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LANGUAGE SHIFT REGARDING CANADA'S FRENCH-SPEAKING POPULATION

- DATA COMPARABILITY AND TRENDS FROM 1971 TO 2001

By
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Abstract

The importance of establishing valid language shift trends regarding Canada's French-speaking populations and the historical comparability of Canadian census language data are considered. Based on an empirical theory, comparability breaks in language data since 1971 are identified and evaluated. The proportions of Canadian-born persons of French mother tongue, and of French home language, to the total population of relevant birth regions are then adjusted separately, to reduce the impact of comparability breaks. The resulting language shift trends regarding the French-speaking populations are portrayed using language vitality indices for reference cohorts. It is found that for the whole of Canada, and for the provinces of Quebec and New Brunswick, the vitality of French among the Canadian-born rebounded in 2001, after consistently decreasing from 1971 to 1991. It is also observed that for other regions, the vitality of French went down continuously, indicating a sustained and aggravated assimilation over the past 30 years.

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Introduction

Language shift concerning the French-speaking population is an issue central to Canadian social and political life ([19], p. 1). According to de Vries ([14], pp. 347-348), the prevalence of ethnolinguistic pluralism has been responsible for acts of violence against the state and for referendums on sovereignty held in Quebec. He added that, " with the express purposes of reducing the possibilities for overt conflict and of promoting 'national unity' or the continued existence of the nation state", laws and regulations were created in Canada, which necessitate knowing how many members belong to a particular linguistic minority. This knowledge is largely dependent on the series of Canadian census language data. It is essential to examine the comparability of such data prior to any conclusion being made with respect to the trends of language shift regarding any linguistic group.

In Chapter I we shall first present a brief historical review of the relationship between the French-speaking and English-speaking populations in Canada, to better understand the importance of and tensions underlying language shift concerning French. Then the measurement of language shift will be discussed, with a note on the properties of the customized census data used in this study.

The comparability problems of the Canadian census language data will be explored in depth in Chapter II. First of all, the possible sources of comparability breaks will be discussed. To better illustrate the impacts of such breaks, the census mother tongue data and main home language data will be examined separately, including the possible impacts of the comparability breaks on the enumeration of the French-speaking population. To identify the comparability breaks regarding the home language data, we first put forward some empirical hypotheses derived from previous studies, and

then verify the hypotheses by using the customized data from the 1991 and 1996 censuses. We then formulate a theory and apply it to identifying comparability breaks for the series of home language data from the censuses of 1971 to 2001.

In the last chapter, the trends of language shift concerning the Canadian-born French-speaking population will be evaluated using a set of language vitality indices which have been derived from proportions of Francophones[2] and of French home language speakers in the total population, adjusted on the basis of the results obtained in Chapter 2. We learn, for example, that for the whole of Canada, the vitality index of French among persons born in Canada rebounded in 2001 after consistently decreasing from 1971 to 1991. For the provinces of Quebec and New Brunswick, we also observe that an increase in the vitality index of French occurred recently. These findings are discussed along with others in terms of the effectiveness or ineffectiveness of various language policies destined to promote the use of French.

[2]A Francophone is a person with French as mother tongue. See the glossary ([30], pp. 139-140) for similar definitions of Anglophone and Allophone.

Chapter 1

Language Shift in Canada

1.1 Historical review: why language matters in Canada

The permanence of a French-speaking population in North America has been uncertain since the very beginning of Canada. Language rights in Canada reflect this tension between what came to be known as the two founding nations, namely, the French and the British. More specifically, the evolution of language rights over time illustrates the struggle for survival of the French-speaking population since the early eighteenth century.

A modus vivendi between the English- and French- speaking groups was initially reached in what were to become the Maritime Provinces ([36], p. 42). However, the ascendancy of British colonists through continuing immigration, followed by the deportation of the Acadians in 1755 gave the Maritimes "a predominantly English stamp"([36], p. 42). As a result of the assimilating pressure of English and of the decreasing proportion of the French-speaking population, French also lost its official status in the Western Provinces where it had formerly achieved such status to different extents.

Likewise, after the Conquest of 1760, French initially remained one of the two languages of the government and courts of what was Canada at that time ([36], p.

42). Its status was quickly consolidated by the Quebec Act of 1774, "a successful attempt to secure the neutrality of British North America's French-speaking Roman Catholic colonists in the escalating conflicts with its English-speaking Protestant colonists to the south"([38], p. 15).

However, once the English-speaking population in the province was augmented by the massive immigration of British Loyalists following the American war of Independence, new conflicts emerged due to their strong will to make English the sole official language ([36], p. 44). To relieve the tension, the Constitutional Act of 1791 was passed, which divided the old province of Quebec into Upper Canada (the future Ontario) and Lower Canada (today's Quebec) (ibid).

Nonetheless, old animosities were not dissolved by the new legislation. Article VIII of the Quebec Act, "which made French law applicable in matters of property and civil rights"([36], p. 45), was abrogated and replaced with the laws of England in 1792(ibid). In the same year, mixed English-French juries were abolished (ibid). Moreover, with the ideals of the American and of the French revolutions acting as catalysts, demands of self-rule arose in both Upper Canada and Lower Canada. Continued frustration of the Patriot movement, which spearheaded such demands in Lower Canada, led to the Rebellion of 1837-1838 which was easily crushed.

