Language Variation and Change, **17** (2005), 133–154. Printed in the U.S.A.

DOI: 10.1017/S0954394505050064

The Canadian shift in Montreal

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ABSTRACT

Based on an impressionistic study of 16 young Canadians, mostly from Ontario, Clarke, Elms, and Youssef (1995) reported that the short front vowels of Canadian English are involved in a chain shift, the "Canadian Shift," triggered by the merger of /ɒ/ and /ɔː/ in low-back position, whereby /æ/ is retracted to low-central position, and /ɛ/ and /ɪ/ are lowered toward the low-front space vacated by /æ/. This article extends the study of the Canadian Shift to the English-speaking community of Montreal, Quebec, using acoustic rather than impressionistic analysis and a larger and more diverse sample. The new data motivate a revised view of the Shift, at least as it operates in Montreal, in which the three front vowels are retracted in a set of parallel shifts, rather than rotating in a chain shift.

In 1991, Labov demonstrated that the major dialects of North American English could be categorized in three groups, based on two phonological criteria. These involved the organization of the low-front and low-back corners of the vowel space. One criterion was the split of /æ/ into tense and lax phonemes (tense /æː/ in *past* vs. lax /æ/ in *pat*). The other was the merger of /ɒ/ (*cot*) and /ɔː/ (*caught*) as a single, low-back phoneme (the "low-back merger"). Labov further showed that these criteria were the structural basis for chain shifts affecting whole subsystems of vowels in the dialects of two of the groups, giving each a distinctive sound. These chain shifts—the Northern Cities Shift, affecting the Inland Northern region of the United States, and the Southern Shift, affecting the Southern United States—have been widely reported and discussed since their initial exposition in Labov, Yaeger, and Steiner (1972). Labov grouped most of the remaining varieties of North American English—those spoken in New England, Western Pennsylvania, the Western United States, and Canada—into a "Third Dialect." The basis for this geographically discontinuous group was that all of its members feature single phonemes in both corners of the low vowel space. In the low-front space they have a single /æ/ phoneme with purely phonetic tensing and raising

An earlier version of this paper was presented at NWAVE 32 (University of Pennsylvania, October 10, 2003). Thanks are due to members of the audience at that presentation, as well as to anonymous reviewers of the present version of the article, for helpful comments. In the preparation of the present version, the author is especially indebted to Anicka Fast and Erika Lawrance for research assistance and to Myrtis Fossey for assistance with statistical analysis. This research received financial support from three sources: the Research Grants Office of McGill University, the Canadian Foundation for Innovation, and the *Fonds québécois de la recherche sur la société et la culture* (Grant #2003-NC-81927).

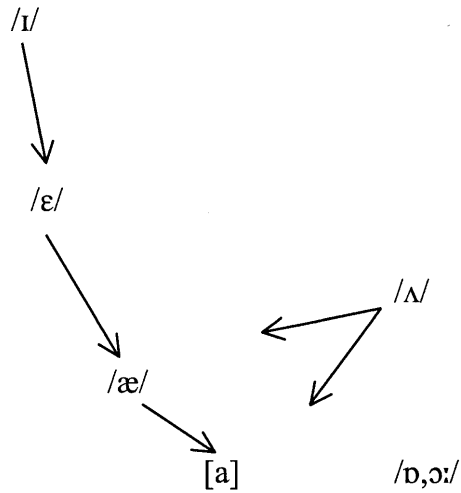

FIGURE 1. The Canadian Shift, as reported by Clarke et al. (1995:212).

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only and always before anterior nasal consonants. In the low-back region they have a single phoneme created by the merger of pairs of words like *cot* and *caught*, *Don* and *dawn*, *stock* and *stalk*, and *collar* and *caller*. The systematic effect of these structural conditions appeared to be stability. Labov found that the dialects involved were characterized by an absence of the extensive chain shifts observed in the Northern and Southern dialects.

The accuracy of Labov's characterization of the Third Dialect was challenged in the case of Canadian English by Clarke, Elms, and Youssef (1995), writing a few years later in this journal. They reported that, contrary to Labov's generalization, Canadian English exhibits its own set of phonetic shifts. These were similar in nature to those Labov had identified in the Northern and Southern dialects and arose from one of Labov's pivotal conditions—the low-back merger. In a study of 16 young Canadians, Clarke et al. found that /æ/ was retracting from its low-front position into low-central position (a development first observed in Vancouver English by Esling & Warkentyne 1993), that /ɛ/ was descending to fill the low-front space vacated by /æ/, and that /ɪ/ was in turn descending to fill the space vacated by /ɛ/. They labeled this coordinated set of developments the Canadian Shift (Figure 1) and suggested that it was triggered by the large empty space made available in the low-central region by the low-back merger (Clarke et al., 1995:212). An associated development, the centralization or lowering of /ʌ/, could not be causally linked to the low-back merger in the same way, so that its status as part of the Canadian Shift was not clear.

Clarke et al.'s article represented an important advance in the study of Canadian English, being the first general study of the Canadian vowel system since the well-known analyses of Canadian Raising (Chambers, 1973; Joos, 1942).[1] Labov

https://doi.org/10.1017/S0954394505050064 Published online by Cambridge University Press

was quick to adopt the Canadian Shift as part of his own view of Canadian English, and it figures prominently in the analysis of Canadian English developed in the *Atlas of North American English* (Labov, Ash, & Boberg, forthcoming). Its operation in Ontario English has been confirmed by several subsequent studies (De Decker, 2001; De Decker & Mackenzie, 1999; Hoffman, 1998, 1999), while D'Arcy (2002) has examined its adoption by young women in St. John's, Newfoundland. Its most remarkable aspect is the retraction of /æ/. In Southern Ontario, home to the largest concentration of speakers of Canadian English, this development of /æ/ contrasts sharply with the tensing and raising of /æ/ directly across the border in American cities like Buffalo and Detroit, where the Northern Cities Shift holds sway. As a result of these opposing shifts, the pronunciation [hat] corresponds to different words on either side of the border. In Ontario, it is an item of headwear, /hæt/, whereas in Western New York State and Southeastern Michigan, it is the opposite of *cold*, /hɒt/.[2] The operation of the Canadian Shift reinforces not only Canada's unique linguistic identity, but more generally the enduring strength of regional dialect differences in North America.

The value of Clarke et al.'s contribution in providing the first description and analysis of the Canadian Shift cannot be doubted. Like most initial studies, however, theirs gives rise to several questions for further research. The first arises from the fact that all of the participants in their main sample of 16 people were in their 20s, except one, aged 33. This narrow range of ages prevented the authors from carrying out an apparent-time analysis that might have revealed whether a shift was in fact in progress, and in what direction it was moving. A secondary sample of six older subjects (in their 50s and 60s) was studied in an attempt to address this question, but the comparison of the two age groups proved inconclusive; the authors found the older group was "clearly too small to permit much in the way of generalization" about the effect of age (Clarke et al., 1995:217). An analysis of acoustic data from older and younger speakers involved only two speakers in each group, one female and one male (1995:218–219). The operation of the Canadian Shift was therefore largely inferred from a comparison with non-Canadian speech, or from untested assumptions about the original position of the short front vowels in Canadian speech, rather than directly demonstrated by means of statistically valid generational differences.

