note
191. Butcher
192. Soft
193. Line
194. Caught
195. Spoons
196. Bid
197. Cuff
198. Bridge
199. Judge
200. Toot
202. More
203. Last
150. Coin
201. Catch
207. Ploy
208. Couch
209. Mallet
210. Sibling
211. Well
212. Stack
213. Hem
214. Where
215. Mary
216. Crude
217. Rose
218. Tone
219. Slow
220. Roach
221. Down
222. Colour
223. Pal
224. Have
225. Allow
226. Bare
227. Fly
228. Foul
229. Men
230. Poor

176. Jazz
177. Haul
178. Weather

204. Span
205. Duck
206. Lick

231. Lobster
232. Tile
233. Full
234. Mouse
235. Soar
236. Through
237. Loaf
238. Pony
239. Malt
240. Busy

Appendix E

Word List for 1980s Interviews

(from Clarke's St. John's Sociolinguistic Survey)

1. Pam
2. Rolaids
3. Bury
4. Ghosts
5. Beer
6. Asks
7. Nothing
8. Line
9. Back
10. Bat
11. Mouth
12. Pool
13. Eating
14. Northerly
15. Lion
16. Petal
17. Plaster
18. New
19. Length
20. Stocking
21. Prefer
22. Always
23. Employee
24. Faith
25. Left
26. Howled
27. Dream
28. They
29. Bathroom
30. Dare
31. Herring
32. High-School
33. Trowel
34. Sure
35. Eggcup
36. Really
37. Often
38. life
39. Mare
40. Child
41. Supper
42. Look
43. Edging
44. Untie
45. Giggle
46. Whether
47. Which
48. Tomatoes
49. Half
50. Childhood
51. Very
52. Dune-buggy
53. Bothered
54. Catch
55. Tuned
56. Author
57. Behave
58. Asked
59. Thought
60. Berry
61. Giant
62. Walking
63. Catfood
64. Chair
65. Taught
66. Bigger
67. Toy
68. Bag
69. Dressing-gown
70. Broom
71. Don
72. Truthful

73. Wrote
74. Sour
75. Shoe
76. Listening
77. Relief
78. Nylon
79. Student
80. Mostly
81. Idea
82. Love
83. Suitable
84. Vinegar
85. Hospital
86. Foolish
87. Human
88. Parka
89. Haul
90. Eight
91. Hard-boiled
92. Thaw
93. Guitar
94. Steal
95. Poured
96. Made
97. Guarded
98. Wasps
99. Poem
100. Udder
101. Stupid
102. Locality
103. Sauce
104. Is
105. Orange
106. Lobster
107. Fishcakes
108. Pal
109. Off
110. Soothe
111. Midyear
112. Newfoundland
113. Tutor
114. Frostbite
115. Pore
116. Quite
117. Unfurl
118. Thigh
119. Worm
120. Snuggle
121. Bomb
122. Bullfrog
123. Rhythm
124. Buy
125. Bear
126. Moored
127. On-loading
128. Desire
129. Wordy
130. Barrel
131. Beg
132. Bathe
133. Because
134. Trod
135. Moth-eaten
136. Anything
137. Avoid
138. Seam
139. Leg
140. Detract
141. Ankle
142. Doubt
143. Product
144. Enjoy
145. Match
146. Hollow
147. Lift
148. Cheer
149. Protect
150. Loud
151. Seem
152. Of
153. Hiss
154. Pathetic
155. Scalped
156. Peddle
157. Pen
158. Where
159. Dance

160. Otherwise
161. Lottery
162. Regatta
163. Tie
164. Toboggan
165. Oil
166. Roads
167. Ruler
168. Salt
169. Heart
170. Moon
171. Loss
172. Joint
173. Quarter
174. Hearth
175. If
176. Hoist
177. Grandfather
178. Fuzzy
179. Milking
180. Thorn
181. Accounting
182. Fellow
183. Hoof
184. Kiln
185. Package
186. Litre
187. Machine
188. Flagpole
189. Appeared
190. Sailed
191. Couldn't
192. Monthly
193. Films
194. Posts
195. Hire
196. Pulpit
197. Mice
198. Rang
199. Stapler
200. Attic
201. Furthest
202. Loot
203. Actually
204. Great
205. Unloading
206. Ride
207. Tuesday
208. Ruin
209. Plays
210. Aisle
211. Bead
212. Drawer
213. Fact
214. Tugboat
215. Paths
216. Higher
217. Mower
218. Spoons
219. Washrag
220. Toothbrush
221. Bath
222. Breathe
223. Without
224. Alive
225. Button
226. Due
227. Bottle
228. Health
229. White
230. Buttered
231. Attack
232. Boy
233. Balm
234. Thick
235. Creation
236. Already
237. Dew
238. Though
239. Zipper
240. Bitter
241. Spoiled
242. Board
243. With
244. There
245. Train
246. Catalogue

247. Thrilled
248. Handle
249. Dawn
250. Flower
251. Right
252. Wit
253. Sorry
254. Last
255. Weather
256. Maid
257. Groceries
258. Hearing
259. Palm
260. Million
261. Thirty-three
262. Cigar
263. Laws
264. Government
265. Worthy
266. Told
267. Dutiful
268. Ate
269. Soothing
270. Coastal
271. Foghorn
272. Fetching
273. Just
274. Throne
275. Horror
276. Eighty-sixth
277. Roof
278. Felt
279. Soul
280. Was
281. Mayor
282. Wrong
283. Fork
284. Wide
285. Thread
286. Something
287. Soft
288. More
289. Thrash
290. Find
291. Sale
292. Thirteen
293. Saturday
294. Trial
295. Have
296. Evening
297. Faces

Appendix F
Normalized F1 and F2 Values and Coding Values for the All Tokens in the Current Data

Table F1. Coding Key.

Variable		Code
Vowel Variable	/ɪ/	1
	/ɛ/	2
	/æ/	3
	/ɑ/	5
	/ʌ/	6
	/ʊ/	7
	/o:/	62
	/u:/	72
Generational Group	YF03	1
	YF80	2
	OF03	3
Pre- and Foll-MOA	(Oral) Stop	1
	Fricative	2
	Nasal	3
Pre- and Foll-POA	Labial	1
	Coronal	2
	Dorsal	3
Pre- and Foll-Voicing	Voiceless	1
	Voiced	2

*Coding for Vowel Variable is taken directly from Plotnik.

Table F2. Normalized results for all variables and all speakers.

F1 (Hz)	F2 (Hz)	Vowel Variable	Generational Group	Foll-MOA	Foll-POA	Foll-Voicing	Pre-POA	Pre-MOA	Pre-Voicing	Token
524	1935	1	1	1	1	2	2	2	1	Sibling
505	2156	1	1	1	1	2	2	2	1	Sibling
555	2151	1	1	1	1	1	2	2	2	Zipper
458	2015	1	1	1	1	1	2	2	2	Zipper
570	2161	1	1	1	1	1	2	2	2	Zipper
517	1988	1	1	1	1	1	2	2	2	Zipper
558	2128	1	1	1	2	1	2	-	2	Lit
481	2416	1	1	1	2	1	2	-	2	Lit
592	2228	1	1	1	2	1	2	-	2	Lit
565	2230	1	1	1	2	1	2	-	2	Lit
513	2261	1	1	1	3	1	2	-	2	Lick
600	2085	1	1	1	3	1	2	-	2	Lick
570	2251	1	1	1	3	1	2	-	2	Lick
517	2495	1	1	1	3	1	2	-	2	Lick
598	2250	1	1	1	3	2	3	1	2	Giggle
473	2605	1	1	1	3	2	3	1	2	Giggle
480	2295	1	1	1	3	2	3	1	2	Giggle
444	2398	1	1	1	3	2	3	1	2	Giggle
425	2217	1	1	2	2	2	1	1	2	Busy
458	2251	1	1	2	2	2	1	1	2	Busy
412	1981	1	1	2	2	2	1	1	2	Busy
444	2303	1	1	2	2	2	1	1	2	Busy
555	2120	1	1	2	2	1	1	2	1	Fish
505	2297	1	1	2	2	1	1	2	1	Fish
547	2318	1	1	2	2	1	1	2	1	Fish
580	2217	1	1	2	2	1	1	3	2	Miss
481	2297	1	1	2	2	1	1	3	2	Miss
614	2273	1	1	2	2	1	1	3	2	Miss
620	2058	1	1	2	1	1	2	-	2	Lift
600	2275	1	1	2	1	1	2	-	2	Lift
531	2107	1	1	2	1	1	2	-	2	Lift
614	1988	1	1	2	1	1	2	-	2	Lift
517	1795	1	1	2	2	1	2	-	2	Listening
411	2039	1	1	2	2	2	3	-	2	Wizard
435	1922	1	1	2	2	2	3	-	2	Wizard
444	1903	1	1	2	2	2	3	-	2	Wizard
513	1841	1	1	2	2	2	3	--	2	Wizard
492	2374	1	1	2	1	1	-	-	-	If
591	2281	1	1	3	3	2	1	2	1	Finger
505	2548	1	1	3	3	2	1	2	1	Finger
438	1594	1	1	3	3	2	1	2	1	Finger
585	2395	1	1	3	3	2	1	2	1	Finger
593	2084	1	1	3	2	2	1	2	2	Vinegar

**Data is sorted first by Vowel Variable, then by Generational Group.

F1 (Hz)	F2 (Hz)	Vowel Variable	Generational Group	Foll-MOA	Foll-POA	Foll-Voicing	Pre-POA	Pre-MOA	Pre-Voicing	Token
434	2329	1	1	3	2	2	1	2	2	Vinegar
450	2027	1	1	3	2	2	1	2	2	Vinegar
547	2108	1	1	3	2	2	1	2	2	Vinegar
586	2225	1	1	3	2	2	2	-	2	Lint
565	2414	1	1	3	2	2	2	-	2	Lint
530	2323	1	1	3	2	2	2	-	2	Lint
556	2441	1	1	3	2	2	2	-	2	Lint
583	2427	1	1	3	1	2	3	2	1	Him
510	2669	1	1	3	1	2	3	2	1	Him
548	2426	1	1	3	1	2	3	2	1	Him
576	2463	1	1	3	1	2	3	2	1	Him
450	2527	1	2	1	2	2	1	3	2	midyear
433	2124	1	2	1	2	2	1	3	2	midyear
433	2124	1	2	1	2	2	1	3	2	midyear
436	2342	1	2	1	2	2	1	3	2	midyear
523	2258	1	2	1	3	1	2	2	1	Thick
482	2273	1	2	1	3	1	2	2	1	Thick
482	2273	1	2	1	3	1	2	2	1	Thick
501	2211	1	2	1	3	1	2	2	1	Thick
450	2013	1	2	1	1	1	2	2	2	Zipper
433	1999	1	2	1	1	1	2	2	2	Zipper
433	1999	1	2	1	1	1	2	2	2	Zipper
500	2067	1	2	1	1	1	2	2	2	Zipper
499	2379	1	2	1	3	2	3	1	2	Giggle
409	2521	1	2	1	3	2	3	1	2	Giggle
409	2521	1	2	1	3	2	3	1	2	Giggle
451	2377	1	2	1	3	2	3	1	2	Giggle
426	2404	1	2	1	2	1	3	-	2	Wit
409	2198	1	2	1	2	1	3	-	2	Wit
409	2198	1	2	1	2	1	3	-	2	Wit
441	2203	1	2	1	2	1	3	-	2	Wit
474	2209	1	2	2	2	1	1	2	1	Fishcakes
433	2149	1	2	2	2	1	1	2	1	Fishcakes
433	2149	1	2	2	2	1	1	2	1	Fishcakes
454	2082	1	2	2	2	1	1	2	1	Fishcakes
474	2379	1	2	2	1	1	2	-	2	Lift
433	2223	1	2	2	1	1	2	-	2	Lift
433	2223	1	2	2	1	1	2	-	2	Lift
483	2075	1	2	2	1	1	2	-	2	Lift
426	2160	1	2	2	2	1	2	-	2	Listening
433	1850	1	2	2	2	1	2	-	2	Listening
433	1850	1	2	2	2	1	2	-	2	Listening
480	1952	1	2	2	2	1	2	-	2	Listening
474	2551	1	2	2	2	1	3	2	1	Hiss
457	2496	1	2	2	2	1	3	2	1	Hiss
457	2496	1	2	2	2	1	3	2	1	Hiss
475	2306	1	2	2	2	1	3	2	1	Hiss
372	2374	1	2	2	2	2	-	-	-	Is
409	2471	1	2	2	2	2	-	-	-	Is
409	2471	1	2	2	2	2	-	-	-	Is
441	2286	1	2	2	2	2	-	-	-	Is
362	2357	1	2	3	2	2	1	1	1	Pin
445	2611	1	2	3	2	2	1	1	1	Pin

F1 (Hz)	F2 (Hz)	Vowel Variable	Generational Group	Foll-MOA	Foll-POA	Foll-Voicing	Pre-POA	Pre-MOA	Pre-Voicing	Token
445	2611	1	2	3	2	2	1	1	1	Pin
476	2483	1	2	3	2	2	1	1	1	Pin
504	2094	1	2	3	2	2	1	2	2	Vinegar
432	2073	1	2	3	2	2	1	2	2	Vinegar
432	2073	1	2	3	2	2	1	2	2	Vinegar
467	2125	1	2	3	2	2	1	2	2	Vinegar
481	2135	1	2	3	2	2	3	-	2	Winner
419	2002	1	2	3	2	2	3	-	2	Winner
419	2002	1	2	3	2	2	3	-	2	Winner
461	2268	1	2	3	2	2	3	-	2	Winner
503	2253	1	2	3	2	2	3	-	2	Winter
457	2143	1	2	3	2	2	3	-	2	Winter
457	2143	1	2	3	2	2	3	-	2	Winter
464	2237	1	2	3	2	2	3	-	2	Winter
401	2126	1	3	1	1	2	2	2	1	Sibling
515	1956	1	3	1	1	2	2	2	1	Sibling
614	1822	1	3	1	1	2	2	2	1	Sibling
503	1955	1	3	1	1	2	2	2	1	Sibling
515	1548	1	3	1	1	1	2	2	1	Sip
516	2017	1	3	1	1	1	2	2	2	Zipper
469	1798	1	3	1	1	1	2	2	2	Zipper
543	2263	1	3	1	1	1	2	2	2	Zipper
470	2265	1	3	1	2	1	2	-	2	Lit
539	2000	1	3	1	2	1	2	-	2	Lit
493	2184	1	3	1	2	1	2	-	2	Lit
550	2130	1	3	1	2	1	2	-	2	Lit
447	2335	1	3	1	3	1	2	-	2	Lick
515	2124	1	3	1	3	1	2	-	2	Lick
517	2523	1	3	1	3	1	2	-	2	Lick
614	2066	1	3	1	3	1	2	-	2	Lick
401	1892	1	3	1	3	2	3	1	2	Giggle
490	1692	1	3	1	3	2	3	1	2	Giggle
469	1508	1	3	1	3	2	3	1	2	Giggle
459	2408	1	3	1	3	2	3	1	2	Giggle
378	2081	1	3	2	2	2	1	1	2	Busy
466	1981	1	3	2	2	2	1	1	2	Busy
445	1704	1	3	2	2	2	1	1	2	Busy
583	2052	1	3	2	2	2	1	1	2	Busy
424	2302	1	3	2	2	1	1	2	1	Fish
466	2197	1	3	2	2	1	1	2	1	Fish
445	1725	1	3	2	2	1	1	2	1	Fish
484	2430	1	3	2	2	1	1	2	1	Fish
516	2178	1	3	2	2	1	1	3	2	Miss
611	1956	1	3	2	2	1	1	3	2	Miss
542	2209	1	3	2	2	1	1	3	2	Miss
552	2317	1	3	2	2	1	1	3	2	Miss
401	2325	1	3	2	1	1	2	-	2	Lift
533	1825	1	3	2	1	1	2	-	2	Lift
542	2000	1	3	2	1	1	2	-	2	Lift
485	2343	1	3	2	1	1	2	-	2	Lift
377	2104	1	3	2	2	2	3	-	2	Wizard
490	1764	1	3	2	2	2	3	-	2	Wizard
493	1774	1	3	2	2	2	3	-	2	Wizard