As a consequence, the Constitution of 1791 was suspended in so far as it affected Lower Canada, and in Upper Canada English was made "the only language in the debates of the legislature as well as before the courts of justice, and in all public documents"(ibid). The Earl of Durham was appointed High Commissioner and Governor General of British North America, and produced his famous Report on the Affairs of British North America after five months of research. "Durham's proposed solutions are well known: union of the two provinces as a means of eventually providing an **English** majority in the legislature; eventual assimilation of the French by the influx of **English** settlers, as in Louisiana; and introduction of responsible government, to make the executive responsible to the legislature"([36], pp. 45-46, our emphasis).

The Parliament of the United Kingdom followed these solutions. It passed the 1840 Act of Union to reunite Upper Canada and Lower Canada ([36], p. 46). Section XLI of the Act provided English as the only official language in "all the records and

proceedings of the legislative council and of the legislative assembly"(ibid). This section was repealed in 1849 after a long struggle by French-speaking members of the legislative assembly, and the official status of French was again recognized in the United Province of Canada (ibid).

In the British North America Act of 1867 "which had created the federal Dominion of Canada as a colony of the United Kingdom"([3], p. 5), article 133 "recognizes implicitly English and French as official languages of the Federal and Quebec legislatures, including the passage of laws"(ibid, p. 17). However, article 93 "made education the responsibility of provincial governments, thereby leaving them the choice of language of education"([23], p. 129).

In 1890 regulations of the Ontario Department of Education made English the language of instruction. In 1910, Bishop Fallon of London (Ontario) stated that bilingual schools could not give the type of education that was needed in southern Ontario and wanted to wipe out every vestige of bilingual teaching in the public schools of this Diocese ([1], pp. 174). Two years later Ontario enacted Regulation 17, claiming English to be the sole language of instruction after grade three, with the study of French limited to one hour a day ([11], pp. 5-6). In Northwest Territories, Alberta and Saskatchewan, during the fifty years after the promulgation of B.N.A. Act, English was also made the language of instruction, while the use of French was only allowed to early grades ([11], pp. 4-7).

English was thus established as the dominant language in the greater part of Canada, and the use of French was gradually limited to the present Province of Quebec and its neighbouring regions. It is easy to understand, therefore, why language maintenance and language shift are today such a concern to French Canada. Moreover, it could be argued that the same instinct of survival explains how, by maintaining an extremely high birth rate, Canada's French-speaking minority maintained its weight at about thirty percent of the population of Canada for almost a century from the 1850s to the 1950s, thus counterbalancing the significant inflow of immigration which continuously strengthened the English population. During the 1960s, however, the birth rate of Canada's Francophone population plummeted to the same inadequate level as that of its Anglophone population, where it has remained to this day.

This being so, as long as the concern for survival among Canada's French-speaking minority has not been put to rest, the tensions between English Canada and French Canada will not disappear.

More recently, this tension has given birth to the crisis of national unity which afflicts Canada since the 1960s. To dissolve the linguistic grounds which had given rise to the movement for the political independence of Quebec, the Royal Commission on Bilingualism and Biculturalism (RCBB) was created by Prime Minister Lester B. Pearson in 1963, to inquire as to how to "develop the Canadian Confederation on the basis of an equal partnership between the two founding races..."([35], p. 23).

Following the recommendations of the RCBB, the first Official Languages Act was enacted in 1969, which claimed in its Declaration of Status of Languages that the English and French languages "enjoy equality of status and equal rights and privileges as to their use in all the institutions of the Parliament and Government of Canada". In the same year, the Official Languages of New Brunswick Act gave equal official status to English and French, making New Brunswick Canada's first and, to date, only officially bilingual province ([11], p. 16).

Dissatisfied with the Canadian government's solution, the Quebec government struck its own commission of inquiry into the status of French in the province. It subsequently passed Bills 22 (in 1974) and 101 (1977) proclaiming French the official language of Quebec and favouring the use of French at school and at work in the province.

According to one observer, "All these measures can be construed as attempts to bolster the French-speaking minority's resistance to Anglicization at the Canadian level, and, within Quebec, to give French a new power of assimilation among Allophone immigrants - ultimately, to compensate at least partially for inadequate Francophone fertility in Quebec by means of Francization, just as the Anglophone majority succeeds in doing via Anglicization at the Canadian level"([7], p. 41). In this light, it is essential to examine the impact of these measures, by carefully evaluating the trends of language shift regarding Canada's various French-speaking populations over the past 30 years.

1.2 Brief overview of previous studies regarding language shift trends

Many important and influential works have been produced on language shift trends affecting the French-speaking population in Canada. For example, Lachapelle and Henripin observed that language shift in Canada had acted so as to reduce the proportion of Francophones and to increase the proportion of Anglophones. They predicted that this trend would not likely be reversed though it might be alleviated somewhat ([25], p. 308). At the same time, they noted that Francophones had been concentrating more and more in Quebec, with the proportion of Anglophones increasing in the rest of Canada ([25], p. xxxii).