A second question arising from Clarke et al.'s study is the application of their findings to other regions of Canada, given that all of their participants came from Ontario, except for one from each of Alberta and British Columbia. Apart from the question of whether the 14 young Ontarians they studied are in fact representative of Ontario speech as a whole, the limited geographic range of their sample calls into question whether the Canadian Shift is really just an Ontario Shift, or a development that characterizes Canadian English in general, from British Columbia to Newfoundland. Although Ontario is the most populous province in Canada, its 8 million native speakers of English in fact represent less than half of the Canadian total of over 17 million.[3] Looking for evidence of the Shift outside Ontario is therefore an important extension of Clarke et al.'s research.

A third question concerns Clarke et al.'s method of data collection. They measured a total of 1,900 tokens of /ɪ, ɛ, æ, ɒ, ʌ/, approximately 24 tokens per vowel per participant, certainly an adequate number. However, their main analysis was based on impressionistic transcription of these tokens rather than on acoustic analysis, which served only to supplement the auditory analysis in a few cases (1995:212). A reliance on impressionistic transcription can sometimes introduce various sources of error, ranging from the imprecision of the analytical categories used in impressionistic transcription to problems of intertoken and intercoder reliability and objectivity. The level of accuracy and reliability attained by Clarke et al. was no doubt very high. Nevertheless, the inherent limitations of auditory-impressionistic analysis suggest that our knowledge of the nature and progress of the Canadian Shift could be advanced by further study using large-scale acoustic analysis.

There are, in fact, independent reasons to reexamine the nature of the Canadian Shift. In particular, two subsequent, small-scale, acoustic studies of the Shift in Ontario have failed to find clear evidence for the lowering of /ɛ/, the central component that ties the Shift together, linking the retraction of /æ/ with the lowering of /ɪ/. Data from these studies suggest that the major development of /ɛ/ is centralization rather than lowering. If this finding were substantiated by a larger study, it would indicate that the nature of the Canadian Shift is not so much a rotation of the short vowels down and around the front periphery of the vowel space, as a set of parallel retractions. The mental process underlying this development would not then be the maintenance of adequate margins of security between neighboring phonemes, which is thought to be the basis for chain shifts, but rather a kind of analogy that produces identical alterations in the production of phonologically similar vowels.

The first indication that /ɛ/ was not following the development reported by Clarke et al. came from preliminary analyses of the data collected for the *Atlas of North American English* (Labov et al., forthcoming). This project interviewed ten speakers of Ontario English during the 1990s. The sample included four men and six women, aged 17 to 55, from cities and towns across the province. Acoustic analysis was performed on tokens of both spontaneous and formally elicited speech. Pearson coefficients showing correlations between age and the first and second formants of the five vowels studied by Clarke et al. are given in Table 1. Only two of the acoustic measures show a noteworthy correlation with age. The strongest of these is the F2 of /æ/, for which $r = 0.64$, a positive correlation: the younger the speaker (i.e., the lower the age), the lower the F2 of /æ/. Because F2 is directly correlated with the advancement of a vowel, this means that younger speakers have a more retracted pronunciation of /æ/, a direct confirmation of what was reported by Clarke et al. However, a similar correlation, slightly weaker at $r = 0.47$, was found for the F2 of /ɛ/, indicating that /ɛ/ is also more retracted among younger speakers. By contrast, no correlation was found with the F1 of /ɛ/ ($r = 0.16$), which directly contradicts Clarke et al.'s report that /ɛ/ is descending into the low-front space vacated by /æ/. In short, this small sample of Ontario speakers suggests that /ɛ/ is retracting rather than descending.

https://doi.org/10.1017/S0954394505050064 Published online by Cambridge University Press

TABLE 1. *Pearson coefficients (r) showing the influence of age on acoustic measures of the Canadian Shift*

Vowel	*r* (F1)	*r* (F2)
/ɪ/	0.08	−0.02
/ɛ/	0.16	0.47
/æ/	0.11	0.64
/ɒ/	0.07	−0.22
/ʌ/	0.38	0.22

Note: Sample of ten speakers of Ontario English, ages 17–55, interviewed for the *Atlas of North American English* (Labov, Ash, & Boberg, forthcoming).

A second acoustic study of the Canadian Shift in Ontario was carried out by Lawrance (2002), who examined the effect of community size and distance from Toronto, Ontario's largest city, on the vowels studied by Clarke et al. Lawrance performed acoustic analysis on the speech of 27 young women from a wide range of cities and towns in Ontario, including Toronto. Because all her subjects were between the ages of 18 and 25, her data cannot support an apparent-time analysis, but her analysis of geolinguistic factors revealed a pattern of variation that matches that of Table 1, rather than that of Clarke et al. Lawrance found that the main parameters differentiating the speakers involved F2, or advancement, rather than F1, or height. The subjects from smaller and more distant towns showed less retracted articulations of /ɪ, ɛ, æ/ than the subjects from larger towns closer to Toronto, or from Toronto itself. There was comparatively little evidence for variation of these vowels up or down the front periphery. This suggests that the Canadian Shift may be diffusing outward from its point of origin in Toronto, in a hierarchical pattern like that identified by Trudgill (1974). We can only reach this conclusion, however, if we take the Shift to involve parallel retraction of /ɪ, ɛ, æ/, rather than retraction of /æ/ with consequent downward shifts in /ɛ/ and /ɪ/. The conflict between these data and those of Clarke et al. calls the essential nature of the Canadian Shift into question.

This article seeks to augment our understanding of the Canadian Shift by addressing all three of the questions arising from Clarke et al.'s study. It presents acoustic rather than impressionistic data; it expands our view of the Shift beyond Ontario to Montreal, Quebec, a distinct speech community;[4] and its design involves a sample divided among three generational groups, allowing for an apparent-time analysis of the diachronic progress and direction of the Shift. Specifically, the present study sets out to answer three questions: Is the Canadian Shift active in Montreal English, as well as in Ontario; what is the phonetic character of the Canadian Shift in Montreal; and how is the Shift socially embedded,[5] that is, what

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TABLE 2. *Sample of 35 participants, by age and sex*

	Birth year		
Sex	<1946	1946–1965	>1965
Female	8	6	7
Male	5	5	4
Total	13	11	11

are the social characteristics of speakers who show relatively more or less advanced forms of the Shift? The next section provides an introduction to this study.