F1 (Hz)	F2 (Hz)	Vowel Variable	Generational Group	Foll-MOA	Foll-POA	Foll-Voicing	Pre-POA	Pre-MOA	Pre-Voicing	Token
477	1899	1	3	2	2	2	3	-	2	Wizard
462	2592	1	3	3	3	2	1	2	1	Finger
680	1733	1	3	3	3	2	1	2	1	Finger
497	2514	1	3	3	3	2	1	2	1	Finger
682	2186	1	3	3	3	2	1	2	1	finger
429	2224	1	3	3	2	2	1	2	2	Vinegar
626	1816	1	3	3	2	2	1	2	2	Vinegar
544	2213	1	3	3	2	2	1	2	2	Vinegar
605	2247	1	3	3	2	2	1	2	2	Vinegar
453	2371	1	3	3	2	2	2	-	2	Lint
611	1774	1	3	3	2	2	2	-	2	Lint
487	1907	1	3	3	2	2	2	-	2	Lint
572	2342	1	3	3	2	2	2	-	2	Lint
563	2637	1	3	3	1	2	3	2	1	Him
693	1940	1	3	3	1	2	3	2	1	Him
712	2143	1	3	3	1	2	3	2	1	Him
725	2187	1	3	3	1	2	3	2	1	Him
734	1933	2	1	1	2	1	1	1	2	Bet
646	2180	2	1	1	2	1	1	1	2	Bet
727	2161	2	1	1	2	1	1	1	2	Bet
638	2157	2	1	1	2	1	1	1	2	Bet
646	2151	2	1	1	3	2	1	1	2	Beg
624	2227	2	1	1	3	2	1	1	2	Beg
704	2273	2	1	1	3	2	1	1	2	Beg
638	2303	2	1	1	3	2	1	1	2	Beg
824	2047	2	1	1	2	1	1	3	2	Met
646	2251	2	1	1	2	1	1	3	2	Met
749	1932	2	1	1	2	1	1	3	2	Met
661	2254	2	1	1	2	1	1	3	2	Met
677	2001	2	1	1	3	1	2	-	1	Check
741	1991	2	1	1	3	1	2	-	1	Check
718	1932	2	1	1	3	1	2	-	1	Check
734	2061	2	1	1	3	1	2	-	1	Check
666	2001	2	1	1	2	2	3	2	1	Head
600	2321	2	1	1	2	2	3	2	1	Head
683	2195	2	1	1	2	2	3	2	1	Head
630	2223	2	1	1	2	2	3	2	1	Head
580	2040	2	1	2	2	2	1	3	2	Measure
624	2180	2	1	2	2	2	1	3	2	Measure
727	2049	2	1	2	2	2	1	3	2	Measure
614	2133	2	1	2	2	2	1	3	2	Measure
712	1886	2	1	2	1	1	2	1	2	Deaf
670	2251	2	1	2	1	1	2	1	2	Deaf
543	2183	2	1	2	1	1	2	1	2	Deaf
685	2133	2	1	2	1	1	2	1	2	Deaf
687	2047	2	1	2	1	1	2	-	2	Left
694	2109	2	1	2	1	1	2	-	2	Left
705	1975	2	1	2	1	1	2	-	2	Left
739	2037	2	1	2	1	1	2	-	2	Left
646	2173	2	1	2	2	1	2	-	2	DressingGown
694	1968	2	1	2	2	1	2	-	2	DressingGown
683	1844	2	1	2	2	1	2	-	2	DressingGown
638	2061	2	1	2	2	1	2	-	2	DressingGown

F1 (Hz)	F2 (Hz)	Vowel Variable	Generational Group	Foll-MOA	Foll-POA	Foll-Voicing	Pre-POA	Pre-MOA	Pre-Voicing	Token
669	2040	2	1	2	1	2	-	-	-	Every
646	2227	2	1	2	1	2	-	-	-	Every
659	2139	2	1	2	1	2	-	-	-	Every
614	2278	2	1	2	1	2	-	-	-	Every
618	2177	2	1	3	2	2	1	1	1	Pen
635	2366	2	1	3	2	2	1	1	1	Pen
699	2306	2	1	3	2	2	1	1	1	Pen
727	2232	2	1	3	2	2	1	1	1	Pen
640	2195	2	1	3	2	2	1	3	2	Men
597	2385	2	1	3	2	2	1	3	2	Men
689	2295	2	1	3	2	2	1	3	2	Men
610	2467	2	1	3	2	2	1	3	2	Men
680	2232	2	1	3	3	2	2	-	2	Length
727	2112	2	1	3	3	2	2	-	2	Length
639	2157	2	1	3	3	2	2	-	2	Length
675	2691	2	1	3	3	2	2	-	2	Length
618	2143	2	1	3	1	2	3	2	1	Hem
636	2454	2	1	3	1	2	3	2	1	Hem
618	2292	2	1	3	1	2	3	2	1	Hem
660	2536	2	1	3	1	2	3	2	1	Hem
669	2062	2	2	1	2	2	1	1	1	Petal
597	2282	2	2	1	3	2	1	1	2	Beg
471	2471	2	2	1	3	2	1	1	2	Beg
471	2471	2	2	1	3	2	1	1	2	Beg
508	2218	2	2	1	3	2	1	1	2	Beg
669	2160	2	2	1	3	1	2	1	1	(Pro)tect
582	2074	2	2	1	3	1	2	1	1	(Pro)tect
582	2074	2	2	1	3	1	2	1	1	(Pro)tect
651	2134	2	2	1	3	1	2	1	1	(Pro)tect
621	2184	2	2	1	2	1	2	2	1	(Pa)thetic
592	2020	2	2	1	2	1	2	2	1	(Pa)thetic
592	2020	2	2	1	2	1	2	2	1	(Pa)thetic
640	2022	2	2	1	2	1	2	2	1	(Pa)thetic
470	2099	2	2	1	2	2	2	-	2	(Al)ready
470	2099	2	2	1	2	2	2	-	2	(Al)ready
536	2020	2	2	1	2	2	2	-	2	(Al)ready
557	2074	2	2	1	2	2	2	-	2	Thread
557	2074	2	2	1	2	2	2	-	2	Thread
536	2092	2	2	1	2	2	2	-	2	Thread
597	2258	2	2	1	3	2	2	-	2	Leg
621	2356	2	2	1	3	2	3	-	-	Eggcup
532	2273	2	2	1	3	2	3	-	-	Eggcup
532	2273	2	2	1	3	2	3	-	-	Eggcup
469	2257	2	2	1	3	2	3	-	-	Eggcup
718	2061	2	2	2	1	1	2	-	2	Left
646	1974	2	2	2	1	1	2	-	2	Left
646	1974	2	2	2	1	1	2	-	2	Left
659	1990	2	2	2	1	1	2	-	2	Left
645	2111	2	2	2	2	1	2	-	2	DressingGown
455	1995	2	2	2	2	1	2	-	2	DressingGown
455	1995	2	2	2	2	1	2	-	2	DressingGown
520	1934	2	2	2	2	1	2	-	2	DressingGown
597	1842	2	2	2	1	2	3	-	2	Weather

F1 (Hz)	F2 (Hz)	Vowel Variable	Generational Group	Foll-MOA	Foll-POA	Foll-Voicing	Pre-POA	Pre-MOA	Pre-Voicing	Token
607	1825	2	2	2	1	2	3	-	2	Weather
607	1825	2	2	2	1	2	3	-	2	Weather
614	1783	2	2	2	1	2	3	-	2	Weather
669	1818	2	2	2	1	2	3	-	2	Whether
677	1900	2	2	2	1	2	3	-	2	Whether
677	1900	2	2	2	1	2	3	-	2	Whether
586	1848	2	2	2	1	2	3	-	2	Whether
493	2539	2	2	3	2	2	1	1	1	Pen
493	2539	2	2	3	2	2	1	1	1	Pen
534	2418	2	2	3	2	2	1	1	1	Pen
548	2309	2	2	3	2	2	1	1	1	Pen
589	2581	2	2	3	2	2	1	1	1	Pen
586	2574	2	2	3	2	2	1	1	1	Pen2
490	2255	2	2	3	2	2	1	1	1	Pen2
490	2255	2	2	3	2	2	1	1	1	Pen2
611	2267	2	2	3	3	2	2	-	2	Length
611	2171	2	2	3	3	2	2	-	2	Length
611	2171	2	2	3	3	2	2	-	2	Length
584	2172	2	2	3	3	2	2	-	2	Length
659	2053	2	3	1	2	1	1	1	2	Bet
662	2232	2	3	1	2	1	1	1	2	Bet
562	2242	2	3	1	2	1	1	1	2	Bet
689	2257	2	3	1	2	1	1	1	2	Bet
562	1996	2	3	1	3	2	1	1	2	Beg
635	1932	2	3	1	3	2	1	1	2	Beg
686	2184	2	3	1	3	2	1	1	2	Beg
669	2273	2	3	1	3	2	1	1	2	Beg
723	1756	2	3	1	2	1	1	3	2	Met
659	1740	2	3	1	2	1	1	3	2	Met
711	1846	2	3	1	2	1	1	3	2	Met
704	2402	2	3	1	2	1	1	3	2	Met
700	2037	2	3	1	3	1	2	-	1	Check
683	1932	2	3	1	3	1	2	-	1	Check
735	1967	2	3	1	3	1	2	-	1	Check
651	2232	2	3	1	3	1	2	-	1	Check
608	2335	2	3	1	2	2	3	2	1	Head
659	2005	2	3	1	2	2	3	2	1	Head
765	1774	2	3	1	2	2	3	2	1	Head
702	2199	2	3	1	2	2	3	2	1	Head
737	2176	2	3	2	2	2	1	3	2	Measure
611	1981	2	3	2	2	2	1	3	2	Measure
735	2187	2	3	2	2	2	1	3	2	Measure
766	2374	2	3	2	2	2	1	3	2	Measure
700	2197	2	3	2	1	1	2	1	2	Deaf
707	1861	2	3	2	1	1	2	1	2	Deaf
759	1774	2	3	2	1	1	2	1	2	Deaf
749	2152	2	3	2	1	1	2	1	2	Deaf
677	1636	2	3	2	1	1	2	-	2	Left
683	1764	2	3	2	1	1	2	-	2	Left
735	1822	2	3	2	1	1	2	-	2	Left
738	2165	2	3	2	1	1	2	-	2	Left
631	1736	2	3	2	2	1	2	-	2	DressingGown
659	1837	2	3	2	2	1	2	-	2	DressingGown

F1 (Hz)	F2 (Hz)	Vowel Variable	Generational Group	Foll-MOA	Foll-POA	Foll-Voicing	Pre-POA	Pre-MOA	Pre-Voicing	Token
783	1653	2	3	2	2	1	2	-	2	DressingGown
678	2107	2	3	2	2	1	2	-	2	DressingGown
631	2220	2	3	2	1	2	3	-	-	Every
635	2197	2	3	2	1	2	3	-	-	Every
711	2136	2	3	2	1	2	3	-	-	Every
723	2481	2	3	2	1	2	3	-	-	Every
648	2460	2	3	3	2	2	1	1	1	Pen
647	2388	2	3	3	2	2	1	1	1	Pen
703	1992	2	3	3	2	2	1	1	1	Pen
752	2284	2	3	3	2	2	1	1	1	Pen
714	2304	2	3	3	2	2	1	3	2	Men
622	2274	2	3	3	2	2	1	3	2	Men
565	1922	2	3	3	2	2	1	3	2	Men
789	2575	2	3	3	2	2	1	3	2	Men
738	2226	2	3	3	3	2	2	-	2	Length
690	2297	2	3	3	3	2	2	-	2	Length
762	2062	2	3	3	3	2	2	-	2	Length
739	2241	2	3	3	3	2	2	-	2	Length
662	2421	2	3	3	1	2	3	2	1	Hem
682	2121	2	3	3	1	2	3	2	1	Hem
866	2218	2	3	3	1	2	3	2	1	Hem
792	2633	2	3	3	1	2	3	2	1	Hem
712	2106	3	1	1	3	2	1	1	2	Bag
789	2180	3	1	1	3	2	1	1	2	Bag
793	2004	3	1	1	3	2	1	1	2	Bag
782	2157	3	1	1	3	2	1	1	2	Bag
779	1841	3	1	1	3	1	2	1	1	Stack
812	2062	3	1	1	3	1	2	1	1	Stack
794	1915	3	1	1	3	1	2	1	1	Stack
782	2037	3	1	1	3	1	2	1	1	Stack
823	1929	3	1	1	1	1	2	-	2	Lap
858	2148	3	1	1	1	1	2	-	2	Lap
838	1735	3	1	1	1	1	2	-	2	Lap
855	1964	3	1	1	1	1	2	-	2	Lap
735	1819	3	1	1	2	2	2	-	2	Glad
835	2015	3	1	1	2	2	2	-	2	Glad
793	1867	3	1	1	2	2	2	-	2	Glad
758	2061	3	1	1	2	2	2	-	2	Glad
779	1910	3	1	1	2	1	3	1	1	Catfood
741	2156	3	1	1	2	1	3	1	1	Catfood
749	2004	3	1	1	2	1	3	1	1	Catfood
807	2037	3	1	1	2	1	3	1	1	Catfood
801	1949	3	1	2	1	1	1	1	2	Bathroom
906	1873	3	1	2	1	1	1	1	2	Bathroom
816	1762	3	1	2	1	1	1	1	2	Bathroom
807	1964	3	1	2	1	1	1	1	2	Bathroom
757	1907	3	1	2	2	2	2	-	2	Jazz
882	2039	3	1	2	2	2	2	-	2	Jazz
816	1869	3	1	2	2	2	2	-	2	Jazz
831	1988	3	1	2	2	2	2	-	2	Jazz
845	2104	3	1	2	2	1	2	-	2	Last
906	1968	3	1	2	2	1	2	-	2	Last
775	1789	3	1	2	2	1	2	-	2	Last