Using census language data from 1971 onwards, de Vries showed that the Francophone population outside Quebec failed to maintain itself ([15], p. 63), and that the largest Francophone minority outside Quebec, namely, the Franco-Ontarians, experienced increasing shift to English ([15], p. 64). Following the 1996 census, Castonguay pointed out that anglicization rate of Francophones outside Quebec increased consistently during the 25-year period from 1971 to 1996, while in Quebec the allophone language shift toward English would continue to "undermine the percentage weight of the francophone majority in Quebec"([8], p. 74).

However, a few researchers, such as Mougeon and Beniak, have been more optimistic about the survival of the French-speaking populations. After examining the sociolinguistic conditions favouring language shift and sociopolitical developments aimed at reducing linguistic assimilation for the Francophone minority in Ontario, they argued that "language shift is not necessarily an inexorable process", and "Franco-Ontarians have now reached a level of institutional support for their ancestral language that makes it both possible and attractive for those who wish to maintain French to do so"([31], pp. 123-124).

The studies discussed above, as well as some others, have thrown great light on language shift trends affecting the French-speaking populations in Canada. We shall further discuss these works in Chapter 3 along with our own findings.

1.3 Measurement of language shift

Linguists have defined language shift as "the change from the habitual use of one language to that of another"([?], p. 68). In Canada, census data have been the most important resource for measuring language shift and its counterpart, language maintenance. Before 1971, due to the lack of any data measuring the current use of language, language shift and language maintenance were gauged either by calculating the ratio of the population of a given mother tongue to the population of its corresponding ethnic group ([24], p. 31), or by comparing the mother tongue and the official language data of children to that of their parents ([29], p. 182).

However, both methods have severe limitations. As for the first method, the ethnic origin question in Canadian censuses is problematic to begin with. For example, the vague and confusing definition of ethnic origin created some difficulty for the respondent to identify his or her ethnic origin (for an in-depth discussion, see [39]; [32], p. 35; [14], pp. 349-356). Critics also pointed out that language shift calculated in this way could not reflect the current situation, since the mother tongue data did not profile the contemporary use of language at the time of the census, so that the information concerning it "is a generation behind the facts"([36], p. 18). The deficiency of the second measurement was also pointed out in Gryz's paper in 1977, where he demonstrated that Lieberson's use of some 1931 census cross-tabulations to estimate the language distribution for 1961 had resulted in certain distortions ([22]).

Thanks to a suggestion of the Royal Commission on Bilingualism and Biculturalism (RCBB), a question on current home language was added to the census in 1971. Home language was defined as the language spoken most often by the person at home. Unlike one's mother tongue, which is usually decided even before birth, a person's home language depends more on the preference of the respondent, as one's own home is a more intimate setting, where "constraints found in the language of education, of work, of the media, etc. are inoperative"([32], p. 6). Therefore, data from this question informed researchers directly on the current use of language at the time of the census, opening new dimensions for the study of language shift and language maintenance.

Soon several indicators for language shift were put forward ([5]; [13]; [22]). Later an "index of linguistic continuity", which corresponds to the ratio between the number of persons speaking a given main home language and those claiming the corresponding mother tongue, was developed by Lachapelle and Henripin to measure the effects of language shift ([25], pp. 120-122); and a "linguistic mobility rate", namely, the proportion of persons with a given mother tongue who use a different language at home, was used to measure the propensity of a given mother-tongue group to carry out a language shift (ibid).

The true measure of the vitality of a language in a situation of language shift is the extent to which a language is used ([20], p. 108). The index of linguistic continuity reflects this extent. Therefore, instead of using Lachapelle and Henripin's vocabulary, we will call the latter the "index of language vitality" and employ it to approximate the degree of language maintenance and shift regarding the French-speaking population of Canada in the following discussion. Moreover, these language shift trends will be depicted on the basis of Canadian census data concerning the native born population. The reason that we eliminate immigrant population from our observation lies in a consideration pointed out by the B&B Commission ([37], p. 119):

> *The fate of a language depends on the persistence of its use by the native born. While immigrants provide immediate support to the language, it is the native born who determine its retention in the long run.*

1.4 Some definitions and notations

The difference between this vitality index and unity will be considered as the net shift rate of a certain language, which can be illustrated by the following example. If we denote the Anglophone population in Canada by A, and the population of those claiming to speak English most often at home in Canada as a, then the vitality index of English in Canada is $\frac{a}{A}$. Let A_a stand for the number of members of A who claim to speak English most frequently at home. Using the same notation we can denote

the population of Anglophones who speak French most often at home as A_f , and the population of Anglophones (see Glossary) who speak other languages most often at home as A_t . Likewise, we can use F_a, F_f, F_t for maintenance and shift among Francophones, and T_a, T_f, T_t for maintenance or shift among Allophone. Since $a = A_a + F_a + T_a$, we have $\frac{a}{A} = \frac{A_a+F_a+T_a}{A} = \frac{A_a}{A} + \frac{F_a+T_a}{A}$, so that the vitality index is a combination of language maintenance among anglophones and of the attraction of English in terms of the Anglicization of Francophones and Allophones. We also obtain $\frac{a}{A} - 1 = \frac{a-A}{A} = \frac{(A_a+F_a+T_a)-(A_a+A_f+A_t)}{A} = \frac{(F_a-A_f)+(T_a-A_t)}{A}$. Now $F_a - A_f$ corresponds to the net shift from French to English, that is, the number of Francophones who shifted to English minus the number of Anglophones who shifted to French. Similarly $T_a - A_t$ measures net shift from other languages to English.