METHOD

The study presented in this article involved the acoustic analysis of over one thousand tokens of the six short vowels of English, /ɪ, ɛ, æ, ɒ, ʌ, ʊ/, produced by 35 native speakers of Montreal English from three ethnic groups (9 Irish, 15 Italian, and 11 Jewish[6]). The most important characteristics of the sample, age and sex, are shown in Table 2. The participants are divided among three generational groups based on their year of birth: 13 were born during or before the Second World War; 11 are from the post-war "baby boom" generation; and the remaining 11 represent the children of the baby-boomers, born after 1965.[7] There are more women (21) than men (14), but each generational group contains a similar mix of both sexes, and of all three ethnic groups. An additional social factor taken into account in the analysis was the participants' education: 13 have a university degree, whereas 22 do not; most of the latter group have high school education or less. The demographic characteristics of individual participants are shown in Table 3.

All subjects participated in a tape-recorded sociolinguistic interview, carried out by an undergraduate linguistics student from McGill University, usually in the participant's home.[8] The participants were asked to provide the demographic information in Table 3, read a word list, and discuss their opinions and experiences of life in Montreal. The tokens analyzed in the present study, like those analyzed by Clarke et al., were taken exclusively from the word list portion of the interview, to ensure an identical set of data from each participant. The word list contained 115 common, monosyllabic words featuring all of the stressed vowels of English in random order and in a variety of allophonic environments. Of these, 41 words featured the short vowels studied here. For example, the tokens of /ɛ/ read by each participant were *dead, deck, set, step, sell,* and *ten*. While allophonic conditioning of the Canadian Shift was examined by Clarke et al. (1995:213–216), it will not be addressed here. Allophonic effects were, however, controlled

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TABLE 3. *Age, sex, ethnicity, education, and occupation of individual participants*

Birth year	Sex	Ethnicity	University	Occupation
1919	f	Irish	no	factory worker, homemaker
1920	m	Irish	no	buyer for technology company
1923	f	Italian	no	factory worker, waitress
1924	m	Irish	yes	owner of textile business
1927	m	Italian	no	repairman for railroad
1928	f	Italian	no	seamstress, retail clerk
1928	m	Jewish	no	bookkeeper
1932	f	Irish	no	secretary at factory
1936	f	Jewish	no	secretary, condo manager
1940	f	Irish	no	florist
1942	f	Italian	yes	teacher
1943	m	Jewish	yes	executive at jewelry company
1944	f	Jewish	no	elementary school teacher
1949	f	Jewish	yes	physiotherapist
1949	m	Jewish	yes	clothing manufacturer
1951	f	Irish	no	accounting clerk
1952	m	Italian	no	import-export business
1956	f	Italian	no	office worker, retail clerk
1956	m	Jewish	no	clothing sales (family business)
1957	f	Italian	yes	clerical staff at university
1957	f	Jewish	no	dental assistant/receptionist
1958	f	Italian	no	medical receptionist
1960	m	Italian	no	mechanical designer, installer
1962	m	Italian	no	supervisor at electrical supply business
1971	f	Italian	no	clothing designer (unemployed)
1971	f	Jewish	no	cashier, nurse
1973	f	Irish	yes	legal secretary
1977	f	Irish	yes	university student
1977	f	Italian	no	sales clerk, luggage claim clerk
1978	m	Irish	yes	university student
1978	m	Italian	no	bartender
1979	f	Italian	yes	university student
1979	f	Jewish	yes	receptionist, retail worker, student
1980	m	Italian	yes	university student
1981	m	Jewish	yes	junior college student

for by having each participant read the same words, and by ensuring that each vowel was represented by a comparable set of allophonic environments.[9]

Acoustic analysis of the word list tokens was performed with the Computerized Speech Lab system developed by Kay Elemetrics (Model 4400). Waveform, spectrogram, and linear predictive coding (LPC) analyses were carried out on each token. The frequency of the first and second formants was measured using the LPC analysis. The measurement was made at the point that best represented the central tendency of the vowel. This was usually the maximum value of F1, or the middle of a steady state in F1. In a few cases, the trajectory of F2 was

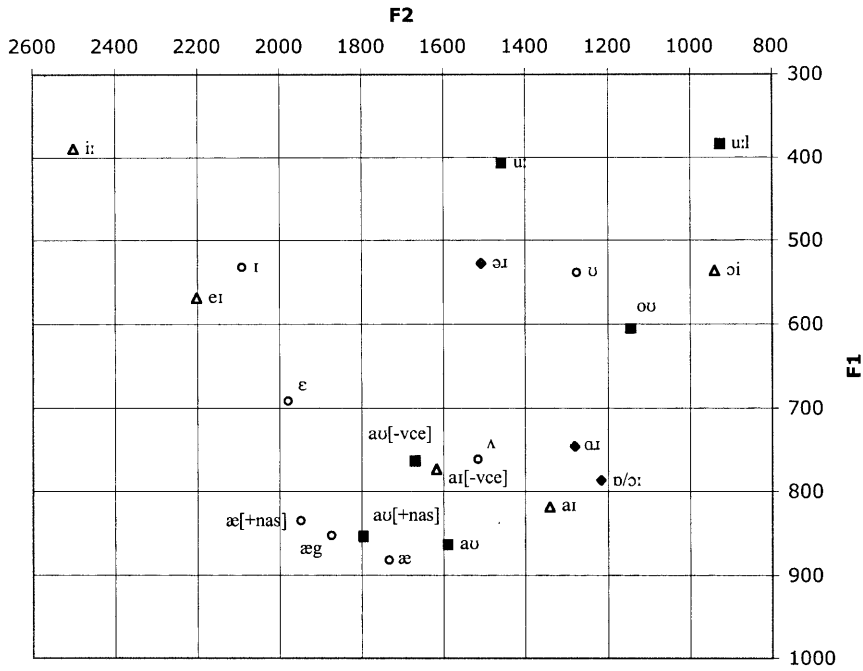

FIGURE 2. Normalized F1/F2 measurements for 35 speakers of Montreal English, showing means for stressed vowel phonemes and major allophones. Mean of three ethnic groups (Irish, Italian, and Jewish). Short vowels are indicated by open circles, except for /ɒ/ (*cot*), which is merged with long /ɔ:/ (*caught*). Back-upgliding vowels are indicated by black squares, front-upgliding vowels by white triangles, non-upgliding long vowels by black diamonds.

used as a guide to establishing a more precise point of measurement within an F1 steady state. All of the measurements thus obtained were normalized to eliminate interspeaker differences related to the size or shape of the vocal tract, using the Constant Log Interval procedure of Nearey (1977).[10]

Figure 2 shows the mean F1 and F2 values for all of the stressed vowels of English, with important allophones, for the 35 speakers.[11] It provides a general view of the vowel system of Montreal English. Note the merger of /ɒ/ and /ɔ:/ in the lower-mid-back region, held by Clarke et al. to be the trigger for the Canadian Shift. The short front vowels involved in the Shift do, in fact, appear to be somewhat shifted relative to their position in some other English dialects: /ɪ/ and /ɛ/ are fairly low, and the main distribution of /æ/ (excluding its allophones before nasals and before /g/) is low-central, not far from the main distribution of /aʊ/. The position of /ʌ/ is lower-mid-central, near the raised allophones of /aʊ/ and /aɪ/ that occur in Canadian Raising environments (before voiceless obstruents). This also appears to reflect the operation of the shifts indicated in Clarke et al.