F1 (Hz)	F2 (Hz)	Vowel Variable	Generational Group	Foll-MOA	Foll-POA	Foll-Voicing	Pre-POA	Pre-MOA	Pre-Voicing	Token
854	2181	3	1	2	2	1	2	-	2	Last
823	1948	3	1	2	1	1	3	2	1	Half
835	2085	3	1	2	1	1	3	2	1	Half
906	2026	3	1	2	1	1	3	2	1	Half
854	1964	3	1	2	1	1	3	2	1	Half
753	2195	3	1	2	1	2	3	2	1	Have
882	2156	3	1	2	1	2	3	2	1	Have
793	1960	3	1	2	1	2	3	2	1	Have
807	2230	3	1	2	1	2	3	2	1	Have
689	2122	3	1	3	2	2	1	1	1	Span
652	2436	3	1	3	2	2	1	1	1	Span
714	2273	3	1	3	2	2	1	1	1	Span
685	2274	3	1	3	2	2	1	1	1	Span
676	2120	3	1	3	3	2	1	1	2	Bang
742	2446	3	1	3	3	2	1	1	2	Bang
722	2121	3	1	3	3	2	1	1	2	Bang
644	2354	3	1	3	3	2	1	1	2	Bang
693	2055	3	1	3	1	2	1	2	1	Family
795	2129	3	1	3	1	2	1	2	1	Family
758	2129	3	1	3	1	2	1	2	1	Family
749	2174	3	1	3	1	2	1	2	1	Family
659	2271	3	1	3	2	2	3	2	1	Handle
670	2285	3	1	3	2	2	3	2	1	Handle
725	2373	3	1	3	2	2	3	2	1	Handle
680	2406	3	1	3	2	2	3	2	1	Handle
865	2013	3	2	1	3	1	1	1	1	Package
856	1999	3	2	1	3	1	1	1	1	Package
856	1999	3	2	1	3	1	1	1	1	Package
783	1986	3	2	1	3	1	1	1	1	Package
865	2087	3	2	1	2	1	1	1	2	Bat
781	2174	3	2	1	2	1	1	1	2	Bat
781	2174	3	2	1	2	1	1	1	2	Bat
677	2013	3	2	1	2	1	1	1	2	Bat
690	2136	3	2	1	3	2	1	1	2	Bag
589	1950	3	2	1	3	2	1	1	2	Bag
822	1940	3	2	1	3	2	1	-	1	Flagpole
781	1999	3	2	1	3	2	1	-	1	Flagpole
781	1999	3	2	1	3	2	1	-	1	Flagpole
729	2044	3	2	1	3	2	1	-	1	Flagpole
817	2026	3	2	1	2	1	3	1	1	Catfood
756	2074	3	2	1	2	1	3	1	1	Catfood
756	2074	3	2	1	2	1	3	1	1	Catfood
671	2067	3	2	1	2	1	3	1	1	Catfood
792	2038	3	2	2	1	1	1	1	2	Bath
781	2024	3	2	2	1	1	1	1	2	Bath
781	2024	3	2	2	1	1	1	1	2	Bath
712	1979	3	2	2	1	1	1	1	2	Bath
865	1993	3	2	2	1	1	1	1	2	Bathroom
781	2024	3	2	2	1	1	1	1	2	Bathroom
781	2024	3	2	2	1	1	1	1	2	Bathroom
678	1951	3	2	2	1	1	1	1	2	Bathroom
781	2124	3	2	2	2	1	1	1	2	Bass
781	2124	3	2	2	2	1	1	1	2	Bass

F1 (Hz)	F2 (Hz)	Vowel Variable	Generational Group	Foll-MOA	Foll-POA	Foll-Voicing	Pre-POA	Pre-MOA	Pre-Voicing	Token
865	1964	3	2	2	2	1	2	-	2	Last
781	1999	3	2	2	2	1	2	-	2	Last
781	1999	3	2	2	2	1	2	-	2	Last
704	1899	3	2	2	2	1	2	-	2	Last
817	1817	3	2	2	1	1	3	2	1	Half
781	2074	3	2	2	1	1	3	2	1	Half
781	2074	3	2	2	1	1	3	2	1	Half
674	2042	3	2	2	1	1	3	2	1	Half
841	2062	3	2	2	1	2	3	2	1	Have
806	2149	3	2	2	1	2	3	2	1	Have
806	2149	3	2	2	1	2	3	2	1	Have
699	2040	3	2	2	1	2	3	2	1	Have
876	2305	3	2	3	1	2	1	1	1	Pam
683	2286	3	2	3	1	2	1	1	1	Pam
683	2286	3	2	3	1	2	1	1	1	Pam
650	2127	3	2	3	1	2	1	1	1	Pam
734	2297	3	2	3	2	2	2	1	2	Dance
648	2162	3	2	3	2	2	2	1	2	Dance
648	2162	3	2	3	2	2	2	1	2	Dance
595	2042	3	2	3	2	2	2	1	2	Dance
677	2135	3	2	3	3	2	2	-	2	Rang
668	2061	3	2	3	3	2	2	-	2	Rang
668	2061	3	2	3	3	2	2	-	2	Rang
604	2043	3	2	3	3	2	2	-	2	Rang
726	2226	3	2	3	2	2	3	2	1	Handle
609	2137	3	2	3	2	2	3	2	1	Handle
609	2137	3	2	3	2	2	3	2	1	Handle
603	2164	3	2	3	2	2	3	2	1	Handle
700	2311	3	3	1	3	2	1	1	2	Bag
755	1837	3	3	1	3	2	1	1	2	Bag
783	2233	3	3	1	3	2	1	1	2	Bag
843	2173	3	3	1	3	2	1	1	2	Bag
815	2104	3	3	1	3	1	2	1	1	Stack
779	1788	3	3	1	3	1	2	1	1	Stack
879	1918	3	3	1	3	1	2	1	1	Stack
782	2086	3	3	1	3	1	2	1	1	Stack
907	2104	3	3	1	1	1	2	-	2	Lap
803	1813	3	3	1	1	1	2	-	2	Lap
904	1943	3	3	1	1	1	2	-	2	Lap
955	2027	3	3	1	1	1	2	-	2	Lap
815	2242	3	3	1	2	2	2	-	2	Glad
755	1837	3	3	1	2	2	2	-	2	Glad
904	1846	3	3	1	2	2	2	-	2	Glad
871	1935	3	3	1	2	2	2	-	2	Glad
746	2104	3	3	1	2	1	3	1	1	Catfood
683	1596	3	3	1	2	1	3	1	1	Catfood
832	1675	3	3	1	2	1	3	1	1	Catfood
823	2113	3	3	1	2	1	3	1	1	Catfood
815	2035	3	3	2	1	1	1	1	2	Bathroom
755	1861	3	3	2	1	1	1	1	2	Bathroom
904	1821	3	3	2	1	1	1	1	2	Bathroom
840	2296	3	3	2	1	1	1	1	2	Bathroom
723	2035	3	3	2	2	2	2	-	2	Jazz

F1 (Hz)	F2 (Hz)	Vowel Variable	Generational Group	Foll-MOA	Foll-POA	Foll-Voicing	Pre-POA	Pre-MOA	Pre-Voicing	Token
731	1908	3	3	2	2	2	2	-	2	Jazz
879	1725	3	3	2	2	2	2	-	2	Jazz
802	2229	3	3	2	2	2	2	-	2	Jazz
884	1920	3	3	2	2	1	2	-	2	Last
779	1837	3	3	2	2	1	2	-	2	Last
855	1798	3	3	2	2	1	2	-	2	Last
836	1924	3	3	2	2	1	2	-	2	Last
746	2127	3	3	2	1	1	3	2	1	Half
779	1932	3	3	2	1	1	3	2	1	Half
904	1822	3	3	2	1	1	3	2	1	Half
890	2109	3	3	2	1	1	3	2	1	Half
838	2127	3	3	2	1	2	3	2	1	Have
803	1693	3	3	2	1	2	3	2	1	Have
879	1702	3	3	2	1	2	3	2	1	Have
853	2019	3	3	2	1	2	3	2	1	Have
743	2127	3	3	3	2	2	1	1	1	Span
790	1884	3	3	3	2	2	1	1	1	Span
769	1965	3	3	3	2	2	1	1	1	Span
809	2106	3	3	3	2	2	1	1	1	Span
681	2072	3	3	3	3	2	1	1	2	Bang
736	2028	3	3	3	3	2	1	1	2	Bang
875	2363	3	3	3	3	2	1	1	2	Bang
753	2217	3	3	3	3	2	1	1	2	Bang
770	2058	3	3	3	1	2	1	2	1	Family
763	1949	3	3	3	1	2	1	2	1	Family
964	1874	3	3	3	1	2	1	2	1	Family
809	2152	3	3	3	1	2	1	2	1	Family
853	2131	3	3	3	2	2	3	2	1	Handle
777	1835	3	3	3	2	2	3	2	1	Handle
876	2070	3	3	3	2	2	3	2	1	Handle
792	2389	3	3	3	2	2	3	2	1	Handle
779	1111	5	1	1	1	1	1	1	1	Pop
812	1189	5	1	1	1	1	1	1	1	Pop
749	1108	5	1	1	1	1	1	1	1	Pop
878	1241	5	1	1	1	1	1	1	1	Pop
735	1133	5	1	1	3	2	1	2	1	Fog
765	1166	5	1	1	3	2	1	2	1	Fog
816	1335	5	1	1	3	2	1	2	1	Fog
831	1241	5	1	1	3	2	1	2	1	Fog
824	1186	5	1	1	3	1	2	-	2	Lock
835	1095	5	1	1	3	1	2	-	2	Lock
815	1275	5	1	1	3	1	2	-	2	Lock
878	1265	5	1	1	3	1	2	-	2	Lock
848	1435	5	1	1	2	2	3	1	1	Cod
835	1237	5	1	1	2	2	3	1	1	Cod
749	1108	5	1	1	2	2	3	1	1	Cod
806	1337	5	1	1	2	2	3	1	1	Cod
775	1111	5	1	1	2	1	3	1	1	Cot
835	1142	5	1	1	2	1	3	1	1	Cot
815	1231	5	1	1	2	1	3	1	1	Cot
904	1299	5	1	1	2	1	3	1	1	Cot
768	1260	5	1	2	1	2	1	1	1	Palm
785	1197	5	1	2	1	2	1	1	1	Palm

F1 (Hz)	F2 (Hz)	Vowel Variable	Generational Group	Foll-MOA	Foll-POA	Foll-Voicing	Pre-POA	Pre-MOA	Pre-Voicing	Token
748	1116	5	1	2	1	2	1	1	1	Palm
838	1259	5	1	2	1	2	1	1	1	Palm
801	1244	5	1	2	1	2	1	1	2	Bothered
812	1189	5	1	2	1	2	1	1	2	Bothered
793	1231	5	1	2	1	2	1	1	2	Bothered
841	1337	5	1	2	1	2	1	1	2	Bothered
779	1041	5	1	2	1	1	1	3	2	Motheaten
812	1166	5	1	2	1	1	1	3	2	Motheaten
727	1085	5	1	2	1	1	1	3	2	Motheaten
807	1168	5	1	2	1	1	1	3	2	Motheaten
844	1388	5	1	2	2	2	2	1	2	Dawn
752	1261	5	1	2	2	2	2	1	2	Dawn
770	1251	5	1	2	2	2	2	1	2	Dawn
779	1255	5	1	2	2	2	2	1	2	Dawn
666	1101	5	1	2	2	2	2	1	-	Lawn
831	1241	5	1	2	1	1	2	2	1	Soft
646	1088	5	1	2	1	2	2	3	2	Novel
789	1237	5	1	2	1	2	2	3	2	Novel
793	1332	5	1	2	1	2	2	3	2	Novel
758	1265	5	1	2	1	2	2	3	2	Novel
763	1165	5	1	2	2	2	2	-	2	Lawn
802	1232	5	1	2	2	2	2	-	2	Lawn
790	1231	5	1	2	2	2	2	-	2	Lawn
736	1154	5	1	2	3	2	2	-	2	Wrong
794	1154	5	1	2	3	2	2	-	2	Wrong
785	1158	5	1	2	3	2	2	-	2	Wrong
801	1194	5	1	2	3	2	2	-	2	Wrong
757	1111	5	1	2	2	2	3	1	1	Caused
765	1213	5	1	2	2	2	3	1	1	Caused
749	1264	5	1	2	2	2	3	1	1	Caused
831	1241	5	1	2	2	2	3	1	1	Caused
735	1088	5	1	2	2	1	3	-	2	Wasps
906	1237	5	1	2	2	1	3	-	2	Wasps
749	1153	5	1	2	2	1	3	-	2	Wasps
651	1013	5	2	1	3	2	1	2	1	Foghorn
880	1179	5	2	1	3	2	1	2	1	Foghorn
880	1179	5	2	1	3	2	1	2	1	Foghorn
794	1029	5	2	1	3	2	1	2	1	Foghorn
694	1134	5	2	1	2	1	2	1	1	Taught
905	1229	5	2	1	2	1	2	1	1	Taught
905	1229	5	2	1	2	1	2	1	1	Taught
816	1169	5	2	1	2	1	2	1	1	Taught
617	1040	5	2	1	3	1	2	1	1	Stocking
632	955	5	2	1	3	1	2	1	1	Stocking
632	955	5	2	1	3	1	2	1	1	Stocking
636	1069	5	2	1	3	1	2	1	1	Stocking
622	1023	5	2	1	1	2	2	-	2	Lobster
856	1254	5	2	1	1	2	2	-	2	Lobster
856	1254	5	2	1	1	2	2	-	2	Lobster
662	1052	5	2	1	1	2	2	-	2	Lobster
609	958	5	2	1	2	2	2	-	2	Trod
781	1502	5	2	1	2	2	2	-	2	Trod
781	1502	5	2	1	2	2	2	-	2	Trod

F1 (Hz)	F2 (Hz)	Vowel Variable	Generational Group	Foll-MOA	Foll-POA	Foll-Voicing	Pre-POA	Pre-MOA	Pre-Voicing	Token
839	1213	5	2	1	2	2	2	-	2	Trod
693	1070	5	2	2	1	2	1	1	1	Palm
896	1320	5	2	2	1	2	1	1	1	Palm
896	1320	5	2	2	1	2	1	1	1	Palm
725	1092	5	2	2	1	2	1	1	1	Palm
811	1615	5	2	2	1	2	1	1	2	Bomb
966	1561	5	2	2	1	2	1	1	2	Bomb
966	1561	5	2	2	1	2	1	1	2	Bomb
823	1613	5	2	2	1	2	1	1	2	Bomb
549	981	5	2	2	1	2	1	1	2	Bothered
831	1304	5	2	2	1	2	1	1	2	Bothered
831	1304	5	2	2	1	2	1	1	2	Bothered
574	1012	5	2	2	1	2	1	1	2	Bothered
742	1109	5	2	2	1	1	1	3	2	Motheaten
806	1502	5	2	2	1	1	1	3	2	Motheaten
806	1502	5	2	2	1	1	1	3	2	Motheaten
638	1099	5	2	2	1	1	1	3	2	Motheaten
644	1139	5	2	2	2	2	2	1	2	Don
762	1630	5	2	2	2	2	2	1	2	Don
762	1630	5	2	2	2	2	2	1	2	Don
604	1176	5	2	2	2	2	2	1	2	Don
723	927	5	2	2	1	1	2	2	1	Soft
731	1030	5	2	2	1	1	2	2	1	Soft
731	1030	5	2	2	1	1	2	2	1	Soft
740	952	5	2	2	1	1	2	2	1	Soft
625	931	5	2	2	2	2	2	-	2	Laws
806	1030	5	2	2	2	2	2	-	2	Laws
806	1030	5	2	2	2	2	2	-	2	Laws
846	1108	5	2	2	2	2	2	-	2	Laws
751	1031	5	2	2	3	2	2	-	2	Wrong
838	1183	5	2	2	3	2	2	-	2	Wrong
838	1183	5	2	2	3	2	2	-	2	Wrong
743	1063	5	2	2	3	2	2	-	2	Wrong
587	978	5	2	2	2	1	3	-	2	Wasps
856	1327	5	2	2	2	1	3	-	2	Wasps
856	1327	5	2	2	2	1	3	-	2	Wasps
688	1054	5	2	2	2	1	3	-	2	Wasps
954	1460	5	3	1	1	1	1	1	1	Pop
828	1332	5	3	1	1	1	1	1	1	Pop
879	1363	5	3	1	1	1	1	1	1	Pop
849	1172	5	3	1	1	1	1	1	1	Pop
907	1368	5	3	1	3	2	1	2	1	Fog
803	1307	5	3	1	3	2	1	2	1	Fog
977	1314	5	3	1	3	2	1	2	1	Fog
849	1310	5	3	1	3	2	1	2	1	Fog
954	1529	5	3	1	3	1	2	-	2	Lock
828	1260	5	3	1	3	1	2	-	2	Lock
904	1243	5	3	1	3	1	2	-	2	Lock
987	1361	5	3	1	3	1	2	-	2	Lock
930	1414	5	3	1	2	2	3	1	1	Cod
779	1380	5	3	1	2	2	3	1	1	Cod
879	1532	5	3	1	2	2	3	1	1	Cod
920	1438	5	3	1	2	2	3	1	1	Cod