1.5 The nature of our customized census language data

To ensure the consistency of the sample universes from the censuses of 1971 to 2001, non-permanent residents, people living on Indian reservations and institutional residents have been excluded from our data.

The language data have also been simplified by equally distributing the relatively rare multiple answers among the appropriate major language categories as reported, namely, English, French and Other languages. It is reasonable to do so because of the following considerations. First of all, the number of respondents who give multiple answers to the mother tongue or main home language questions is generally small. Secondly, previous studies carried out by Statistics Canada have proved that multiple answers to the mother tongue question are highly unstable (e.g. [18]). Thirdly, it can be assumed that very few people really speak two languages exactly equally often at home, which also undermines the reliability of multiple answers to the main home language question.

As the present study concerns the French-speaking populations in Canada, we only examines those birth regions which contain a substantial population of people

who report French as mother tongue or main home language. Hence, in the following we will focus mainly on Canada as a whole, secondly on the province of Quebec and on the whole of Canada outside Quebec, and lastly on the provinces of New Brunswick and Ontario, and on the complementary regions comprising the whole of Canada outside of Quebec and New Brunswick, and the whole of Canada minus Quebec, New Brunswick, and Ontario. For convenience, Canada and the provinces of Quebec, New Brunswick and Ontario will be noted as "CA", "QC", "NB" and "ON", while the complementary regions will be referred as "CA-QC", "CA-QCNB" and "CA-QCNBON" respectively.

Chapter 2

Comparability of Census Data

2.1 Sources of comparability breaks

Language shift and language maintenance trends concerning a French-speaking population can tentatively be established by comparing the vitality index of French over censuses. However, "any comparison over time of census data would not be robust unless it is accompanied by clear statements underlying changes that take place from census to census - be they related to wording of questions, instructions that accompanied questions, coverage, collection, editing and imputation procedures, etc."([44], p. 25). Since the calculation of the vitality index requires both mother tongue and main home language data from Canadian censuses, a comparability break in either of these two types of data would lead us to misread the real trends of language shift. Therefore, it is essential to first examine closely the historical comparability of the census data concerning mother tongue and home language.

For example, in their study on the comparability of Canadian mother tongue census data between 1976 and 1981 ([17], pp. 10-12), Demers and Kralt noted that changes in census methodology were made in the wording of the mother tongue question, in the presentation of the question, in the transfer of data from questionnaire to computer and in the treatment of non-response and multiple responses. Such factors could be considered as potential sources of a comparability break in the home language and mother tongue data with which we are concerned. We shall also see

that bias built into a question may also be responsible for comparability problems in language data, to which we shall refer as a "question bias" in this study. On top of all this, various coverage errors, as well as changes in sample design and estimation procedures between censuses can also play a role in creating comparability breaks in census language data series.

We shall refer to changes in the wording and the layout of language questions in the census questionnaire as "questionnaire changes". This, together with question bias, will be summarized as "questionnaire factors" in this study. It has been shown in the National Census Test of November 1988 ([41], Tables F1 and F2, and p. 9) that, as far as the province of Quebec and the rest of Canada are concerned, the proposed questionnaire changes, which were eventually implemented in the 1991 census, will give birth to an over-enumeration of people who speak the majority language most often at home, along with a deflation of the Anglophone population. In addition, Castonguay *et al.* have further pointed out that questionnaire changes resulted similarly in a comparability break between the 1991 and 2001 census language data ([9]). Moreover, it has been found that a bias built into the census mother tongue question directly results in a continual mother tongue shift from Allophone to Anglophone among the population born in Canada [10]. While approximate information has been achieved on how fluctuations in coverage error have affected the mother tongue and home language data, according to Statistics Canada's net undercoverage estimates[1] and [46] (p. 8), how the other changes in the data production procedure, e.g., changes in transfer of data from questionnaire to computer ([17], p. 11), affected the comparability of mother tongue and home language data still remains largely unknown. In the present study we will therefore mainly examine how questionnaire factors have impacted the mother tongue and home language data, in order to produce more comparable vitality indices for French. As the various questionnaire factors differ in their impact on mother tongue and home language, it is necessary to analyze these factors separately for the two language questions concerned.

[1]Net undercoverage estimates by mother tongue are not available for censuses before 1991 ([45], p. 52). For 1991 and following censuses, the estimates are available upon request from the Social Survey Methods Division of Statistics Canada.

2.2 Questionnaire factors concerning mother tongue

There are two sources of mother tongue data: the short questionnaire, which is delivered to most households, and the long questionnaire, which is answered by a sample of residential households. In this study, mother tongue data from the short questionnaire will not be used for calculating the vitality index for birth cohorts, since questions concerning main home language and birth place, for example, are not contained in the short questionnaire. Thus the questionnaire factors concerning the mother tongue data derived from the long questionnaire are our main concern.