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Other features characteristic of Montreal English are the relatively retracted and raised positions of /aɪ/ and /ɑɹ/, and the moderate centralization of the main distribution of /u:/ relative to its allophone before /l/, which remains in back position. The latter development, without a parallel centralization of /oʊ/, is typical of Canadian English as a whole.

The mean F1 and F2 values for each vowel for each participant, together with each participant's demographic data, were analyzed statistically with the General Linear Model of SPSS (Statistical Package for the Social Sciences, Version 10 for the Macintosh). The dependent variables were the F1 and F2 of the six short vowels, /ɪ, ɛ, æ, ɒ, ʌ, ʊ/, indicating their height and advancement, respectively. The last of these vowels, /ʊ/, was not included in Clarke et al.'s analysis but was included here so that the behavior of the entire subsystem of short vowels might be studied. The independent variables were the generational group, sex, ethnicity, and education of the participants. Table 4 gives descriptive statistics (mean and standard deviation) for each of the dependent measures according to generational group.

RESULTS AND ANALYSIS

The first step in the statistical analysis of the acoustic data was to see whether they showed, as a set, a correlation with generational group that might indicate a change in progress of the sort proposed by Clarke et al. A multivariate analysis of covariance (MANCOVA) was therefore carried out, with generational group as the fixed factor; sex, ethnicity, and education as covariates; and the F1 and F2 of the six short vowels as dependent variables. The result of this analysis was $F(2, 36) = 2.961$; $p < .005$. From this we can conclude that age does have a significant effect on the articulation of the short vowels of Montreal English, and that this effect is independent of any effect of sex, ethnicity, or education.

The next step was to see which of the 12 dependent measures showed a significant correlation with generational group. This was accomplished with an analysis of covariance (ANCOVA), with the same design as the MANCOVA previously described. The results are shown in Table 5. According to this analysis, generational group has a significant independent effect on four measures: the F1 of /æ/; and the F2 of /ɪ, ɛ, æ/.[12] Significant independent effects were not found for the F1 of /ɪ/ or /ɛ/, or for either measure of the back vowels. These data contradict the position of Clarke et al. that the Canadian Shift involves a lowering of /ɪ/ and /ɛ/. Instead, they support the view that emerges from the acoustic studies of Ontario speech cited previously, in which the main parameter of variation in the articulation of /ɪ/ and /ɛ/ is advancement rather than height. The descriptive statistics in Table 4 show that the significant effects in Montreal English involve a lower F2, or more retracted vowels, for younger participants. In fact, the especially large F value for the F2 of /ɛ/ ($F = 13.946$, $p = .000$) suggests that the retraction of /ɛ/ is the most active part of the Canadian Shift in Montreal.

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TABLE 4. *Descriptive statistics (mean and standard deviation) for analysis of F1 and F2 of short vowels by generational group*

Measure	Generational Group	Mean	Standard Deviation
F1 (ɪ)	1	524	53
	2	532	32
	3	537	30
	Total	531	40
F2 (ɪ)	1	2133	115
	2	2097	77
	3	2027	76
	Total	2089	100
F1 (ɛ)	1	671	52
	2	690	37
	3	719	66
	Total	692	55
F2 (ɛ)	1	2047	71
	2	2009	73
	3	1855	102
	Total	1975	116
F1 (æ)	1	851	43
	2	929	42
	3	887	70
	Total	887	61
F2 (æ)	1	1776	48
	2	1764	118
	3	1663	107
	Total	1737	104
F1 (ɒ)	1	786	62
	2	807	76
	3	779	37
	Total	790	60
F2 (ɒ)	1	1220	75
	2	1217	61
	3	1224	64
	Total	1220	65
F1 (ʌ)	1	772	49
	2	773	55
	3	740	61
	Total	762	56
F2 (ʌ)	1	1543	94
	2	1473	69
	3	1524	82
	Total	1515	86
F1 (ʊ)	1	537	36
	2	529	33
	3	547	40
	Total	537	36
F2 (ʊ)	1	1270	112
	2	1213	105
	3	1342	90
	Total	1275	113

Note: From oldest to youngest, the groups are: (1) born before 1946, (2) born 1946–1965, and (3) born after 1965.

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TABLE 5. *Analysis of covariance (ANCOVA) of generational group with F1 and F2 of short vowels, with sex, ethnicity, and education held constant*

Measure	*F*	Significance (*p* value)
F1 (ɪ)	0.267	(.767)
F2 (ɪ)	3.130	.059
F1 (ɛ)	2.229	(.126)
F2 (ɛ)	13.946	.000
F1 (æ)	6.709	.004
F2 (æ)	3.722	.036
F1 (ɒ)	0.556	(.580)
F2 (ɒ)	0.184	(.833)
F1 (ʌ)	0.939	(.403)
F2 (ʌ)	2.002	(.153)
F1 (ʊ)	0.477	(.626)
F2 (ʊ)	2.511	(.099)

Note: Nonsignificant effects ($p > .05$) are shown in parentheses.

It must be admitted that the effect of generational group on the F1 or height of /ɛ/ was fairly close to being significant, at $p = .126$, and that Table 4 shows what appears to be a steady if moderate increase in the F1 of /ɛ/ with each generation. This suggests that the development of /ɛ/ in Montreal may involve some degree of lowering as well as retraction, which might attain statistical significance in a larger sample. However, where Clarke et al.'s diagram of the Canadian Shift (Fig. 1) shows lowering to be the primary direction of change in the articulation of /ɛ/, with the limited degree of associated retraction no more than what might be imposed by the shape of the vowel space, in Montreal the trajectory of /ɛ/ involves a much greater degree of retraction than of lowering. Both reports identify a diagonal trajectory, but they can be clearly distinguished by the main direction of the diagonal. Moreover, they differ very clearly on the development of /ɪ/. Whereas Clarke et al. reported a lowering of /ɪ/ with virtually no retraction, the Montreal data show a retraction of /ɪ/ with no evidence of lowering.