F1 (Hz)	F2 (Hz)	Vowel Variable	Generational Group	Foll-MOA	Foll-POA	Foll-Voicing	Pre-POA	Pre-MOA	Pre-Voicing	Token
907	1483	5	3	1	2	1	3	1	1	Cot
858	1452	5	3	1	2	1	3	1	1	Cot
904	1314	5	3	1	2	1	3	1	1	Cot
855	1320	5	3	1	2	1	3	1	1	Cot
1,155	1530	5	3	2	1	2	1	1	1	Palm
718	1172	5	3	2	1	2	1	1	1	Palm
897	1105	5	3	2	1	2	1	1	1	Palm
736	1191	5	3	2	1	2	1	1	1	Palm
954	1436	5	3	2	1	2	1	1	2	Bothered
707	1283	5	3	2	1	2	1	1	2	Bothered
879	1267	5	3	2	1	2	1	1	2	Bothered
951	1341	5	3	2	1	2	1	1	2	Bothered
930	1414	5	3	2	1	1	1	3	2	Motheaten
803	1380	5	3	2	1	1	1	3	2	Motheaten
952	1412	5	3	2	1	1	1	3	2	Motheaten
850	1294	5	3	2	1	1	1	3	2	Motheaten
871	1585	5	3	2	2	2	2	1	2	Dawn
710	1275	5	3	2	2	2	2	1	2	Dawn
900	1312	5	3	2	2	2	2	1	2	Dawn
884	1458	5	3	2	2	2	2	1	2	Dawn
1,023	1483	5	3	2	1	2	2	3	2	Novel
779	1410	5	3	2	1	2	2	3	2	Novel
952	1556	5	3	2	1	2	2	3	2	Novel
911	1452	5	3	2	1	2	2	3	2	Novel
894	1433	5	3	2	2	2	2	-	2	Lawn
808	1182	5	3	2	2	2	2	-	2	Lawn
920	1292	5	3	2	2	2	2	-	2	Lawn
889	1311	5	3	2	2	2	2	-	2	Lawn
978	1405	5	3	2	3	2	2	-	2	Wrong
773	1078	5	3	2	3	2	2	-	2	Wrong
892	1119	5	3	2	3	2	2	-	2	Wrong
982	1196	5	3	2	3	2	2	-	2	Wrong
884	1391	5	3	2	2	2	3	1	1	Caused
779	1188	5	3	2	2	2	3	1	1	Caused
879	1243	5	3	2	2	2	3	1	1	Caused
891	1414	5	3	2	2	2	3	1	1	Caused
907	1551	5	3	2	2	1	3	-	2	Wasps
851	1307	5	3	2	2	1	3	-	2	Wasps
904	1267	5	3	2	2	1	3	-	2	Wasps
862	1327	5	3	2	2	1	3	-	2	Wasps
624	1088	6	1	1	3	2	2	1	1	Tugboat
765	1381	6	1	1	3	2	2	1	1	Tugboat
727	1072	6	1	1	3	2	2	1	1	Tugboat
710	1217	6	1	1	3	2	2	1	1	Tugboat
712	1155	6	1	1	1	1	2	2	1	Supper
812	1472	6	1	1	1	1	2	2	1	Supper
772	1040	6	1	1	1	1	2	2	1	Supper
734	1241	6	1	1	1	1	2	2	1	Supper
644	1291	6	1	1	2	1	2	3	2	Nut
765	1331	6	1	1	2	1	2	3	2	Nut
771	1377	6	1	1	2	1	2	3	2	Nut
734	1168	6	1	1	2	1	2	3	2	Nut
687	1388	6	1	1	1	2	2	-	2	Rub

F1 (Hz)	F2 (Hz)	Vowel Variable	Generational Group	Foll-MOA	Foll-POA	Foll-Voicing	Pre-POA	Pre-MOA	Pre-Voicing	Token
741	1331	6	1	1	1	2	2	-	2	Rub
682	1197	6	1	1	1	2	2	-	2	Rub
710	1144	6	1	1	1	2	2	-	2	Rub
689	1186	6	1	1	3	1	2	-	2	Luck
765	1213	6	1	1	3	1	2	-	2	Luck
793	1166	6	1	1	3	1	2	-	2	Luck
758	1168	6	1	1	3	1	2	-	2	Luck
666	1073	6	1	2	2	2	1	3	2	Muzzle
741	1189	6	1	2	2	2	1	3	2	Muzzle
705	946	6	1	2	2	2	1	3	2	Muzzle
685	1120	6	1	2	2	2	1	3	2	Muzzle
646	1045	6	1	2	1	1	2	3	2	Nothing
765	1402	6	1	2	1	1	2	3	2	Nothing
771	1166	6	1	2	1	1	2	3	2	Nothing
807	1313	6	1	2	1	1	2	3	2	Nothing
673	994	6	1	2	1	2	2	-	2	Love
741	1260	6	1	2	1	2	2	-	2	Love
704	1175	6	1	2	1	2	2	-	2	Love
734	1241	6	1	2	1	2	2	-	2	Love
732	1000	6	1	2	2	1	2	-	2	Lush
765	1189	6	1	2	2	1	2	-	2	Lush
772	1242	6	1	2	2	1	2	-	2	Lush
758	1144	6	1	2	2	1	2	-	2	Lush
712	1155	6	1	2	1	1	3	1	1	Cuff
812	1260	6	1	2	1	1	3	1	1	Cuff
702	1450	6	1	2	1	1	3	1	1	Cuff
710	1120	6	1	2	1	1	3	1	1	Cuff
673	1130	6	1	3	1	2	2	2	1	Something
749	1423	6	1	3	1	2	2	2	1	Something
722	1397	6	1	3	1	2	2	2	1	Something
739	1386	6	1	3	1	2	2	2	1	Something
701	1235	6	1	3	2	2	2	-	2	Run
744	1195	6	1	3	2	2	2	-	2	Run
793	1337	6	1	3	2	2	2	-	2	Run
769	1263	6	1	3	2	2	2	-	2	Run
718	1598	6	2	1	2	1	1	1	2	Buttered
706	1055	6	2	1	2	1	1	1	2	Buttered
706	1055	6	2	1	2	1	1	1	2	Buttered
726	1573	6	2	1	2	1	1	1	2	Buttered
768	1609	6	2	1	3	2	2	1	1	Tugboat
831	1154	6	2	1	3	2	2	1	1	Tugboat
831	1154	6	2	1	3	2	2	1	1	Tugboat
766	1714	6	2	1	3	2	2	1	1	Tugboat
865	1629	6	2	1	1	1	2	2	1	Supper
806	1154	6	2	1	1	1	2	2	1	Supper
806	1154	6	2	1	1	1	2	2	1	Supper
889	1835	6	2	1	1	1	2	2	1	Supper
694	1403	6	2	1	3	2	2	3	2	Snuggle
831	1626	6	2	1	3	2	2	3	2	Snuggle
831	1626	6	2	1	3	2	2	3	2	Snuggle
663	1442	6	2	1	3	2	2	3	2	Snuggle
806	1228	6	2	1	2	2	-	-	-	Udder
806	1228	6	2	1	2	2	-	-	-	Udder

F1 (Hz)	F2 (Hz)	Vowel Variable	Generational Group	Foll-MOA	Foll-POA	Foll-Voicing	Pre-POA	Pre-MOA	Pre-Voicing	Token
773	1251	6	2	1	2	2	-	-	-	Udder
646	1672	6	2	2	2	2	1	2	1	Fuzzy
856	1129	6	2	2	2	2	1	2	1	Fuzzy
856	1129	6	2	2	2	2	1	2	1	Fuzzy
677	1712	6	2	2	2	2	1	2	1	Fuzzy
841	1638	6	2	2	1	1	2	3	2	Nothing
731	1477	6	2	2	1	1	2	3	2	Nothing
731	1477	6	2	2	1	1	2	3	2	Nothing
707	1344	6	2	2	1	1	2	3	2	Nothing
792	1256	6	2	2	1	2	2	-	2	Love
781	1129	6	2	2	1	2	2	-	2	Love
781	1129	6	2	2	1	2	2	-	2	Love
800	1287	6	2	2	1	2	2	-	2	Love
646	1694	6	2	2	2	1	2	-	2	Just
831	1327	6	2	2	2	1	2	-	2	Just
831	1327	6	2	2	2	1	2	-	2	Just
694	1573	6	2	2	1	2	3	1	2	Government
657	1055	6	2	2	1	2	3	1	2	Government
657	1055	6	2	2	1	2	3	1	2	Government
701	1574	6	2	2	1	2	3	1	2	Government
792	1109	6	2	2	1	2	-	-	-	Otherwise
790	1052	6	2	2	1	2	-	-	-	Otherwise
823	1263	6	2	3	2	2	1	3	2	Monthly
697	1155	6	2	3	2	2	1	3	2	Monthly
697	1155	6	2	3	2	2	1	3	2	Monthly
846	1299	6	2	3	2	2	1	3	2	Monthly
785	1201	6	2	3	1	2	2	2	1	Something
725	1487	6	2	3	1	2	2	2	1	Something
725	1487	6	2	3	1	2	2	2	1	Something
749	1181	6	2	3	1	2	2	2	1	Something
793	1368	6	3	1	3	2	2	1	1	Tugboat
731	1404	6	3	1	3	2	2	1	1	Tugboat
835	1372	6	3	1	3	2	2	1	1	Tugboat
686	1195	6	3	1	3	2	2	1	1	Tugboat
793	1368	6	3	1	1	1	2	2	1	Supper
779	1404	6	3	1	1	1	2	2	1	Supper
808	1339	6	3	1	1	1	2	2	1	Supper
807	1299	6	3	1	1	1	2	2	1	Supper
861	1275	6	3	1	2	1	2	3	2	Nut
755	1332	6	3	1	2	1	2	3	2	Nut
879	1290	6	3	1	2	1	2	3	2	Nut
768	1155	6	3	1	2	1	2	3	2	Nut
677	1138	6	3	1	1	2	2	-	2	Rub
707	1236	6	3	1	1	2	2	-	2	Rub
759	1267	6	3	1	1	2	2	-	2	Rub
913	1193	6	3	1	1	2	2	-	2	Rub
838	1252	6	3	1	3	1	2	-	2	Luck
731	1236	6	3	1	3	1	2	-	2	Luck
808	1267	6	3	1	3	1	2	-	2	Luck
797	1063	6	3	1	3	1	2	-	2	Luck
861	1276	6	3	2	2	2	1	3	2	Muzzle
659	1139	6	3	2	2	2	1	3	2	Muzzle
711	1097	6	3	2	2	2	1	3	2	Muzzle

F1 (Hz)	F2 (Hz)	Vowel Variable	Generational Group	Foll-MOA	Foll-POA	Foll-Voicing	Pre-POA	Pre-MOA	Pre-Voicing	Token
781	1323	6	3	2	2	2	1	3	2	Muzzle
793	1322	6	3	2	1	1	2	3	2	Nothing
779	1332	6	3	2	1	1	2	3	2	Nothing
855	1436	6	3	2	1	1	2	3	2	Nothing
729	1217	6	3	2	1	1	2	3	2	Nothing
838	1275	6	3	2	1	2	2	-	2	Love
707	1260	6	3	2	1	2	2	-	2	Love
735	1121	6	3	2	1	2	2	-	2	Love
776	1145	6	3	2	1	2	2	-	2	Love
793	1184	6	3	2	2	1	2	-	2	Lush
659	1091	6	3	2	2	1	2	-	2	Lush
832	1243	6	3	2	2	1	2	-	2	Lush
856	1162	6	3	2	2	1	2	-	2	Lush
770	1207	6	3	2	1	1	3	1	1	Cuff
755	1283	6	3	2	1	1	3	1	1	Cuff
735	1479	6	3	2	1	1	3	1	1	Cuff
708	1056	6	3	2	1	1	3	1	1	Cuff
779	1389	6	3	3	1	2	2	2	1	Something
624	1140	6	3	3	1	2	2	2	1	Something
834	1472	6	3	3	1	2	2	2	1	Something
823	1462	6	3	3	1	2	2	2	1	Something
825	1166	6	3	3	2	2	2	-	2	Run
639	1199	6	3	3	2	2	2	-	2	Run
871	1262	6	3	3	2	2	2	-	2	Run
679	1171	6	3	3	2	2	2	-	2	Run
597	1401	7	1	1	2	1	1	1	1	Put
505	1207	7	1	1	2	1	1	1	1	Put
531	948	7	1	1	2	1	1	1	1	Put
518	934	7	1	1	2	1	1	1	1	Put
542	1245	7	1	1	2	2	2	1	1	Stood
460	1213	7	1	1	2	2	2	1	1	Stood
563	1234	7	1	1	2	2	2	1	1	Stood
504	1143	7	1	1	2	2	2	1	1	Stood
580	1120	7	1	1	3	1	2	1	1	Took
502	1167	7	1	1	3	1	2	1	1	Took
561	1076	7	1	1	3	1	2	1	1	Took
523	1087	7	1	1	3	1	2	1	1	Took
636	1212	7	1	1	3	1	2	-	2	Look
582	1178	7	1	1	3	1	2	-	2	Look
531	924	7	1	1	3	1	2	-	2	Look
602	1144	7	1	1	3	1	2	-	2	Look
504	1254	7	1	1	2	2	3	1	2	Good
504	1041	7	1	1	2	2	3	1	2	Good
503	1116	7	1	1	2	2	3	1	2	Good
506	1110	7	1	1	2	2	3	1	2	Good
525	1217	7	2	1	3	1	2	-	2	Look
427	1106	7	2	1	3	1	2	-	2	Look
427	1106	7	2	1	3	1	2	-	2	Look
494	1229	7	2	1	3	1	2	-	2	Look
458	1271	7	2	1	2	2	3	1	1	Couldn't
461	1077	7	2	1	2	2	3	1	1	Couldn't
461	1077	7	2	1	2	2	3	1	1	Couldn't
500	1436	7	2	1	2	2	3	1	1	Couldn't