2.2.1 Questionnaire bias and its impact on Allophones

The most distinctive questionnaire factor concerning mother tongue (for definition, see Figures 2.2.3, 2, and 4) is that the language reported must be "still understood", an artificial condition for being a mother tongue ever since the 1941 census ([14], p. 357). Its possible impact on the census mother tongue data was pointed out by Lieberson in 1966: "very likely a certain part of the population who learned some other language first will no longer be able to speak or understand it and, therefore, will have some other language which they currently know reported as their mother tongue"([28], p. 12). We shall show that the second "some other languages" here are most probably the official languages by comparing the rates of decrease of mother tongue subgroups, based on our customized census language data concerning the non-immigrant population in 1991 and 1996[2]. The census questionnaires concerning language were perfectly identical for these two censuses, though the net undercoverage rate varied somewhat between 1991 and 1996 for the three mother tongue groups, as can be seen from Table 1.

We notice that, in 1996, in the whole of Canada, enumeration of all three mother tongue groups was improved, as compared to 1991, especially among Francophones. Decrease in net undercoverage rate is also observed among Anglophones and Francophones in the province of Quebec and in the rest of Canada. The Allophone population living in Quebec seems to have been much better enumerated in 1996, relative to

[2]For the literature review on this topic one may refer to [10] (pp. 1-3).

Table 1: Net undercoverage rates (in %) between 1991 and 1996, by census mother tongue

Net undercoverage rate	Place of residence	A	F	T	Total
1991	CA	2.50	2.50	4.90	2.85
	QC	2.10	2.30	5.70	2.58
	CA-QC	2.50	3.50	4.70	2.92
1996	CA	2.14	1.61	4.81	2.44
	QC	1.03	1.45	3.53	1.61
	CA-QC	2.18	2.55	5.02	2.71
2001	CA	2.31	1.58	7.02	2.89
	QC	1.35	1.43	6.39	1.90
	CA-QC	2.34	2.09	7.12	3.20

1991, while Allophones living in the rest of Canada experienced a somewhat higher net undercoverage rate in 1996. In the main, these differences resulted from different coverage errors among young adults below 35 years of age.

Table 2 shows that, from 1991 to 1996, among all birth cohorts except for the 15-19 cohort[3], the rates of decrease of Allophones are above average and much higher than those of Anglophones. The non-immigrant population is practically identical to the Canadian-born, and it can be assumed that any increase through in-migration of non-immigrants during the five years was negligible. Increase by birth is also excluded. Hence the fluctuations shown in Table 2 are a consequence of death, emigration, and comparability problems which includes coverage error and questionnaire factors. We may consider especially the cohorts between 35 and 54 years of age, for the undercoverage rate is known to be maximal among young adults, and for the more senior cohorts the mortality rates of the three language groups may not be equal and could thus act as a confounding factor to the issue at hand.

We notice that among the cohorts aged from 35 to 54, where the impacts of differences in coverage error, mortality rate, and, no doubt, also emigration are less

[3]While among the 15-19 cohort the rate of decrease of Allophones appears lower than average and that of Anglophones, this irregularity might probably be ascribed to a "return" of the previously non-enumerated Allophone children.

Table 2: Rate of decrease (in %) between 1991 and 1996 of non-immigrants, by census mother tongue, Canada

Age in 1991	Total	English	French	Other
0-4	-0.74	-2.04	-1.12	12.1
5-9	-0.55	-0.89	-0.96	5.38
10-14	0.37	0.52	-0.46	2.37
15-19	3.85	4.18	3.10	3.15
20-24	2.27	2.34	1.31	5.67
25-29	-0.03	-0.08	-0.51	3.43
30-34	1.18	1.06	0.76	5.65
35-39	1.34	1.24	1.08	5.44
40-44	1.67	1.59	1.33	8.22
45-49	3.33	3.24	3.14	7.14
50-54	4.35	4.05	4.17	9.39
55-59	5.30	4.76	5.53	9.14
60-64	8.70	7.91	9.46	11.98
65-69	14.12	13.26	15.52	15.28
70-74	21.11	19.92	23.43	22.09
75-79	33.46	31.62	37.55	33.81

important, the rate of decrease of Allophones is still much higher than that of Anglophones and Francophones, while the rates of decrease of Anglophones are uniformly lower than those for the total population. Although the improved coverage of Anglophones in 1996 and the consistent discrepancy between Anglophones and Allophones with respect to net undercoverage rate (see Table 1) may contribute slightly to slow down the decrease of Anglophones, it still appears that substantial net mother tongue shift from the Allophone cohorts to the Anglophone cohorts has occurred. The same conclusion can be drawn based on the comparison of the rate of decrease of mother tongue birth cohorts over the two ten-year periods from 1971 to 1981 and 1991 to 2001, though not for the decade from 1981 to 1991, as shown in Table 3. The exceptional case of the 1981-1991 decade will be explained in section 2.2.3 below. For users of the linguistic continuity index, or language vitality index, neglecting the mother tongue shift caused by the built-in bias in the census mother tongue question would definitely underestimate the extent of language shift to English among the Allophone minority.