To develop a more detailed view of generational differences in the articulation of the short vowels, a multivariate analysis of variance (MANOVA) was next performed, as a preliminary step in carrying out Tukey HSD post-hoc tests of the differences between individual generational groups for each measure. The MANOVA tested the effect of generational group on the F1 and F2 of the six short vowels, without the other demographic factors as covariates. Like the MANCOVA, this test found a significant main effect of generational group: $F(2, 42) = 3.386$; $p < .001$. An analysis of variance (ANOVA) was also performed, for which the results are given in Table 6. In general, these data confirm the results of the ANCOVA shown in Table 5, with the difference that other demographic fac-

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TABLE 6. *Analysis of variance (ANOVA) of generational group with F1 and F2 of short vowels*

Measure	*F*	Significance (*p* value)
F1 (ɪ)	0.307	(.738)
F2 (ɪ)	3.944	.029
F1 (ɛ)	2.502	(.098)
F2 (ɛ)	17.563	.000
F1 (æ)	6.609	.004
F2 (æ)	5.051	.012
F1 (ɒ)	0.664	(.522)
F2 (ɒ)	0.031	(.969)
F1 (ʌ)	1.304	(.285)
F2 (ʌ)	2.187	(.129)
F1 (ʊ)	0.701	(.504)
F2 (ʊ)	4.303	.022

Note: Nonsignificant effects ($p > .05$) are shown in parentheses.

tors are not held constant. Significant effects were again found for the F1 of /æ/, and for the F2 of /ɪ, ɛ, æ/. The F2 of /ɛ/ once again shows the largest *F* value, whereas the F1 of /ɛ/ still falls just short of significance at $p = .098$.

One difference between Tables 5 and 6 is that the F2 of /ʊ/ shows a significant correlation with generational group in the ANOVA that did not appear in the ANCOVA, suggesting that age has an effect on this measure that is not independent of other social factors. The descriptive statistics in Table 4 do not show a linear correlation, but the decline in F2 from the oldest to the middle group appears small beside the large rise in F2 from the middle to the youngest group, suggesting that /ʊ/ has begun to centralize among young speakers. As before, the other back vowels show no correlation with generational group.

The results of the Tukey HSD post-hoc tests are given in Table 7. The table shows only the five measures that were found to be significantly correlated with generational group in the ANOVA (Table 6). By comparing Table 7 with the descriptive statistics in Table 4, it is possible to develop a more precise view of the diachronic progress of the Canadian Shift in Montreal, as reflected in apparent time. None of the generational effects differentiates all three groups. Groups 1 and 2, the oldest and middle generations, differ significantly only with respect to the F1 of /æ/, which is higher for the middle group, suggesting that /æ/ began to move lower among baby-boomers but reached the maximum extent of this shift (the bottom of the vowel space) by the mid-1960s. Groups 2 and 3, the middle and youngest generations, differ significantly with respect to three measures: the F2 of /ɛ, æ, ʊ/. The first two of these differences show that the principal development of the Canadian Shift in Montreal—the parallel retraction of /ɛ/ and /æ/—is a comparatively recent phase that was introduced by the children of baby-

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TABLE 7. *Tukey HSD post-hoc tests of generational differences in the dependent measures shown to be significantly correlated with generational group in the ANOVA (Table 6) (Group 1 is the oldest participants, Group 2 the middle generation, and Group 3 the youngest)*

	Group comparisons (*p* value)		
Measure	1 vs. 2	1 vs. 3	2 vs. 3
F2 (ɪ)	(.624)	.024	(.194)
F2 (ɛ)	(.508)	.000	.000
F1 (æ)	.003	(.229)	(.161)
F2 (æ)	(.948)	.016	.042
F2 (ʊ)	(.377)	(.223)	.017

Note: Nonsignificant effects ($p > .05$) are shown in parentheses.

boomers after the mid-1960s. The highest front vowel, /ɪ/, shows a less vigorous retraction, which is significant only when the youngest group (3) is compared with the oldest group (1). As suggested previously, the centralization of /ʊ/ appears to be a recent innovation, introduced by the youngest generation. Its structural connection with the Canadian Shift is not clear; it may, in fact, be a purely coincidental development.

At this point, we have answered two of the three questions posed in the introduction. The Canadian Shift, or something very similar to it, is active in Montreal, but its phonetic character is not identical with the version of the Shift reported for Ontario English by Clarke et al. The two reports agree on the retraction of /æ/, which is likely to be the most perceptually salient element of the Shift, because it directly opposes the development of /æ/ in Inland Northern speech. However, where Clarke et al. found that the retraction of /æ/ had triggered a lowering of /ɛ/ and /ɪ/ in a chain shift relationship, the Montreal data show instead a parallel retraction of /ɛ/ and /ɪ/, the former more vigorous than the latter. The retraction of /ɛ/ in fact appears to be the most active component of the Shift in contemporary Montreal speech. The parallel retraction of all three front vowels is shown in Figure 3, which plots each participant's mean F2 of /ɪ, ɛ, æ/ against his or her year of birth. The three linear regression lines show how the mean F2 declines as birth year increases: the younger the participant, the more centralized the vowel. The slope of the line for /ɛ/ is steeper than those for the other vowels, indicating that the retraction of /ɛ/ is more marked than the other changes.

SOCIAL EMBEDDING OF THE CANADIAN SHIFT

The third question posed in the introduction was how the Canadian Shift is socially embedded. What are the social characteristics of the speakers who are leading

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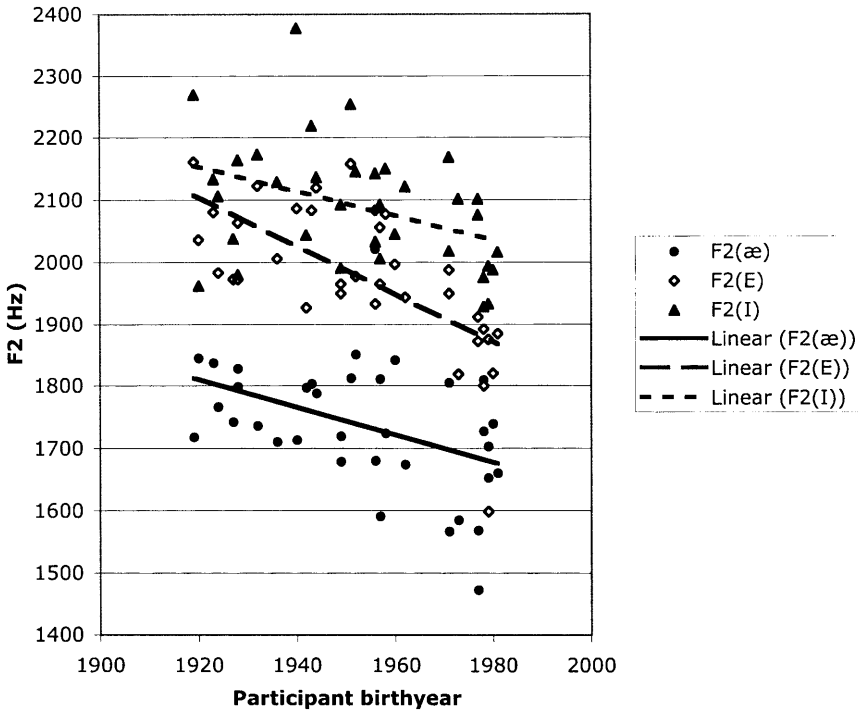

FIGURE 3. Parallel retraction of front short vowels /ɪ, ɛ, æ/: the principal phonetic character of the Canadian Shift in Montreal. Mean second formant as a function of participant birth year, with linear regression of each distribution, for 35 speakers of Montreal English. Lower F2 values indicate more retracted vowels.

this change? Clarke et al. found that women were ahead of men in adopting the Canadian Shift (1995:216–217), but the limitations of their sample did not permit an analysis of other social factors. The Montreal sample is more diverse, including three different ethnic groups and two educational groups, as well as a division between men and women. It will be seen, however, that the analysis of social factors permitted by this diversity adds very little to what was established by Clarke et al.