F1 (Hz)	F2 (Hz)	Vowel Variable	Generational Group	Foll-MOA	Foll-POA	Foll-Voicing	Pre-POA	Pre-MOA	Pre-Voicing	Token
551	1152	7	2	2	1	1	2	-	2	Roof
452	1056	7	2	2	1	1	2	-	2	Roof
452	1056	7	2	2	1	1	2	-	2	Roof
482	1324	7	2	2	1	1	2	-	2	Roof
435	971	7	2	2	1	1	3	1	1	Hoof
453	971	7	2	2	1	1	3	2	1	Hoof
453	971	7	2	2	1	1	3	2	1	Hoof
492	1158	7	2	2	1	1	3	2	1	Hoof
458	909	7	3	1	2	1	1	1	1	Put
566	1409	7	3	1	2	1	1	1	1	Put
506	1099	7	3	1	2	1	1	1	1	Put
474	1092	7	3	1	2	1	1	1	1	Put
414	991	7	3	1	2	2	2	1	1	Stood
606	1276	7	3	1	2	2	2	1	1	Stood
512	1217	7	3	1	2	2	2	1	1	Stood
460	1153	7	3	1	2	2	2	1	1	Stood
444	1131	7	3	1	3	1	2	1	1	Took
597	1373	7	3	1	3	1	2	1	1	Took
450	1167	7	3	1	3	1	2	1	1	Took
498	1107	7	3	1	3	1	2	1	1	Took
425	982	7	3	1	3	1	2	-	2	Look
574	1492	7	3	1	3	1	2	-	2	Look
506	1073	7	3	1	3	1	2	-	2	Look
497	1151	7	3	1	3	1	2	-	2	Look
416	942	7	3	1	2	2	3	1	2	Good
589	1320	7	3	1	2	2	3	1	2	Good
430	1017	7	3	1	2	2	3	1	2	Good
421	1057	7	3	1	2	2	3	1	2	Good
558	1000	62	1	1	1	2	2	-	2	Robe
576	1095	62	1	1	1	2	2	-	2	Robe
639	1156	62	1	1	1	2	2	-	2	Robe
589	975	62	1	1	1	2	2	-	2	Robe
470	979	62	1	1	2	2	2	-	2	Roads
600	1142	62	1	1	2	2	2	-	2	Roads
596	1166	62	1	1	2	2	2	-	2	Roads
517	1024	62	1	1	2	2	2	-	2	Roads
519	1062	62	1	1	2	1	2	-	2	Wrote
600	1118	62	1	1	2	1	2	-	2	Wrote
614	1332	62	1	1	2	1	2	-	2	Wrote
571	1160	62	1	1	2	1	2	-	2	Wrote
598	1277	62	1	1	1	1	3	2	1	Hope
646	1283	62	1	1	1	1	3	2	1	Hope
592	1143	62	1	1	1	1	3	2	1	Hope
734	1168	62	1	1	1	1	3	2	1	Hope
558	1000	62	1	2	2	1	1	1	1	Posts
576	1071	62	1	2	2	1	1	1	1	Posts
639	1166	62	1	2	2	1	1	1	1	Posts
661	1120	62	1	2	2	1	1	1	1	Posts
602	1000	62	1	2	2	2	2	-	2	Rose
529	1095	62	1	2	2	2	2	-	2	Rose
682	1130	62	1	2	2	2	2	-	2	Rose
589	1024	62	1	2	2	2	2	-	2	Rose
620	1344	62	1	2	2	1	3	1	1	Coastal

F1 (Hz)	F2 (Hz)	Vowel Variable	Generational Group	Foll-MOA	Foll-POA	Foll-Voicing	Pre-POA	Pre-MOA	Pre-Voicing	Token
662	1190	62	1	2	2	1	3	1	1	Coastal
547	1219	62	1	2	2	1	3	1	1	Coastal
589	975	62	1	2	2	1	3	1	1	Coastal
610	1030	62	1	3	2	2	1	1	1	Pony
619	1048	62	1	3	2	2	1	1	1	Pony
702	995	62	1	3	2	2	1	1	1	Pony
642	944	62	1	3	2	2	1	1	1	Pony
557	1071	62	1	3	2	2	1	3	2	Moan
567	942	62	1	3	2	2	1	3	2	Moan
653	1162	62	1	3	2	2	1	3	2	Moan
612	1094	62	1	3	2	2	1	3	2	Moan
661	1065	62	1	3	2	2	2	1	1	Tone
644	1071	62	1	3	2	2	2	1	1	Tone
674	1076	62	1	3	2	2	2	1	1	Tone
654	920	62	1	3	2	2	2	1	1	Tone
638	1010	62	1	3	1	2	2	-	2	Chrome
641	1049	62	1	3	1	2	2	-	2	Chrome
619	972	62	1	3	1	2	2	-	2	Chrome
683	1015	62	1	3	1	2	2	-	2	Chrome
597	1598	62	2	1	-	1	2	2	2	Though
706	1080	62	2	1	-	1	2	2	2	Though
706	1080	62	2	1	-	1	2	2	2	Though
607	1539	62	2	1	-	1	2	2	2	Though
646	1524	62	2	1	2	1	2	-	2	Wrote
781	1080	62	2	1	2	1	2	-	2	Wrote
781	1080	62	2	1	2	1	2	-	2	Wrote
647	1206	62	2	1	2	1	2	-	2	Wrote
621	1037	62	2	2	2	1	1	1	1	Posts
681	1105	62	2	2	2	1	1	1	1	Posts
681	1105	62	2	2	2	1	1	1	1	Posts
677	1203	62	2	2	2	1	1	1	1	Posts
572	1207	62	2	2	2	1	1	3	2	Mostly
632	1005	62	2	2	2	1	1	3	2	Mostly
632	1005	62	2	2	2	1	1	3	2	Mostly
656	1368	62	2	2	2	1	1	3	2	Mostly
523	1329	62	2	2	2	1	2	-	2	Groceries
582	1154	62	2	2	2	1	2	-	2	Groceries
582	1154	62	2	2	2	1	2	-	2	Groceries
637	1449	62	2	2	2	1	2	-	2	Groceries
646	1598	62	2	2	2	1	3	1	1	Coastal
632	1055	62	2	2	2	1	3	1	1	Coastal
632	1055	62	2	2	2	1	3	1	1	Coastal
602	1154	62	2	2	2	1	3	1	1	Coastal
603	847	62	2	3	1	2	1	1	1	Poem
680	1083	62	2	3	1	2	1	1	1	Poem
680	1083	62	2	3	1	2	1	1	1	Poem
673	1170	62	2	3	1	2	1	1	1	Poem
731	1129	62	2	3	2	2	2	-	2	Onloading
731	1129	62	2	3	2	2	2	-	2	Onloading
488	962	62	2	3	2	2	2	-	2	Throne
583	1206	62	2	3	2	2	2	-	2	Throne
583	1206	62	2	3	2	2	2	-	2	Throne
637	1287	62	2	3	2	2	2	-	2	Throne

F1 (Hz)	F2 (Hz)	Vowel Variable	Generational Group	Foll-MOA	Foll-POA	Foll-Voicing	Pre-POA	Pre-MOA	Pre-Voicing	Token
706	1080	62	2	3	2	2	2	-	2	Unloading
706	1080	62	2	3	2	2	2	-	2	Unloading
654	1138	62	3	1	1	2	2	-	2	Robe
587	1292	62	3	1	1	2	2	-	2	Robe
662	1194	62	3	1	1	2	2	-	2	Robe
563	1048	62	3	1	1	2	2	-	2	Robe
723	1275	62	3	1	2	2	2	-	2	Roads
686	1226	62	3	1	2	2	2	-	2	Roads
542	1074	62	3	1	2	2	2	-	2	Roads
546	1057	62	3	1	2	2	2	-	2	Roads
609	1115	62	3	1	2	1	2	-	2	Wrote
659	1283	62	3	1	2	1	2	-	2	Wrote
414	977	62	3	1	2	1	2	-	2	Wrote
565	1063	62	3	1	2	1	2	-	2	Wrote
746	977	62	3	1	1	1	3	2	1	Hope
635	1044	62	3	1	1	1	3	2	1	Hope
517	952	62	3	1	1	1	3	2	1	Hope
575	994	62	3	1	1	1	3	2	1	Hope
654	1161	62	3	2	2	2	2	-	2	Rose
659	1283	62	3	2	2	2	2	-	2	Rose
566	1025	62	3	2	2	2	2	-	2	Rose
639	1126	62	3	2	2	2	2	-	2	Rose
700	1184	62	3	2	2	1	3	1	1	Coastal
683	1380	62	3	2	2	1	3	1	1	Coastal
639	1097	62	3	2	2	1	3	1	1	Coastal
540	1048	62	3	2	2	1	3	1	1	Coastal
692	1098	62	3	3	2	2	1	1	1	Pony
532	1199	62	3	3	2	2	1	1	1	Pony
647	1055	62	3	3	2	2	1	1	1	Pony
532	995	62	3	3	2	2	1	1	1	Pony
715	1200	62	3	3	2	2	1	3	2	Moan
409	1124	62	3	3	2	2	1	3	2	Moan
694	1027	62	3	3	2	2	1	3	2	Moan
683	930	62	3	3	2	2	1	3	2	Moan
681	1168	62	3	3	2	2	2	1	1	Tone
592	1272	62	3	3	2	2	2	1	1	Tone
636	1179	62	3	3	2	2	2	1	1	Tone
653	1076	62	3	3	2	2	2	1	1	Tone
622	1162	62	3	3	1	2	2	-	2	Chrome
644	1095	62	3	3	1	2	2	-	2	Chrome
745	1111	62	3	3	1	2	2	-	2	Chrome
434	900	62	3	3	1	2	2	-	2	Chrome
483	1480	72	1	1	2	1	1	1	2	Boot
411	1307	72	1	1	2	1	1	1	2	Boot
457	1556	72	1	1	2	1	1	1	2	Boot
565	1530	72	1	1	2	1	1	1	2	Boot
530	1753	72	1	1	2	2	1	2	1	Food
388	1001	72	1	1	2	2	1	2	1	Food
457	1534	72	1	1	2	2	1	2	1	Food
420	1192	72	1	1	2	2	1	2	1	Food
470	1531	72	1	1	1	1	2	-	2	Group
434	1213	72	1	1	1	1	2	-	2	Group
421	1472	72	1	1	1	1	2	-	2	Group

F1 (Hz)	F2 (Hz)	Vowel Variable	Generational Group	Foll-MOA	Foll-POA	Foll-Voicing	Pre-POA	Pre-MOA	Pre-Voicing	Token
324	855	72	1	1	1	1	2	-	2	Group
485	2184	72	1	1	1	2	2	-	2	Lube
434	1283	72	1	1	1	2	2	-	2	Lube
421	1187	72	1	1	1	2	2	-	2	Lube
396	1361	72	1	1	1	2	2	-	2	Lube
491	1796	72	1	1	2	2	2	-	2	Crude
411	1001	72	1	1	2	2	2	-	2	Crude
412	1398	72	1	1	2	2	2	-	2	Crude
444	1072	72	1	1	2	2	2	-	2	Crude
400	1297	72	1	1	2	2	2	-	2	Prude
434	1260	72	1	2	2	2	2	3	2	News
529	2340	72	1	2	2	1	2	3	2	Noose
396	1008	72	1	2	2	1	2	3	2	Noose
470	1509	72	1	2	1	1	2	-	2	Aloof
388	1118	72	1	2	1	1	2	-	2	Aloof
377	1099	72	1	2	1	1	2	-	2	Aloof
421	1192	72	1	2	1	1	2	-	2	Aloof
403	1022	72	1	2	1	2	2	-	2	Groove
411	1071	72	1	2	1	2	2	-	2	Groove
435	1330	72	1	2	1	2	2	-	2	Groove
396	927	72	1	2	1	2	2	-	2	Groove
404	823	72	1	2	2	2	2	-	2	Cruise
388	1071	72	1	2	2	2	2	-	2	Cruise
435	1398	72	1	2	2	2	2	-	2	Cruise
444	1144	72	1	2	2	2	2	-	2	Cruise
430	1480	72	1	2	2	1	3	1	2	Goose
434	1425	72	1	2	2	1	3	1	2	Goose
399	1297	72	1	2	2	1	3	1	2	Goose
421	1712	72	1	2	2	1	3	1	2	Goose
496	1440	72	1	3	2	2	1	3	2	Moon
406	1054	72	1	3	2	2	1	3	2	Moon
465	1444	72	1	3	2	2	1	3	2	Moon
475	1360	72	1	3	2	2	1	3	2	Moon
439	2186	72	1	3	2	2	2	3	2	Noon
397	1717	72	1	3	2	2	2	3	2	Noon
487	2148	72	1	3	2	2	2	3	2	Noon
529	1543	72	1	3	2	2	2	3	2	Noon
517	1914	72	1	3	1	2	2	-	2	Bloom
407	1247	72	1	3	1	2	2	-	2	Bloom
493	1620	72	1	3	1	2	2	-	2	Bloom
483	1266	72	1	3	1	2	2	-	2	Bloom
404	1479	72	1	3	2	2	2	-	2	June
433	1768	72	1	3	2	2	2	-	2	June
512	2158	72	1	3	2	2	2	-	2	June
592	1619	72	1	3	2	2	2	-	2	June
450	1374	72	2	1	1	1	2	1	1	Stupid
433	1974	72	2	1	1	1	2	1	1	Stupid
433	1974	72	2	1	1	1	2	1	1	Stupid
458	1857	72	2	1	1	1	2	1	1	Stupid
415	1573	72	2	1	2	2	2	1	1	Student
409	1925	72	2	1	2	2	2	1	1	Student
409	1925	72	2	1	2	2	2	1	1	Student
461	1760	72	2	1	2	2	2	1	1	Student