Among all the cohorts aged below 55, the rate of decrease of Francophones in Table 2 is uniformly lower than average. However, it would be premature to assert the occurrence of mother tongue shift in favour of French, due to the following considerations. From Table 1 we have seen that, as compared to 1991, the coverage of Francophones was more greatly improved in 1996 than that of Anglophones and Allophones. As the younger Francophone cohorts were more likely to be missed in 1991 than the older cohorts, the improved coverage for Francophones might probably have given rise to an increase of the population for Francophone cohorts aged below 55. Therefore, "it is to be expected that an estimation of census mother tongue shift based on rates of decline of five-year birth cohorts between 1991 and 1996 will somewhat underestimate the true degree of loss of French due to such shifting"([10], p. 10).

One may also observe that the rate of decrease of the younger cohorts in Table 3 is sometimes quite high, in particular over the last two decades. This is not the result of mortality, but rather of the notoriously high undercoverage of these cohorts once they have reached the second census, by which time they are 25 to 34 years of

Table 3: Rate of decrease (in %) over ten years of selected birth cohorts born in Canada, by census mother tongue, Canada

Between 1971 and 1981				
Age in 1971	Total	English	French	Other
15-24	0.11	-1.70	1.20	22.22
25-34	0.95	0.26	0.66	12.43
35-44	2.36	1.89	2.58	5.31
45-54	6.83	5.87	7.55	12.01
Between 1981 and 1991				
Age in 1981	Total	English	French	Other
15-24	3.71	4.27	3.69	-4.83
25-34	1.51	2.19	0.56	-3.63
35-44	2.38	2.73	1.53	4.41
45-54	6.61	6.75	6.03	8.25
Between 1991 and 2001				
Age in 1991	Total	English	French	Other
15-24	6.66	6.98	5.09	9.86
25-34	2.20	2.18	1.28	8.10
35-44	3.02	3.03	2.57	7.53
45-54	6.69	6.63	6.20	12.07

age and less likely to be counted in. For an analysis of undercoverage rates by age, see, for example, [45] and [48].

2.2.2 Mother tongue shift regarding Francophones

We have established as well as possible that question bias, specifically, the additional clause "still understands" in the census mother tongue question causes substantial net mother tongue shift from the Allophone group to the Anglophone and Francophone groups in Canada. We may also notice from Table 2 that, notwithstanding considerably improved enumeration of Francophones in 1996 as compared to 1991, for the non-immigrants cohorts aged 55 years or more in 1991, the decrease rates of Francophones are consistently greater than those of Anglophones and of the total

population, which may imply the existence of sizable mother tongue shift from French to English in the later stages of life. As the language dynamic of Francophones can vary in different regions based on whether they are a majority or minority population, it is necessary to analyze the possible impacts of mother tongue shift on the enumeration of Francophones for the birth regions identified in section 1.5.

It is well understood that with respect to all birth regions outside Quebec, for the most deeply assimilated Allophones, that is, Allophones who have forgotten their true mother tongues, the likelihood to report English as census mother tongue is much higher than to report French. Even inside Quebec, the assimilation of Allophones occurred three times more often in favour of English than in favour of French according to the 1971 census ([40], Table 2-1). Therefore it is likely that among Quebec-born Allophones more might have reported "English" too, than those who might have answered "French" to the mother tongue question. Furthermore, the chance is minimal for Francophones and Anglophones in Canada to be assimilated to any non-official language to such a extent that they can no longer understand French or English. However, the probability may not be negligible for deeply anglicized Francophones outside Quebec and New Brunswick to forget French. We may thus conclude that census mother tongue shift is prone to create an over-enumeration for Anglophones everywhere and an under-enumeration for Allophones for all birth regions, with, perhaps, a slight inflation of F in Quebec, while, much more probably, a noticeable deflation of F outside Quebec and New Brunswick, e.g., in Ontario, can be expected. For those born in New Brunswick, Allophones only amount to a very small proportion of the total population. Francophones have also maintained a large and territorially concentrated population and an educational system which is complete enough to ensure that their members remember French. It is thus understandable that census mother tongue shift among the New-Brunswick born would be practically non-existent.

An ideal confirmation for the above expectation could be obtained by comparing the population decrease rate of the three mother tongue groups between 1991 and 1996 by age cohorts born in these different regions, as we know that the two censuses used identical questionnaires with respect to all language characteristics, and that

other changes in terms of coverage error and data processing might also be considered as minor. This would eliminate the confounding effect of any change to the language questions. However, as such data are not available to us, we must rely on the comparison between 1971 and 1981 instead, as the changes regarding questionnaire factors between these two censuses will be shown in the following section to be minimal, compared with changes between 1981 and 1991, and between 1991 and 2001. This also holds for changes due to the national population gross undercoverage rate ([48], p. 68).