To see whether any social factors other than generational group have a significant independent effect on the Canadian Shift in Montreal, a MANCOVA was conducted for each factor, holding the others constant. Of the three, only sex had a significant effect ($F(1, 12) = 2.358$; $p < .05$). The result for ethnicity was $F(2, 24) = 1.394$; $p > .05$. That for education was $F(1, 12) = 1.320$; $p > .05$. The Canadian Shift therefore appears to be implemented in a socially uniform manner, but with some differences according to the sex of the speaker.

The nature of these sex differences was investigated by carrying out an ANCOVA with sex as the fixed factor and the other social factors as covariates.

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TABLE 8. *Analysis of covariance (ANCOVA) of sex with F1 and F2 of short vowels, with generational group, ethnicity, and education held constant*

Measure	*F*	Significance (*p* value)
F1 (ɪ)	0.223	(.640)
F2 (ɪ)	4.870	.035
F1 (ɛ)	0.356	(.555)
F2 (ɛ)	2.331	(.137)
F1 (æ)	0.385	(.540)
F2 (æ)	8.117	.008
F1 (ɒ)	0.000	(1.000)
F2 (ɒ)	10.610	.003
F1 (ʌ)	2.858	(.101)
F2 (ʌ)	1.608	(.215)
F1 (ʊ)	0.345	(.561)
F2 (ʊ)	0.146	(.705)

Note: Nonsignificant effects ($p > .05$) are shown in parentheses.

The results are shown in Table 8. Only three acoustic measures show a significant effect of sex: the F2 of /ɪ, æ, ɒ/. Remarkably, one of these, the F2 of /ɪ/, is the weakest component of the Shift in Montreal, and another, the F2 of /ɒ/, is not involved in the Shift at all; in fact, /ɒ/ appears to be diachronically stable. Of the most vigorous components of the Shift, only the retraction of /æ/ shows a correlation with sex, while sex appears to have no significant effect on retraction of /ɛ/. This is an unexpected result, given the general view that women tend to lead active sound changes (Labov, 1990:215).

The descriptive statistics for the analysis of the effect of sex are given in Table 9. Only those measures shown to be significantly affected by sex in the ANCOVA (Table 8) are listed. The data in Table 9 show that women are ahead of men in the retraction of /æ/, the most active part of the Canadian Shift among those that are correlated with sex. This conforms both to general views of the role of women in sound change, and specifically to the findings of Clarke et al. The retraction of /ɪ/ shows the opposite sex pattern, with men slightly ahead of women, but we have seen that this is a less active part of the Shift in Montreal, so perhaps this contradiction is not as noteworthy as it might otherwise be. In any event, it is not immediately evident why women should lead in the retraction of one vowel while men lead in the retraction of another, unless perhaps these two vowels have different sociosymbolic values attached to them. This question could well be the subject of future research on the Canadian Shift.

As for the third vowel that shows a correlation with sex, it is perhaps not surprising that women show a lower mean F2 of /ɒ/ than men, as they also have a lower mean F2 of /æ/. The further back the articulation of /ɒ/, the more room

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TABLE 9. *Descriptive statistics (mean and standard deviation) for analysis of F1 and F2 of short vowels by sex (n = 21 women and 14 men)*

Measure	Sex	Mean	Standard Deviation
F2 (ɪ)	f	2117	104
	m	2046	81
F2 (æ)	f	1702	100
	m	1788	92
F2 (ɒ)	f	1194	61
	m	1260	51

Note: Only dependent measures selected as significant by the ANCOVA reported in Table 8 are shown.

there is in the low-central region for the retraction of /æ/. There appears to be a more or less constant distance between the front and back corners of the vowel space. The entire lower space is further back for women than for men. Clearly, however, the social embedding of the Canadian Shift is a subject that would benefit greatly from further research, both in Montreal and elsewhere.

DISCUSSION

The data we have reported motivate a revised view of the Canadian Shift, at least as it operates in Montreal, which is illustrated in Figure 4. It is difficult to know how to reconcile this view with that of Clarke et al., reproduced in Figure 1, other than to suggest that the Shift may operate differently in Ontario and Quebec. To test this hypothesis, data identical to those on Montreal English reported here were collected from seven undergraduate students (five women and two men) from several regions of Ontario[13] who were attending McGill University. This sample, while small, is demographically very similar to the sample that served as the basis for Clarke et al.'s study. If it were found that the Ontario subjects had lower and less centralized productions of /ɪ/ and /ɛ/ than the Montreal subjects (that is, higher mean F1 and lower mean F2 measurements), the inconsistency between the two studies could be confidently ascribed to a regional difference.

In making the regional comparison, the same word list was used for the Ontario subjects, and their production of the six short vowels was measured in the same way as for the Montreal participants. Their acoustic data were normalized in reference to the group mean for the Montreal participants, so that the two groups could be directly compared. A MANCOVA was then carried out to test whether region (Ontario vs. Montreal) was correlated with any differences in the acoustic measures. Sex was held constant as a covariate. The result was $F(1, 12) = 3.191$; $p > .05$; from which it can be concluded that there is no significant difference

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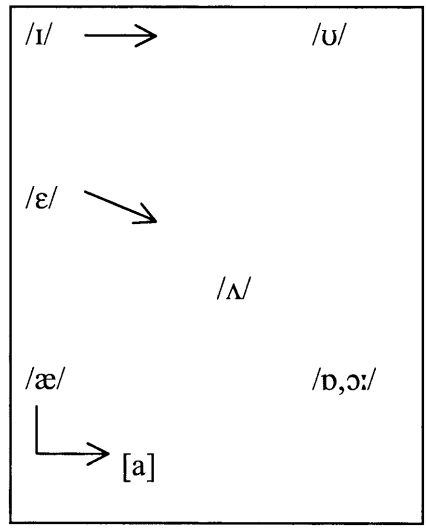

FIGURE 4. The Canadian Shift in Montreal.

between Ontario and Montreal productions of the vowels involved in the Canadian Shift. Of course, the small size of the Ontario sample means that this conclusion can only be tentative at this point, but it seems likely that a robust regional difference would have appeared even with a small sample.