F1 (Hz)	F2 (Hz)	Vowel Variable	Generational Group	Foll-MOA	Foll-POA	Foll-Voicing	Pre-POA	Pre-MOA	Pre-Voicing	Token
426	1744	72	2	1	2	1	2	1	1	suitable
433	1775	72	2	1	2	1	2	1	1	suitable
433	1775	72	2	1	2	1	2	1	1	suitable
499	1427	72	2	1	2	2	2	1	1	Tutor
457	1825	72	2	1	2	2	2	1	1	Tutor
457	1825	72	2	1	2	2	2	1	1	Tutor
473	1679	72	2	1	2	2	2	1	1	Tutor
450	1577	72	2	1	-	3	2	2	1	Shoe
442	2004	72	2	1	-	3	2	2	1	Shoe
450	1881	72	2	1	2	1	2	-	2	Loot
482	1601	72	2	1	2	1	2	-	2	Loot
482	1601	72	2	1	2	1	2	-	2	Loot
456	1648	72	2	1	2	1	2	-	2	Loot
450	1476	72	2	2	1	1	2	1	1	Toothbrush
433	1850	72	2	2	1	1	2	1	1	Toothbrush
433	1850	72	2	2	1	1	2	1	1	Toothbrush
476	1562	72	2	2	1	1	2	1	1	Toothbrush
450	1476	72	2	2	1	2	2	2	1	Soothe
432	1751	72	2	2	1	2	2	2	1	Soothe
432	1751	72	2	2	1	2	2	2	1	Soothe
466	1653	72	2	2	1	2	2	2	1	Soothe
450	1329	72	2	2	1	2	2	2	1	Soothing
457	1751	72	2	2	1	2	2	2	1	Soothing
457	1751	72	2	2	1	2	2	2	1	Soothing
459	1789	72	2	2	1	2	2	2	1	Soothing
433	1601	72	2	2	1	1	2	3	2	Newfoundland
433	1601	72	2	2	1	1	2	3	2	Newfoundland
437	1784	72	2	2	1	1	2	3	2	Newfoundland
401	1232	72	2	2	1	1	2	-	2	Truthful
384	1427	72	2	2	1	1	2	-	2	Truthful
384	1427	72	2	2	1	1	2	-	2	Truthful
414	1273	72	2	2	1	1	2	-	2	Truthful
463	1113	72	2	3	2	2	1	3	2	Moon
451	1059	72	2	3	2	2	1	3	2	Moon
451	1059	72	2	3	2	2	1	3	2	Moon
493	1247	72	2	3	2	2	1	3	2	Moon
434	1717	72	2	3	2	2	2	1	1	Tuned
427	1857	72	2	3	2	2	2	1	1	Tuned
427	1857	72	2	3	2	2	2	1	1	Tuned
483	1743	72	2	3	2	2	2	1	1	Tuned
417	1512	72	2	3	2	2	2	1	2	Dunebuggy
391	1885	72	2	3	2	2	2	1	2	Dunebuggy
391	1885	72	2	3	2	2	2	1	2	Dunebuggy
469	1926	72	2	3	2	2	2	1	2	Dunebuggy
487	1294	72	2	3	1	2	2	-	2	Broom
438	1084	72	2	3	1	2	2	-	2	Broom
438	1084	72	2	3	1	2	2	-	2	Broom
459	1223	72	2	3	1	2	2	-	2	Broom
447	1000	72	3	1	2	1	1	1	2	Boot
490	1404	72	3	1	2	1	1	1	2	Boot
396	1314	72	3	1	2	1	1	1	2	Boot
386	1067	72	3	1	2	1	1	1	2	Boot
378	838	72	3	1	2	2	1	2	1	Food

F1 (Hz)	F2 (Hz)	Vowel Variable	Generational Group	Foll-MOA	Foll-POA	Foll-Voicing	Pre-POA	Pre-MOA	Pre-Voicing	Token
539	1332	72	3	1	2	2	1	2	1	Food
348	1025	72	3	1	2	2	1	2	1	Food
364	940	72	3	1	2	2	1	2	1	Food
401	1000	72	3	1	1	1	2	-	2	Group
442	1307	72	3	1	1	1	2	-	2	Group
373	1074	72	3	1	1	1	2	-	2	Group
407	1251	72	3	1	1	1	2	-	2	Group
378	977	72	3	1	1	2	2	-	2	Lube
490	1548	72	3	1	1	2	2	-	2	Lube
397	1113	72	3	1	1	2	2	-	2	Lube
361	1010	72	3	1	1	2	2	-	2	Lube
447	1252	72	3	1	2	2	2	-	2	Crude
490	1307	72	3	1	2	2	2	-	2	Crude
396	1097	72	3	1	2	2	2	-	2	Crude
398	1013	72	3	1	2	2	2	-	2	Crude
401	1115	72	3	2	2	1	2	3	2	Noose
563	1356	72	3	2	2	1	2	3	2	Noose
445	1523	72	3	2	2	1	2	3	2	Noose
354	963	72	3	2	2	1	2	3	2	Noose
401	907	72	3	2	1	1	2	-	2	Aloof
466	1428	72	3	2	1	1	2	-	2	Aloof
373	1121	72	3	2	1	1	2	-	2	Aloof
457	1250	72	3	2	1	1	2	-	2	Aloof
377	930	72	3	2	1	2	2	-	2	Groove
490	1164	72	3	2	1	2	2	-	2	Groove
373	1049	72	3	2	1	2	2	-	2	Groove
377	995	72	3	2	1	2	2	-	2	Groove
401	1229	72	3	2	2	2	2	-	2	Cruise
466	1356	72	3	2	2	2	2	-	2	Cruise
445	1267	72	3	2	2	2	2	-	2	Cruise
395	1064	72	3	2	2	2	2	-	2	Cruise
377	907	72	3	2	2	1	3	1	2	Goose
466	1524	72	3	2	2	1	3	1	2	Goose
397	1508	72	3	2	2	1	3	1	2	Goose
369	1054	72	3	2	2	1	3	1	2	Goose
420	848	72	3	3	2	2	1	3	2	Moon
344	962	72	3	3	2	2	1	3	2	Moon
421	935	72	3	3	2	2	1	3	2	Moon
415	934	72	3	3	2	2	1	3	2	Moon
526	1117	72	3	3	2	2	2	3	2	Noon
449	1301	72	3	3	2	2	2	3	2	Noon
423	1577	72	3	3	2	2	2	3	2	Noon
384	1072	72	3	3	2	2	2	3	2	Noon
432	1059	72	3	3	1	2	2	-	2	Bloom
458	1333	72	3	3	1	2	2	-	2	Bloom
398	1109	72	3	3	1	2	2	-	2	Bloom
438	1215	72	3	3	1	2	2	-	2	Bloom
386	1283	72	3	3	2	2	2	-	2	June
388	1282	72	3	3	2	2	2	-	2	June
513	1737	72	3	3	2	2	2	-	2	June
324	955	72	3	3	2	2	2	-	2	June

Appendix G
Overall Significance of F1 and F2 by Vowel Variable

Vowel Variable	Independent Variable	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Significance (p)
/ɑ/	Generational Group	F1	392737.726	2	196368.863	28.688	.000
		F2	777866.126	2	388933.063	18.755	.000
	foll-MOA	F1	2498.94	1	2498.94	0.365	(.547)
		F2	3520.948	1	3520.948	0.17	(.681)
	foll-POA	F1	1794.919	2	897.46	0.131	(.877)
		F2	183188.374	2	91594.187	4.417	.014
	foll-Voicing	F1	0	0	.	.	(.917)
		F2	0	0	.	.	(.116)
	pre-MOA	F1	1453.84	2	726.92	0.074	(.929)
		F2	215829.261	2	107914.63	4.19	.018
	pre-POA	F1	7543.785	2	3771.892	0.529	(.590)
		F2	48989.375	2	24494.688	1.389	(.253)
	pre-Voicing	F1	0	0	.	.	(.813)
		F2	0	0	.	.	(.095)
/æ/	Generational Group	F1	85767.433	2	42883.716	13.666	.000
		F2	148087.829	2	74043.915	4.54	.012
	foll-MOA	F1	70911.324	2	35455.662	11.298	.000
		F2	378070.756	2	189035.378	11.59	.000
	foll-POA	F1	53270.652	2	26635.326	8.488	.000
		F2	10777.488	2	5388.744	0.33	(.719)
	foll-Voicing	F1	9254.534	1	9254.534	2.949	.000
		F2	64351.96	1	64351.96	3.945	.000
	pre-MOA	F1	21635.424	2	10817.712	2.335	(.100)
		F2	63656.059	2	31828.029	1.528	(.220)
	pre-POA	F1	345	2	172.5	0.037	(.963)
		F2	25726.118	2	12863.059	0.618	(.541)
	pre-Voicing	F1	0	0	.	.	(.138)
		F2	0	0	.	.	(.312)
/ɪ/	Generational Group	F1	102225.502	2	51112.751	19.051	.000
		F2	692584.62	2	346292.31	8.209	000
	foll-MOA	F1	97923.653	2	48961.826	18.25	.000
		F2	375486.304	2	187743.152	4.45	.013
	foll-POA	F1	15915.154	2	7957.577	2.966	(.055)
		F2	132234.48	2	66117.24	1.567	(.212)
	foll-Voicing	F1	34886.178	1	34886.178	13.003	(.137)
		F2	11765.574	1	11765.574	0.279	.027
	pre-MOA	F1	66643.83	2	33321.915	6.8	.002
		F2	101033.787	2	50516.894	0.812	(.447)
	pre-POA	F1	4704.5	1	4704.5	1.576	(.212)
		F2	22684.5	1	22684.5	0.572	(.451)
	pre-Voicing	F1	0	0	.	.	(.137)
		F2	0	0	.	.	.027

Vowel Variable	Independent Variable	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Significance (p)
/ɛ/	Generational Group	F1	302764.358	2	151382.179	46.123	.000
		F2	227436.848	2	113718.424	3.696	.027
	foll-MOA	F1	5929.14	3	1976.38	0.602	.043
		F2	6217.11	3	2072.37	0.067	.001
	foll-POA	F1	39759.199	2	19879.599	6.057	.003
		F2	565395.886	2	282697.943	9.189	.000
	foll-Voicing	F1	4619.295	1	4619.295	1.407	.026
		F2	16444.8	1	16444.8	0.535	.000
	pre-MOA	F1	17942.554	2	8971.277	3.227	(.615)
		F2	350017.141	2	175008.57	7.914	(.977)
	pre-POA	F1	34511.533	2	17255.767	6.208	.003
		F2	78496.094	2	39248.047	1.775	(.174)
	pre-Voicing	F1	0	0	.	.	(.980)
		F2	0	0	.	.	.012
/ʌ/	Generational Group	F1	40054.223	2	20027.112	5.123	.007
		F2	465436.898	2	232718.449	9.338	.000
	foll-MOA	F1	6145.651	2	3072.825	0.786	(.458)
		F2	74461.626	2	37230.813	1.494	(.229)
	foll-POA	F1	1907.249	2	953.624	0.244	(.784)
		F2	116267.103	2	58133.552	2.333	(.102)
	foll-Voicing	F1	5405.458	1	5405.458	1.383	.044
		F2	45215.656	1	45215.656	1.814	(.966)
	pre-MOA	F1	18674.018	2	9337.009	2.318	(.104)
		F2	68948.449	2	34474.224	0.956	(.388)
	pre-POA	F1	5900.342	2	2950.171	0.802	.032
		F2	78347.087	2	39173.544	1.609	(.658)
	pre-Voicing	F1	0	0	.	.	(.362)
		F2	0	0	.	.	.031
/ʊ/	Generational Group	F1	40054.223	2	20027.112	5.123	.001
		F2	465436.898	2	232718.449	9.338	(.624)
	foll-MOA	F1	6145.651	2	3072.825	0.786	(.529)
		F2	74461.626	2	37230.813	1.494	(.296)
	foll-POA	F1	1907.249	2	953.624	0.244	(.784)
		F2	116267.103	2	58133.552	2.333	(.102)
	foll-Voicing	F1	5405.458	1	5405.458	1.383	(.248)
		F2	45215.656	1	45215.656	1.814	(.635)
	pre-MOA	F1	9434.022	3	3144.674	0.854	(.271)
		F2	233396.721	3	77798.907	3.195	(.176)
	pre-POA	F1	5900.342	2	2950.171	0.802	(.059)
		F2	78347.087	2	39173.544	1.609	(.492)
	pre-Voicing	F1	0	0	.	.	(.809)
		F2	0	0	.	.	(.499)

Vowel Variable	Independent Variable	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Significance (p)
/o:/	Generational Group	F1	33244.05	2	16622.025	3.612	.031
		F2	24316.41	2	12158.205	0.765	(.468)
	foll-MOA	F1	7177.674	2	3588.837	0.78	(.461)
		F2	36476.961	2	18238.48	1.148	(.322)
	foll-POA	F1	20915.595	2	10457.798	2.273	(.108)
		F2	42654.812	2	21327.406	1.342	(.266)
	foll-Voicing	F1	1404.184	1	1404.184	0.305	(.785)
		F2	5463.559	1	5463.559	0.344	.000
	pre-MOA	F1	428.062	2	214.031	0.044	(.957)
		F2	79296.175	2	39648.088	2.518	(.086)
	pre-POA	F1	5593.949	2	2796.975	0.575	(.564)
		F2	105554.678	2	52777.339	3.352	.039
	pre-Voicing	F1	0	0	.	.	(.168)
		F2	0	0	.	.	(.061)
/u:/	Generational Group	F1	16238.491	2	8119.245	3.959	.021
		F2	4381324.523	2	2190662.262	31.707	.000
	foll-MOA	F1	9475.111	2	4737.555	2.31	(.103)
		F2	110984.411	2	55492.205	0.803	(.450)
	foll-POA	F1	1793.883	1	1793.883	0.875	(.351)
		F2	328143.995	1	328143.995	4.749	.031
	foll-Voicing	F1	1.773	1	1.773	0.001	(.929)
		F2	26150.208	1	26150.208	0.378	(.158)
	pre-MOA	F1	1129.995	2	564.998	0.282	(.755)
		F2	1133352.581	2	566676.291	5.124	.008
	pre-POA	F1	8794.679	2	4397.34	2.182	(.116)
		F2	1243298.011	2	621649.005	9.79	.000
	pre-Voicing	F1	0	0	.	.	(.274)
		F2	0	0	.	.	.000

Appendix H
Significance of Pairwise Comparisons: Generational Group

Vowel Variable	Dependent Variable	Generational Group (I)	Generational Group (J)	Mean Difference (I-J)	Std. Error	Significance (p)	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
/ɑ/	F1	1	2	34.21	16.554	(.101)	-5.03	73.46
			3	-87.54(*)	16.554	.000	-126.78	-48.29
		2	1	-34.21	16.554	(.101)	-73.46	5.03
			3	-121.75(*)	16.554	.000	-160.99	-82.51
		3	1	87.54(*)	16.554	.000	48.29	126.78
			2	121.75(*)	16.554	.000	82.51	160.99
	F2	1	2	19.17	26.042	(.742)	-42.56	80.91
			3	-134.37(*)	26.042	.000	-196.1	-72.63
		2	1	-19.17	26.042	(.742)	-80.91	42.56
			3	-153.54(*)	26.042	.000	-215.27	-91.8
		3	1	134.37(*)	26.042	.000	72.63	196.10
			2	153.54(*)	26.042	.000	91.8	215.27
/æ/	F1	1	2	37.68(*)	10.587	.001	12.59	62.77
			3	-33.45(*)	10.587	.006	-58.53	-8.36
		2	1	-37.68(*)	10.587	.001	-62.77	-12.59
			3	-71.12(*)	10.587	.000	-96.21	-46.04
		3	1	33.45(*)	10.587	.006	8.36	58.53
			2	71.12(*)	10.587	.000	46.04	96.21
	F2	1	2	-1.54	24.135	(.998)	-58.73	55.66
			3	72.27(*)	24.135	.009	15.07	129.47
		2	1	1.54	24.135	(.998)	-55.66	58.73
			3	73.80(*)	24.135	.008	16.61	131
		3	1	-72.27(*)	24.135	.009	-129.47	-15.07
			2	-73.80(*)	24.135	.008	-131	-16.61
/ɛ/	F1	1	2	90.26(*)	11.467	.000	63.08	117.44
			3	-25.92	11.235	(.058)	-52.56	0.71
		2	1	-90.26(*)	11.467	.000	-117.44	-63.08
			3	-116.18(*)	11.467	.000	-143.36	-89
		3	1	25.92	11.235	(.058)	-0.71	52.56
			2	116.18(*)	11.467	.000	89	143.36
	F2	1	2	43.74	35.109	(.428)	-39.48	126.96
			3	66.71	34.399	(.132)	-14.83	148.25
		2	1	-43.74	35.109	(.428)	-126.96	39.48
			3	22.97	35.109	(.790)	-60.25	106.19
		3	1	-66.71	34.399	(.132)	-148.25	14.83
			2	-22.97	35.109	(.790)	-106.19	60.25
/ɪ/	F1	1	2	75.68(*)	9.789	.000	52.48	98.87
			3	4.7	9.789	(.881)	-18.50	27.89
		2	1	-75.68(*)	9.789	.000	-98.87	-52.48
			3	-70.98(*)	9.789	.000	-94.18	-47.79
		3	1	-4.7	9.789	(.881)	-27.89	18.5
			2	70.98(*)	9.789	.000	47.79	94.18
	F2	1	2	-35.66	38.816	(.629)	-127.63	56.31
			3	120.93(*)	38.816	.006	28.96	212.9
		2	1	35.66	38.816	(.629)	-56.31	127.63
			3	156.59(*)	38.816	.000	64.62	248.56
		3	1	-120.93(*)	38.816	.006	-212.9	-28.96
			2	-156.59(*)	38.816	.000	-248.56	-64.62