Table 4: Rate of decrease (in %) between 1971 and 1981 of selected birth cohorts, by birth region and census mother tongue

Birth region	Age in 1971	Total	A	F	T
CA	15-24	0.11	-1.70	1.20	22.22
	25-34	0.95	0.26	0.66	12.43
	35-44	2.36	1.89	2.58	5.31
	45-54	6.83	5.87	7.55	12.01
QC	15-24	0.66	1.28	0.11	31.98
	25-34	0.83	3.05	0.00	45.56
	35-44	1.70	-1.63	1.86	21.12
	45-54	6.48	2.79	6.69	29.65
CA-QC	15-24	-0.15	-1.90	7.68	21.04
	25-34	1.01	0.07	4.46	9.57
	35-44	2.68	2.13	6.39	4.26
	45-54	6.98	6.08	11.77	10.91
NB	15-24	-2.03	-3.78	0.46	38.12
	25-34	-3.63	-4.54	-2.54	45.67
	35-44	0.48	0.53	-0.09	44.84
	45-54	4.00	2.83	6.25	-1.20
CA-QCNB	15-24	-0.03	-1.82	11.23	20.98
	25-34	1.32	0.29	7.52	9.45
	35-44	2.82	2.21	8.94	4.16
	45-54	7.17	6.25	13.85	10.93
ON	15-24	0.80	-0.42	8.05	16.96
	25-34	3.16	2.03	6.99	24.76
	35-44	4.05	3.36	7.66	10.83
	45-54	8.71	7.84	13.05	19.26
CA-QCNBON	15-24	-0.78	-3.05	18.10	23.05
	25-34	-0.18	-1.14	8.55	5.38
	35-44	1.83	1.23	11.09	2.60
	45-54	5.98	4.90	15.02	9.23

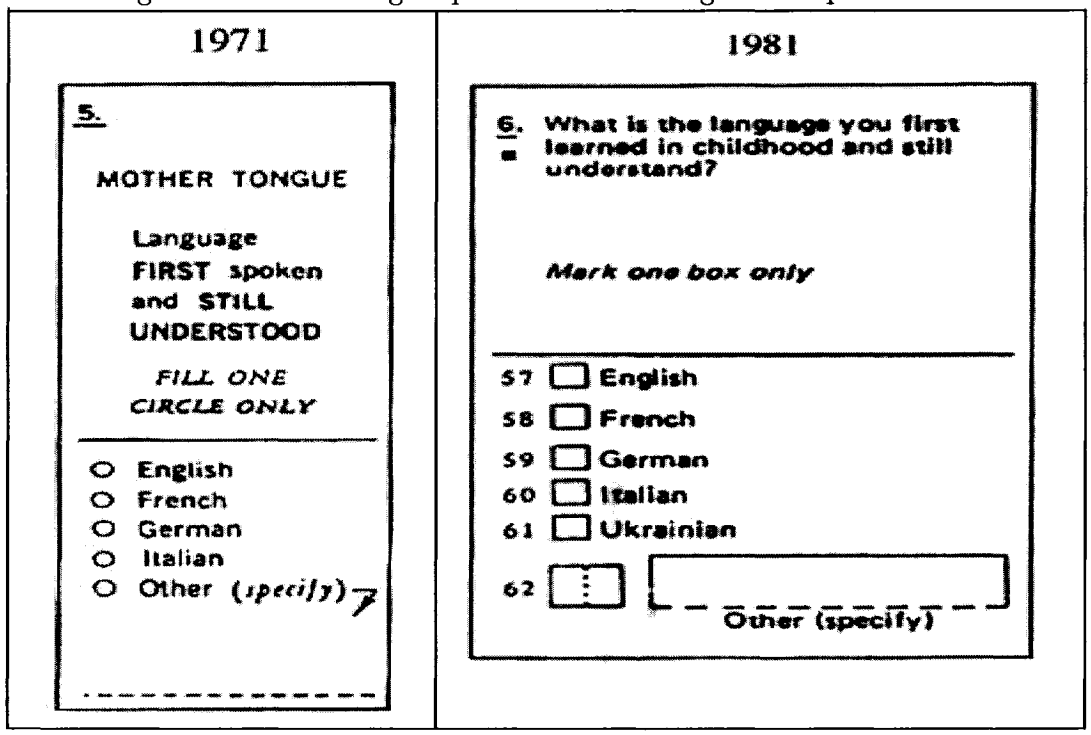
Table 4 shows that the above expectations are basically satisfied. In particular, among the 35-44 and 45-54 cohorts the expected discrepancies in decrease rates between Francophones and Anglophones are evident in the three complementary regions and in the province of Ontario, while for Canada as a whole the decrease rates for Francophones are also slightly greater in general than those for Anglophones. However, expectations are not so clearly confirmed for New Brunswick and Quebec. It can nevertheless be shown that the plausible mother tongue shift from other mother tongues to French among those born in these two regions and aged 35 to 44 and 45 to 54 is not statistically significant, according to a test procedure which will be described in section 2.3.2. This implies that between 1971 and 1981, net mother tongue shift may not have an significant impact on the enumeration of the Francophone population born in Quebec and that born in New Brunswick.

2.2.3 Questionnaire changes regarding mother tongue

Beside the questionnaire design factor, questionnaire changes also contribute to give rise to comparability problems in census mother tongue data. Let us first discuss the changes made in the mother tongue question between 1971 and 1981. We notice that in 1981 the "MOTHER TONGUE" title to the question in 1971 was abolished (Figure 2.2.3). The capitalized "FIRST" in 1971 was changed into lowercase in 1981, and "spoken" was replaced by "learned in childhood", by which the main nature of a mother tongue, that is, a first spoken language, was changed into being a first learned language. The impact of this modification, however, was believed to be minor by Demers and Kralt ([17], p. 10).