Clearly, the nature of regional differences in the operation of the Canadian Shift, like the effect of social factors, represents a promising opportunity for future research. Acoustic analyses of the speech of large samples of comparable subjects from all of Canada's regions should prove particularly valuable in this respect. Labov et al. (forthcoming) offer a first view of the national picture. Based on a limited sample of only a few subjects in each of Canada's urban regions, they find that the Shift does not operate consistently in Atlantic Canada,[14] but serves as a reliable indicator of Canadian speech in the rest of the country, from Quebec to British Columbia, distinguishing it from the American varieties spoken across the international border. The much larger sample of Montreal's English-speaking population examined here confirms this view, at least with regard to Quebec.

If Montreal's participation in the Shift now seems clear, however, the phonetic nature of the Shift remains a puzzle. The multivariate analysis of acoustic data on Canadian English carried out by Labov et al. (forthcoming) reveals a pattern that conforms to both versions of the Shift discussed here: that of Clarke et al., in which the major development of /ɛ/ is a descent towards /æ/ (Figure 1); and that of the present analysis, in which the major development of /ɛ/ is a centralization parallel with the retraction of /æ/ (Figure 4). In other words, Labov et al. found that /ɛ/ is moving diagonally, both down and inward.

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It is particularly difficult to reconcile this result with the preliminary analysis of the Ontario data from Labov et al.'s (forthcoming) study, presented in Table 1, which showed no correlation between age and the F1 of /ɛ/ ($r = .16$). Ontario is the only region of Canada in which Labov et al. have a large enough sample to support an apparent-time analysis without appealing to speakers from other regions. When the analysis is expanded to include speakers from regions outside Ontario, however, an age correlation with the F1 of /ɛ/ emerges. This analysis probably raises as many questions as it answers, given the problems of regional differences and a small sample in each city, combined with the fact that the data on each speaker are not always strictly comparable (unlike in the present analysis, many of the tokens analyzed for each subject were from spontaneous speech, so that allophonic environment and conditions of elicitation were not controlled). Nevertheless, this view of the development of /ɛ/ gains further support from anecdotal, impressionistic observations of the speech of young Canadians. Among young Canadian women in particular, the pronunciation of /ɛ/ is sometimes low enough to produce potential confusion with /æ/, at least when taken out of context, as when *left* and *bet* sound somewhat like *laughed* and *bat*. It is not clear why this development is not reflected in the data presented here. If it is not simply a regional difference, the discrepancy may result from characteristics of the sample on which the present study is based, such as the high proportion of certain ethnic groups, or to the role of aspects of the speech signal other than the height of the first two formants. At this point, the development of /ɛ/ represents an interesting opportunity for future research.

Perhaps the most engaging issue in research on the Canadian Shift, particularly for linguists not closely concerned with the study of Canadian English, is the extent to which the Shift can be seen as an automatic response to its phonological input condition—the space opened up by the low-back merger—rather than as an idiosyncratic development with a local, sociosymbolic value in Canadian English. Clarke et al. (1995:224) correctly pointed out that the obvious way to answer this question is to examine other dialects in which the same input condition is present: the other members of Labov's Third Dialect group. Is the retraction of /æ/, with its associated effect on the other short front vowels, found in every dialect that exhibits the low-back merger? A positive answer would argue for an explanation of the Shift in terms of automatic processes of vowel shifting governed by structural considerations, in particular by the need to maintain equal margins of security around each vowel phoneme. A negative answer, in the absence of other structural impediments to retraction in the other dialects, would suggest that the retraction of /æ/ may have a sociosymbolic value in Canadian English that has less currency in other regions of North America.

The continental overview of vowel pronunciation offered by Labov et al. (forthcoming) shows little evidence of the Canadian Shift outside Canada, but this broad perspective should be confirmed by detailed local studies of larger samples of speakers in each region. These studies will have to contend with the possibility that the presence of a low-back merger may not be the only input condition relevant to the operation of the Canadian Shift. In each Third Dialect region, as it

happens, additional structural factors may come into play. Traditional Eastern New England speech features a low-central vowel, /a:/ (*father*, *palm*, *car*), not present in Canadian English, that might merge with /æ/ if the latter were shifted to low-central position. It was observed earlier that the Canadian Shift pronunciation of *hat* as [hat] matches the Inland Northern pronunciation of *hot*. In Boston, by contrast, it is similar to the traditional pronunciation of *heart* as [ha:t]. Does the possibility of this merger prevent the retraction of /æ/? Western Pennsylvania English (at least the traditional dialect of Pittsburgh, the largest city in the region) also has a low-central vowel not present in Canadian English, though from a different historical source, in this case the monophthongization of /aʊ/. Does the pronunciation of *mouth* and *mouse* as [ma:θ] and [ma:s] discourage the pronunciation of *math* and *mass* in the same way?[15] The phonemic structure of the English of the Western United States is more similar to that of Canadian English: both /aɪ/ and /aʊ/ are diphthongs, and historical /a:/ (*father*) is merged with /ɒ/ (*bother*), which in turn is merged with /ɔ:/. The phonetic realization of this three-way merger, however, is different. In some parts of the West, it is considerably further forward and less rounded than in Canada, approaching the low-central region, so that *cot* and *caught* are both pronounced as [kɑt] rather than as [kɒt]. Does this configuration of the low vowel space preclude the retraction of /æ/?[16]

Further research on the retraction of /æ/ in various dialects may also help to illuminate the mental processes that underlie the Canadian Shift. The version of the Shift presented in Clarke et al. is a classic chain shift, suggesting a clear causal relation between its three principal elements. The basis of this causal relation is the maintenance of maximal margins of security in phonological space to prevent confusion with neighboring phonemes, a key component of the structural economy of vowel systems, as conceived by Martinet (1955) and further developed by Labov (1994). Structural economy of this sort was shown by Moulton (1960, 1962) to explain the articulation of vowels in Northern dialects of Swiss German, in a powerful demonstration of the effect of phonemic structure on phonetic output. It has a clear psycholinguistic basis. By contrast, the version of the Shift presented in Figure 4 is a parallel shift. Parallel shifts have been observed before (e.g., the parallel centralization of the back upgliding vowels /u:, oʊ, aʊ/ in the Midland and South of the United States, or in Southern British English), but their relation to structural economy is less obvious than that of chain shifts. Although structural economy can be evoked to explain the original retraction of /æ/ in Canadian English, parallel retractions of /ɛ/ and /ɪ/ can only be explained as analogical developments, or as the generalization of a phonetic change from one member to the other members of a vocalic subsystem.