Vowel Variable	Dependent Variable	Generational Group (I)	Generational Group (J)	Mean Difference (I-J)	Std. Error	Significance (p)	95% Confidence Interval	
							Lower Bound	Upper Bound
/ʌ/	F1	1	2	-32.94(*)	12.762	.030	-63.25	-2.62
			3	-42.60(*)	12.762	.003	-72.92	-12.29
		2	1	32.94(*)	12.762	.030	2.62	63.25
			3	-9.67	12.762	(.730)	-39.98	20.65
		3	1	42.60(*)	12.762	.003	12.29	72.92
			2	9.67	12.762	(.730)	-20.65	39.98
	F2	1	2	-133.02(*)	32.224	.000	-209.56	-56.48
			3	-39.29	32.224	.444	-115.83	37.25
		2	1	133.02(*)	32.224	.000	56.48	209.56
			3	93.73(*)	32.224	.012	17.19	170.27
		3	1	39.29	32.224	(.444)	-37.25	115.83
			2	-93.73(*)	32.224	.012	-170.27	-17.19
/ʊ/	F1	1	2	-27.64	20.093	(.361)	-76.21	20.92
			3	-47.8	20.967	(.068)	-98.48	2.88
		2	1	27.64	20.093	(.361)	-20.92	76.21
			3	-20.16	14.674	(.362)	-55.62	15.31
		3	1	47.8	20.967	(.068)	-2.88	98.48
			2	20.16	14.674	(.362)	-15.31	55.62
	F2	1	2	-67.23	55.136	(.448)	-200.49	66.03
			3	-69.73	57.535	(.452)	-208.78	69.33
		2	1	67.23	55.136	(.448)	-66.03	200.49
			3	-2.49	40.266	(.998)	-99.81	94.83
		3	1	69.73	57.535	(.452)	-69.33	208.78
			2	2.49	40.266	(.998)	-94.83	99.81
/o:/	F1	1	2	-35.91	15.244	(.053)	-72.18	0.37
			3	-6.65	14.819	(.895)	-41.91	28.62
		2	1	35.91	15.244	(.053)	-.37	72.18
			3	29.26	15.583	(.151)	-7.82	66.34
		3	1	6.65	14.819	(.895)	-28.62	41.91
			2	-29.26	15.583	(.151)	-66.34	7.82
	F2	1	2	-90.53(*)	28.329	.005	-157.94	-23.12
			3	-26.96	27.539	(.592)	-92.49	38.56
		2	1	90.53(*)	28.329	.005	23.12	157.94
			3	63.57	28.959	(.077)	-5.34	132.47
		3	1	26.96	27.539	(.592)	-38.56	92.49
			2	-63.57	28.959	(.077)	-132.47	5.34
/u:/	F1	1	2	-0.07	8.559	1.000	-20.35	20.2
			3	24.36(*)	8.559	.014	4.08	44.63
		2	1	0.07	8.559	1.000	-20.2	20.35
			3	24.43(*)	8.559	.014	4.15	44.7
		3	1	-24.36(*)	8.559	.014	-44.63	-4.08
			2	-24.43(*)	8.559	.014	-44.70	-4.15
	F2	1	2	-203.77(*)	49.675	.000	-321.44	-86.09
			3	248.11(*)	49.675	.000	130.43	365.78
		2	1	203.77(*)	49.675	.000	86.09	321.44
			3	451.88(*)	49.675	.000	334.2	569.55
		3	1	-248.11(*)	49.675	.000	-365.78	-130.43
			2	-451.88(*)	49.675	.000	-569.55	-334.20

Appendix I
Significance of Pairwise Comparisons: pre-POA

Vowel Variable	Dependent Variable	Pre-POA (I)	Pre-POA (J)	Mean Difference (I-J)	Std. Error	Significance (p)	95% Confidence Interval Lower Bound	95% Confidence Interval Upper Bound
/ɑ/	F1	1	2	22.74	14.755	(.275)	-12.24	57.72
			3	-18.72	20.387	(.630)	-67.05	29.61
		2	1	-22.74	14.755	(.275)	-57.72	12.24
			3	-41.46	19.896	(.097)	-88.62	5.71
		3	1	18.72	20.387	(.630)	-29.61	67.05
			2	41.46	19.896	(.097)	-5.71	88.62
	F2	1	2	38.63	23.211	(.223)	-16.39	93.66
			3	-43.53	32.071	(.366)	-119.56	32.50
		2	1	-38.63	23.211	(.223)	-93.66	16.39
			3	-82.17(*)	31.298	.026	-156.36	-7.97
		3	1	43.53	32.071	.366	-32.50	119.56
			2	82.17(*)	31.298	.026	7.97	156.36
/æ/	F1	1	2	-26.79	12.54	(.086)	-56.48	2.9
			3	-8.28	12.833	(.795)	-38.66	22.1
		2	1	26.79	12.54	(.086)	-2.9	56.48
			3	18.51	13.625	(.365)	-13.75	50.77
		3	1	8.28	12.833	(.795)	-22.1	38.66
			2	-18.51	13.625	(.365)	-50.77	13.75
	F2	1	2	103.14(*)	26.586	.000	40.2	166.09
			3	27.93	27.207	(.561)	-36.49	92.35
		2	1	-103.14(*)	26.586	.000	-166.09	-40.2
			3	-75.21(*)	28.887	.027	-143.61	-6.82
		3	1	-27.93	27.207	(.561)	-92.35	36.49
			2	75.21(*)	28.887	.027	6.82	143.61
/ɛ/	F1	1	2	-10.46	10.139	(.736)	-34.49	13.58
			3	-19.97	13.804	(.931)	-52.69	12.75
		2	1	10.46	10.139	(.736)	-13.58	34.49
			3	-9.51	13.629	(.976)	-41.82	22.79
		3	1	19.97	13.804	(.931)	-12.75	52.69
			2	9.51	13.629	(.976)	-22.79	41.82
	F2	1	2	165.14(*)	31.041	.000	91.56	238.73
			3	112.45(*)	42.264	(.217)	12.26	212.63
		2	1	-165.14(*)	31.041	.000	-238.73	-91.56
			3	-52.7	41.727	(.066)	-151.61	46.21
		3	1	-112.45(*)	42.264	(.217)	-212.63	-12.26
			2	52.7	41.727	(.066)	-46.21	151.61

Vowel Variable	Dependent Variable	Pre-POA (I)	Pre-POA (J)	Mean Difference (I-J)	Std. Error	Significance (p)	95% Confidence Interval	
							Lower Bound	Upper Bound
/ɪ/	F1	1	2	-19.94	10.019	(.119)	-43.73	3.84
			3	-20	13.26	(.291)	-51.48	11.48
		2	1	19.94	10.019	(.119)	-3.84	43.73
			3	-0.05	13.164	1.000	-31.31	31.2
		3	1	20	13.26	(.291)	-11.48	51.48
			2	0.05	13.164	1.000	-31.20	31.31
	F2	1	2	84	36.536	(.060)	-2.74	170.74
			3	-118.80(*)	48.352	.041	-233.59	-4.00
		2	1	-84	36.536	(.060)	-170.74	2.74
			3	-202.80(*)	48.003	.000	-316.76	-88.83
		3	1	118.80(*)	48.352	.041	4.00	233.59
			2	202.80(*)	48.003	.000	88.83	316.76
/ʌ/	F1	1	2	-23.92	15.229	(.262)	-60.00	12.17
			3	20.4	22.826	(.645)	-33.69	74.49
		2	1	23.92	15.229	(.262)	-12.17	60
			3	44.32	19.031	(.055)	-0.78	89.41
		3	1	-20.4	22.826	(.645)	-74.49	33.69
			2	-44.32	19.031	(.055)	-89.41	.78
	F2	1	2	-38.14	42.181	(.639)	-138.09	61.82
			3	-24.35	63.225	(.922)	-174.17	125.47
		2	1	38.14	42.181	(.639)	-61.82	138.09
			3	13.79	52.712	(.963)	-111.12	138.7
		3	1	24.35	63.225	(.922)	-125.47	174.17
			2	-13.79	52.712	(.963)	-138.70	111.12
/ʊ/	F1	1	2	-23.92	14.779	(.242)	-58.99	11.16
			3	20.4	22.153	(.628)	-32.18	72.98
		2	1	23.92	14.779	(.242)	-11.16	58.99
			3	44.32(*)	18.469	.047	0.48	88.15
		3	1	-20.4	22.153	(.628)	-72.98	32.18
			2	-44.32(*)	18.469	.047	-88.15	-0.48
	F2	1	2	-38.14	38.012	(.576)	-128.35	52.08
			3	-24.35	56.976	(.904)	-159.58	110.88
		2	1	38.14	38.012	(.576)	-52.08	128.35
			3	13.79	47.502	(.955)	-98.95	126.53
		3	1	24.35	56.976	(.904)	-110.88	159.58
			2	-13.79	47.502	(.955)	-126.53	98.95
/o:/	F1	1	2	7.75	14.947	(.863)	-27.8	43.3
			3	1	19.875	(.999)	-46.26	48.26
		2	1	-7.75	14.947	(.863)	-43.3	27.8
			3	-6.75	17.736	(.923)	-48.93	35.43
		3	1	-1	19.875	(.999)	-48.26	46.26
			2	6.75	17.736	(.923)	-35.43	48.93
	F2	1	2	-58.81	26.899	(.078)	-122.77	5.16
			3	-79.07	35.766	(.074)	-164.12	5.99
		2	1	58.81	26.899	(.078)	-5.16	122.77
			3	-20.26	31.918	(.801)	-96.16	55.64
		3	1	79.07	35.766	(.074)	-5.99	164.12
			2	20.26	31.918	(.801)	-55.64	96.16

Vowel Variable	Dependent Variable	Pre-POA (I)	Pre-POA (J)	Mean Difference (I-J)	Std. Error	Significance (p)	95% Confidence Interval	
							Lower Bound	Upper Bound
/u:/	F1	1	2	6.54	9.341	(.764)	-15.57	28.66
			3	29.77	17.999	(.227)	-12.84	72.37
		2	1	-6.54	9.341	(.764)	-28.66	15.57
			3	23.22	16.347	(.333)	-15.47	61.92
		3	1	-29.77	17.999	(.227)	-72.37	12.84
			2	-23.22	16.347	(.333)	-61.92	15.47
	F2	1	2	-238.29(*)	52.43	.000	-362.41	-114.18
			3	-158.8	101.022	(.261)	-397.94	80.34
		2	1	238.29(*)	52.43	.000	114.18	362.41
			3	79.49	91.753	(.662)	-137.71	296.69
		3	1	158.8	101.022	(.261)	-80.34	397.94
			2	-79.49	91.753	(.662)	-296.69	137.71

Appendix J
Significance of Pairwise Comparisons: pre-MOA

Vowel Variable	Dependent Variable	Pre-MOA (I)	Pre-MOA (J)	Mean Difference (I-J)	Std. Error	Significance (p)	95% Confidence Interval	
							Lower Bound	Upper Bound
/ɑ/	F1	1	2	7.18	26.475	(.960)	-55.69	70.04
			3	-5.38	24.779	(.974)	-64.22	53.45
		2	1	-7.18	26.475	(.960)	-70.04	55.69
			3	-12.56	32.738	(.922)	-90.3	65.17
		3	1	5.38	24.779	(.974)	-53.45	64.22
			2	12.56	32.738	(.922)	-65.17	90.30
	F2	1	2	114.86(*)	42.813	.023	13.21	216.52
			3	-22.89	40.071	(.836)	-118.03	72.26
		2	1	-114.86(*)	42.813	.023	-216.52	-13.21
			3	-137.75(*)	52.94	.028	-263.45	-12.05
		3	1	22.89	40.071	(.836)	-72.26	118.03
			2	137.75(*)	52.94	.028	12.05	263.45
/æ/	F1	1	2	-19.3	12.776	(.289)	-49.55	10.95
			3	-41.91(*)	12.776	.004	-72.16	-11.66
		2	1	19.3	12.776	(.289)	-10.95	49.55
			3	-22.61	14.513	(.267)	-56.98	11.75
		3	1	41.91(*)	12.776	.004	11.66	72.16
			2	22.61	14.513	(.267)	-11.75	56.98
	F2	1	2	-8.82	27.087	(.943)	-72.95	55.32
			3	100.20(*)	27.087	.001	36.07	164.34
		2	1	8.82	27.087	(.943)	-55.32	72.95
			3	109.02(*)	30.769	.002	36.17	181.87
		3	1	-100.20(*)	27.087	.001	-164.34	-36.07
			2	-109.02(*)	30.769	.002	-181.87	-36.17
/ɛ/	F1	1	2	-34.84	15.202	.105	-74.4	4.71
			3	-49.29(*)	14.274	.004	-86.43	-12.15
		2	1	34.84	15.202	.105	-4.71	74.4
			3	-14.44	17.345	(.839)	-59.58	30.69
		3	1	49.29(*)	14.274	.004	12.15	86.43
			2	14.44	17.345	(.839)	-30.69	59.58
	F2	1	2	10.72	46.542	(.996)	-110.38	131.83
			3	59.7	43.701	(.523)	-54.02	173.41
		2	1	-10.72	46.542	(.996)	-131.83	110.38
			3	48.97	53.106	(.793)	-89.21	187.16
		3	1	-59.7	43.701	(.523)	-173.41	54.02
			2	-48.97	53.106	(.793)	-187.16	89.21