A generalization of this type may achieve a certain mental economy, but it is difficult to argue that it enhances structural economy. On the contrary, in the Northern Cities Shift, the retraction of /ɛ/ to [ʌ] follows in a chain shift behind the retraction of /ʌ/ to [ɔ], thereby maintaining margins of security, whereas in the Canadian Shift, /ʌ/ remains in place (at least according to the ANCOVA reported in Table 5). Neither Clarke et al. nor the present study found /ʌ/ to be shifting back toward the rear periphery; in fact, Clarke et al. suggested that it is

moving forward. Figure 2 shows it in lower-mid central position in Montreal, not far from the most retracted allophones of /ɛ/. The retraction of /ɛ/ therefore diminishes the margin of security between /ɛ/ and /ʌ/, potentially causing *deck* and *best* to sound somewhat like *duck* and *bust*. In this case, apparently, the structural integrity of vocalic subsystems takes precedence over the need to maintain maximal contrast between neighboring phonemes. Whether Canadian English, or Montreal English, in fact, shows an approximation or incipient merger of /ɛ/ and /ʌ/ will be left as a subject for future research.

NOTES

1. Previous work on Canadian English had been dominated by the use of written questionnaires to study nonphonetic variables, for example Avis (1954–1956), Scargill and Warkentyne (1972), and Chambers (1994). Important exceptions to this tradition include the studies of Canadian Raising already referred to, and of several phonetic and phonological variables in Vancouver and Ottawa (De Wolf, 1992), among others. However, general studies of the vowel system like that of Labov, Yaeger, and Steiner (1972) in the United States were not well represented in research on Canadian English before 1995. An early impressionistic study of the vowels of Vancouver English (Gregg, 1957) did not give rise to a tradition of similar studies in other regions.

2. The transborder opposition of the Inland Northern and Canadian vowel systems was examined by Boberg (2000).

3. These figures refer to the number of people who claimed English as their only mother tongue in the 2001 Census of Canada. The total populations of Canada and Ontario in 2001 were 30 million and 11.3 million, respectively. (Canada. Statistics Canada, 2001.)

4. Greater Montreal's half-million speakers of English are a small minority of the metropolitan population, which is two-thirds French-speaking. This makes Montreal a speech community distinct from Ontario or Toronto in more than the geographic sense. In particular, physical and cultural isolation from the majority of English-speaking Canada, along with intense contact with French, may have an important influence on Montreal English that has no equivalent elsewhere in North America. Historically, while Montreal's English-speaking community was established at about the same time as Ontario's (the late 18th century), its earliest period was dominated by direct immigration from Britain, rather than by the northward migration of Loyalist refugees from the American Revolution.

5. Labov's term. See, for example, the discussion of the "embedding problem" in the study of the mechanism of linguistic change (Labov, 1972:162).

6. The sample was originally recruited for a study of ethnic differences in the phonetics of Montreal English (Boberg, 2004), which determined its ethnic composition. In that study, ethnicity was not found to influence the articulation of the vowels involved in the Canadian Shift, though it did have important effects on other vowels. The 2001 Census of Canada showed that the 161,235 people of Irish ancestry in Greater Montreal represent the largest portion of the historically English-speaking community, outnumbering those of English or Scottish ancestry, whereas the 224,460 people of Italian origin and 80,390 people of Jewish origin are the most populous of the groups of non-British people who have joined the English-speaking community since immigrating to Montreal. (Canada. Statistics Canada, 2001.) The sample of this study therefore represents a cross-section of the ethnic diversity that characterizes the English-speaking community of Montreal.

7. These generational groups are derived from the analysis of Howe and Strauss (1993), who argued that they represent significant shifts in outlook, experience, and popular culture. The first group's socialization was dominated by the Depression and the Second World War; the second by the Cold War and the counter-cultural and civil rights movements of the 1960s; and the third by the aftermath of the 1960s.

8. The interviews were recorded on Type II (CrO_2) analog cassette tapes, using Marantz PMD 221 cassette recorders and Audiotechnica AT 803b omnidirectional lavalier microphones.

9. Each short vowel was represented by at least one token before /d/, one before /t/, and one before /l/. All of them except /ʊ/ were also represented by a token before /n/. There were four tokens of /æ/ before nasal consonants, but these were not included in the analysis, because prenasal /æ/ often shows a clearly separate distribution from other tokens of /æ/ in North American English, and the degree to which /æ/ is fronted or raised before nasals is subject to ethnic variation in Montreal.

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The word list also included tokens of the short vowels before /r/ (e.g., *spirit, berry, carry*), but these were excluded from the analysis because prerhotic vowels generally form a separate subsystem from the main, nonprerhotic system in most North American dialects. Finally, the representation of the main vowels of interest in the Canadian Shift—/ɪ, ɛ, æ, ɒ/—was augmented by including tokens before /p/ and /k/ as well as /t/. The number of tokens analyzed for each participant was therefore 30: six of /ɪ, ɛ, ɒ/; five of /æ/; four of /ʌ/, and three of /ʊ/.

10. Nearey's Constant Log Interval Hypothesis involves a single scaling factor for F1 and F2. It calculates a scaling factor for each participant as the antilog of the difference between the natural logs of the combined F1/F2 means of the participant and the group (all 35 participants). The participant's formant values are then multiplied by the scaling factor to produce the normalized values. The F1/F2 mean for the group of 35 speakers was 1110.6, of which the natural log is 7.01. The scaling factors ranged from 0.86 for the woman with the highest voice to 1.16 for the man with the lowest voice. The mean F1/F2 means were 1184 for women and 1012 for men; the mean scaling factors were 0.94 for women and 1.10 for men.

11. The values in Figure 2 actually reflect a mean of the means for the three ethnic groups. It will be shown that ethnicity has no effect on the vowels involved in the Canadian Shift, but it does affect other vowels. The interethnic mean prevents the representation of Montreal English as a whole from being unduly subject to the influence of one ethnic group more than another.

12. Probabilities of less than 0.05 were taken to be significant. The probability for the F2 of /ɪ/, $p = .059$, was taken to be marginally significant, since it is only slightly higher than 0.05.

13. Two of the students were from Greater Toronto, one from Southern Ontario, three from Eastern Ontario, and one from Northern Ontario.

14. This finding partly contradicts Clarke et al. (1995:220), who report an incipient retraction of /æ/ in St. John's, Newfoundland, led by middle-class women. The adoption of /æ/-retraction by young women in St. John's has more recently been confirmed by D'Arcy (2002).

15. McCarthy (2004) presented data from an acoustic study of Pittsburgh English that suggested a structural relation between the retraction of /æ/ and the monophthongization of /aʊ/. Retracted /æ/ was only observed among participants for whom monophthongization was strongly recessive or absent.

16. The same condition is true of Newfoundland English, which has a low-central rather than low-back articulation of /ɒ-ɔː/. This may help to explain the observation of Labov et al. (forthcoming) that the Canadian Shift does not operate in Newfoundland (but see note 14).

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