Vowel Variable	Dependent Variable	Pre-MOA (I)	Pre-MOA (J)	Mean Difference (I-J)	Std. Error	Significance (p)	95% Confidence Interval	
							Lower Bound	Upper Bound
/ɪ/	F1	1	2	-60.54(*)	16.652	.001	-100.16	-20.92
			3	-58.41	25.488	(.062)	-119.06	2.23
		2	1	60.54(*)	16.652	.001	20.92	100.16
			3	2.13	22.773	(.995)	-52.06	56.31
		3	1	58.41	25.488	(.062)	-2.23	119.06
			2	-2.13	22.773	(.995)	-56.31	52.06
	F2	1	2	64.71	59.325	(.522)	-76.45	205.87
			3	-4.84	90.801	(.998)	-220.9	211.22
		2	1	-64.71	59.325	(.522)	-205.87	76.45
			3	-69.55	81.128	(.668)	-262.6	123.49
		3	1	4.84	90.801	(.998)	-211.22	220.9
			2	69.55	81.128	(.668)	-123.49	262.60
/ʌ/	F1	1	2	-36.04	16.057	(.091)	-74.50	2.43
			3	-22.77	15.139	(.333)	-59.03	13.50
		2	1	36.04	16.057	(.091)	-2.43	74.50
			3	13.27	15.139	(.686)	-22.99	49.53
		3	1	22.77	15.139	(.333)	-13.5	59.03
			2	-13.27	15.139	(.686)	-49.53	22.99
	F2	1	2	-57.54	49.48	(.496)	-176.06	60.98
			3	3.35	46.65	(.997)	-108.39	115.09
		2	1	57.54	49.48	(.496)	-60.98	176.06
			3	60.88	46.65	(.415)	-50.86	172.63
		3	1	-3.35	46.65	(.997)	-115.09	108.39
			2	-60.88	46.65	(.415)	-172.63	50.86
/ʊ/	Tukey post-hoc tests could not be performed because there are only two pre-MOA types for this variable: (oral) stop and fricative.							
/o:/	F1	1	2	-3.42	22.95	(.999)	-63.36	56.51
			3	19.66	22.95	(.827)	-40.27	79.59
		2	1	3.42	22.95	(.999)	-56.51	63.36
			3	23.08	28.465	(.849)	-51.25	97.42
		3	1	-19.66	22.95	(.827)	-79.59	40.27
			2	-23.08	28.465	(.849)	-97.42	51.25
	F2	1	2	-65.92	41.299	(.385)	-173.77	41.94
			3	17.42	41.299	(.975)	-90.44	125.27
		2	1	65.92	41.299	(.385)	-41.94	173.77
			3	83.33	51.225	(.368)	-50.44	217.11
		3	1	-17.42	41.299	(.975)	-125.27	90.44
			2	-83.33	51.225	(.368)	-217.11	50.44

Vowel Variable	Dependent Variable	Pre-MOA (I)	Pre-MOA (J)	Mean Difference (I-J)	Std. Error	Significance (p)	95% Confidence Interval	
							Lower Bound	Upper Bound
/u:/	F1	1	2	-2.62	12.559	(.976)	-32.56	27.32
			3	-7.97	10.642	(.735)	-33.34	17.4
		2	1	2.62	12.559	(.976)	-27.32	32.56
			3	-5.36	13.338	(.915)	-37.15	26.44
		3	1	7.97	10.642	(.735)	-17.4	33.34
			2	5.36	13.338	(.915)	-26.44	37.15
	F2	1	2	137.63	93.356	(.308)	-84.93	360.19
			3	251.34(*)	79.107	.006	62.75	439.93
		2	1	-137.63	93.356	(.308)	-360.19	84.93
			3	113.71	99.145	(.488)	-122.65	350.07
		3	1	-251.34(*)	79.107	.006	-439.93	-62.75
			2	-113.71	99.145	(.488)	-350.07	122.65

Appendix K
Significance of Pairwise Comparisons: foll-POA

Vowel Variable	Dependent Variable	Foll-POA (I)	Foll-POA (J)	Mean Difference (I-J)	Std. Error	Significance (p)	95% Confidence Interval	
							Lower Bound	Upper Bound
/ɑ/	F1	1	2	1.3	14.404	(.995)	-32.82	35.43
			3	-3.84	17.188	(.973)	-44.57	36.88
		2	1	-1.3	14.404	(.995)	-35.43	32.82
			3	-5.15	17.097	(.951)	-45.65	35.36
		3	1	3.84	17.188	(.973)	-36.88	44.57
			2	5.15	17.097	(.951)	-35.36	45.65
	F2	1	2	-16.4	25.071	(.790)	-75.8	43
			3	69.27	29.918	(.057)	-1.61	140.15
		2	1	16.4	25.071	(.790)	-43	75.8
			3	85.67(*)	29.758	.013	15.17	156.18
		3	1	-69.27	29.918	(.057)	-140.15	1.61
			2	-85.67(*)	29.758	.013	-156.18	-15.17
/æ/	F1	1	2	42.16(*)	9.856	.000	18.81	65.52
			3	51.06(*)	11.614	.000	23.54	78.58
		2	1	-42.16(*)	9.856	.000	-65.52	-18.81
			3	8.9	11.288	(.711)	-17.85	35.65
		3	1	-51.06(*)	11.614	.000	-78.58	-23.54
			2	-8.9	11.288	(.711)	-35.65	17.85
	F2	1	2	-28.36	22.469	(.419)	-81.61	24.89
			3	-52.9	26.478	(.117)	-115.65	9.85
		2	1	28.36	22.469	(.419)	-24.89	81.61
			3	-24.54	25.734	(.607)	-85.53	36.44
		3	1	52.9	26.478	(.117)	-9.85	115.65
			2	24.54	25.734	(.607)	-36.44	85.53
/ɛ/	F1	1	2	-10.46	10.139	.000	-34.49	13.58
			3	-19.97	13.804	.004	-52.69	12.75
		2	1	10.46	10.139	.000	-13.58	34.49
			3	-9.51	13.629	(.994)	-41.82	22.79
		3	1	19.97	13.804	.004	-12.75	52.69
			2	9.51	13.629	(.994)	-22.79	41.82
	F2	1	2	165.14(*)	31.041	.020	91.56	238.73
			3	112.45(*)	42.264	.002	12.26	212.63
		2	1	-165.14(*)	31.041	.020	-238.73	-91.56
			3	-52.7	41.727	(.448)	-151.61	46.21
		3	1	-112.45(*)	42.264	.002	-212.63	-12.26
			2	52.7	41.727	(.448)	-46.21	151.61

Vowel Variable	Dependent Variable	Foll-POA (I)	Foll-POA (J)	Mean Difference (I-J)	Std. Error	Significance (p)	95% Confidence Interval	
							Lower Bound	Upper Bound
/ɪ/	F1	1	2	46.60(*)	9.679	.000	23.67	69.54
			3	17.63	12.218	(.322)	-11.32	46.58
		2	1	-46.60(*)	9.679	.000	-69.54	-23.67
			3	-28.97(*)	10.587	.019	-54.06	-3.89
		3	1	-17.63	12.218	(.322)	-46.58	11.32
			2	28.97(*)	10.587	.019	3.89	54.06
	F2	1	2	-49.94	38.38	(.397)	-140.88	41
			3	-121.86(*)	48.448	.035	-236.65	-7.06
		2	1	49.94	38.38	(.397)	-41	140.88
			3	-71.91	41.981	(.204)	-171.39	27.56
		3	1	121.86(*)	48.448	.035	7.06	236.65
			2	71.91	41.981	(.204)	-27.56	171.39
/ʌ/	F1	1	2	-2.16	11.734	(.981)	-29.96	25.63
			3	-6.78	14.99	(.893)	-42.29	28.72
		2	1	2.16	11.734	(.981)	-25.63	29.96
			3	-4.62	15.737	(.954)	-41.9	32.65
		3	1	6.78	14.99	(.893)	-28.72	42.29
			2	4.62	15.737	(.954)	-32.65	41.9
	F2	1	2	39.53	31.625	(.426)	-35.38	114.44
			3	-21.5	40.4	(.856)	-117.2	74.19
		2	1	-39.53	31.625	(.426)	-114.44	35.38
			3	-61.03	42.413	(.324)	-161.5	39.43
		3	1	21.5	40.4	(.856)	-74.19	117.2
			2	61.03	42.413	(.324)	-39.43	161.5
/ʊ/	F1	1	2	-40.64	28.128	(.332)	-110.11	28.82
			3	-61.13	32.225	(.158)	-140.71	18.46
		2	1	40.64	28.128	(.332)	-28.82	110.11
			3	-20.48	21.096	(.601)	-72.58	31.62
		3	1	61.13	32.225	(.158)	-18.46	140.71
			2	20.48	21.096	(.601)	-31.62	72.58
	F2	1	2	-131.86	76.822	(.216)	-321.58	57.87
			3	-135.75	88.01	(.287)	-353.1	81.6
		2	1	131.86	76.822	(.216)	-57.87	321.58
			3	-3.89	57.616	(.997)	-146.18	138.4
		3	1	135.75	88.01	(.287)	-81.6	353.1
			2	3.89	57.616	(.997)	-138.4	146.18

/o:/ Tukey post-hoc tests could not be performed because there are only two foll-POA types for this variable: labial and coronal.

/u:/ Tukey post-hoc tests could not be performed because there are only two foll-POA types for this variable: labial and coronal.

Appendix L
Significance of Pairwise Comparisons: foll-MOA

Vowel Variable	Dependent Variable	Foll-MOA (I)	Foll-MOA (J)	Mean Difference (I-J)	Std. Error	Significance (p)	95% Confidence Interval	
							Lower Bound	Upper Bound
/ɑ/	F1	1	2	16.37	17.702	(.626)	-25.5	58.23
			3	2.51	18.776	(.990)	-41.9	46.91
		2	1	-16.37	17.702	(.626)	-58.23	25.5
			3	-13.86	18.776	(.741)	-58.26	30.55
		3	1	-2.51	18.776	(.990)	-46.91	41.9
			2	13.86	18.776	(.741)	-30.55	58.26
	F2	1	2	10.85	29.461	(.928)	-58.83	80.53
			3	-32.9	31.248	(.545)	-106.8	41.01
		2	1	-10.85	29.461	(.928)	-80.53	58.83
			3	-43.75	31.248	(.343)	-117.65	30.16
		3	1	32.9	31.248	(.545)	-41.01	106.8
			2	43.75	31.248	(.343)	-30.16	117.65
/æ/	F1	1	2	-16.71	10.233	(.235)	-40.97	7.54
			3	70.38(*)	10.931	.000	44.48	96.28
		2	1	16.71	10.233	(.235)	-7.54	40.97
			3	87.10(*)	10.77	.000	61.57	112.62
		3	1	-70.38(*)	10.931	.000	-96.28	-44.48
			2	-87.10(*)	10.77	.000	-112.62	-61.57
	F2	1	2	15.53	23.33	(.784)	-39.76	70.81
			3	-156.24(*)	24.92	.000	-215.3	-97.18
		2	1	-15.53	23.33	(.784)	-70.81	39.76
			3	-171.77(*)	24.554	.000	-229.95	-113.58
		3	1	156.24(*)	24.92	.000	97.18	215.3
			2	171.77(*)	24.554	.000	113.58	229.95
/ɛ/	F1	1	2	-26.82(*)	9.647	.017	-49.69	-3.96
			3	-12.38	10.325	(.456)	-36.85	12.1
		2	1	26.82(*)	9.647	.017	3.96	49.69
			3	14.45	10.621	(.365)	-10.73	39.62
		3	1	12.38	10.325	(.456)	-12.1	36.85
			2	-14.45	10.621	(.365)	-39.62	10.73
	F2	1	2	108.29(*)	27.211	.000	43.79	172.78
			3	-185.71(*)	29.122	.000	-254.74	-116.68
		2	1	-108.29(*)	27.211	.000	-172.78	-43.79
			3	-294.00(*)	29.958	.000	-365	-222.99
		3	1	185.71(*)	29.122	.000	116.68	254.74
			2	294.00(*)	29.958	.000	222.99	365

Vowel Variable	Dependent Variable	Foll-MOA (I)	Foll-MOA (J)	Mean Difference (I-J)	Std. Error	Significance (p)	95% Confidence Interval	
							Lower Bound	Upper Bound
/ɪ/	F1	1	2	13.62	9.457	(.323)	-8.79	36.02
			3	-30.74(*)	10.03	.007	-54.51	-6.98
		2	1	-13.62	9.457	(.323)	-36.02	8.79
			3	-44.36(*)	10.03	.000	-68.12	-20.59
		3	1	30.74(*)	10.03	.007	6.98	54.51
			2	44.36(*)	10.03	.000	20.59	68.12
	F2	1	2	19.58	37.499	(.861)	-69.27	108.44
			3	-71.97	39.774	(.170)	-166.22	22.27
		2	1	-19.58	37.499	(.861)	-108.44	69.27
			3	-91.56	39.774	(.059)	-185.8	2.68
		3	1	71.97	39.774	(.170)	-22.27	166.22
			2	91.56	39.774	(.059)	-2.68	185.8
/ʌ/	F1	1	2	15.43	11.497	(.374)	-11.80	42.66
			3	14.66	15.244	(.602)	-21.45	50.77
		2	1	-15.43	11.497	(.374)	-42.66	11.80
			3	-.77	15.172	(.999)	-36.71	35.17
		3	1	-14.66	15.244	(.602)	-50.77	21.45
			2	.77	15.172	(.999)	-35.17	36.71
	F2	1	2	47.30	31.204	(.287)	-26.61	121.22
			3	12.12	41.373	(.954)	-85.88	110.12
		2	1	-47.30	31.204	(.287)	-121.22	26.61
			3	-35.18	41.176	(.670)	-132.72	62.35
		3	1	-12.12	41.373	(.954)	-110.12	85.88
			2	35.18	41.176	(.670)	-62.35	132.72

/ʊ/ Tukey post-hoc tests could not be performed because there are only two foll-MOA types for this variable: (oral) stop and fricative..

Vowel Variable	Dependent Variable	Foll-MOA (I)	Foll-MOA (J)	Mean Difference (I-J)	Std. Error	Significance (p)	Lower Bound	Upper Bound
/o:/	F1	1	2	-5.73	15.583	(.928)	-42.81	31.35
			3	-19.49	14.819	(.390)	-54.75	15.77
		2	1	5.73	15.583	(.928)	-31.35	42.81
			3	-13.76	15.244	(.640)	-50.04	22.51
		3	1	19.49	14.819	(.390)	-15.77	54.75
			2	13.76	15.244	(.640)	-22.51	50.04
	F2	1	2	-6.74	28.959	(.971)	-75.65	62.17
			3	74.01(*)	27.539	.023	8.49	139.54
		2	1	6.74	28.959	(.971)	-62.17	75.65
			3	80.75(*)	28.329	.015	13.34	148.16
		3	1	-74.01(*)	27.539	.023	-139.54	-8.49
			2	-80.75(*)	28.329	.015	-148.16	-13.34

Vowel Variable	Dependent Variable	Foll-MOA (I)	Foll-MOA (J)	Mean Difference (I-J)	Std. Error	Significance (p)	95% Confidence Interval	
							Lower Bound	Upper Bound
/u:/	**F1**	1	2	9.65	8.273	(.475)	-9.95	29.25
			3	-9.95	8.707	(.490)	-30.57	10.68
		2	1	-9.65	8.273	(.475)	-29.25	9.95
			3	-19.6	8.837	(.072)	-40.53	1.34
		3	1	9.95	8.707	(.490)	-10.68	30.57
			2	19.6	8.837	(.072)	-1.34	40.53
	F2	1	2	79.48	48.017	(.226)	-34.26	193.23
			3	7.57	50.535	(.988)	-112.14	127.28
		2	1	-79.48	48.017	(.226)	-193.23	34.26
			3	-71.91	51.29	(.343)	-193.41	49.59
		3	1	-7.57	50.535	(.988)	-127.28	112.14
			2	71.91	51.29	(.343)	-49.59	193.41