From Table 3 one may have noticed that among the 35-44 and 45-54 birth cohorts, during 1981-1991 the degree of mother tongue shift from Allophone to Anglophone is not as great as the shift observed between 1971 and 1981, and the discrepancy appears much broader when we compare decrease rates of the 15-24 and 25-34 birth cohorts in 1981 with those of the similar cohorts in 1971 over the respective following ten-year periods. We shall show that this is mainly due to the more major questionnaire changes made in 1991, which offset the impact of the question bias on the enumeration

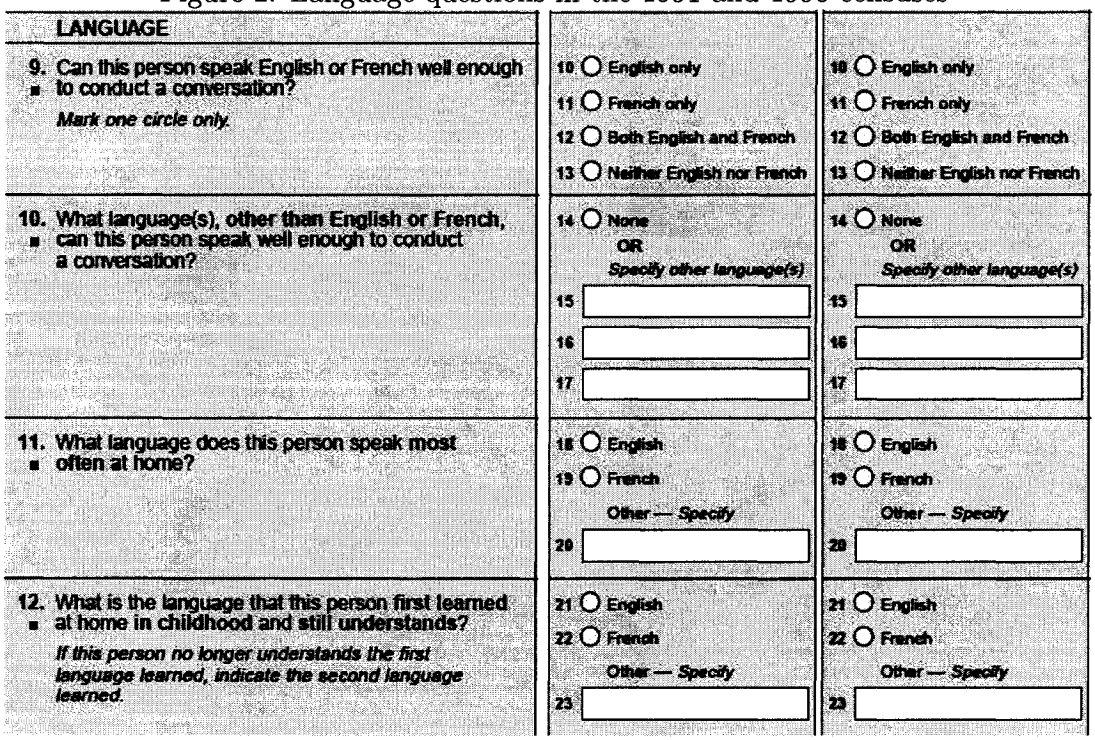
Figure 1: Mother tongue questions in the long census questionnaire



of Francophones and Allophones.

Comparing the mother tongue question in the 1981 census (Figure 2.2.3) with that in 1991 (Figure 2, Question 12), we note that "at home" was added in the later census, which could eliminate the chance for respondents to mistake this question as concerning language first learned at school, and hence help respondents to indicate their true mother tongue. In addition, multiple answers were allowed this time, as "Mark one box only" has been removed. However, the condition "still understand" has been strengthened by an additional requirement that those who have forgotten their mother tongue should answer by giving their second language learned. This no doubt aggravated the bias in favour of reporting assimilating languages in answer to mother tongue question. As a result, we could expect a widespread increase in the Anglophone population, and a corresponding under-enumeration of Allophones in 1991. However, the opposite happened, as we can see from Table 5.

Figure 2: Language questions in the 1991 and 1996 censuses



The explanation for this may be the parallel structure of consecutive pair of language questions in 1991, when all the language questions were gathered together on the same page for the first time. At the beginning of this new language module were set two questions concerning knowledge of official languages and knowledge of non-official languages (a new question first introduced in 1991), followed by the questions on main home language and mother tongue. This rearrangement might "supply a reasonable explanation for the comparability break between the 1991 language data and those from 1971 through 1986"([6]). After first answering the first pair of questions on the knowledge of official languages and on the knowledge of non-official languages, some respondents may have subsequently understood the next question, on main home language, as regarding the use of official languages at home, and taken the last question on "mother tongue", as concerning non-official languages (see Figure 2). Thus, contamination of the second pair of questions by the first pair would have encouraged the reporting of other mother tongues, and led to a leap in the proportion

Table 5: Census mother tongue composition of the population (in %) according to the short and long versions of the questionnaire, Canada, censuses of 1971 to 2001 (non-permanent residents excluded)

Census	English	French	Other
Short questionnaire			
1971	60.2	26.9	13.0
1981	61.5	25.7	12.8
1986	62.4	25.1	12.5
1991	62.3	24.5	13.2
1996	61.2	23.6	15.2
2001	62.0	22.9	15.1
Long questionnaire			
1971	60.1	26.9	13.0
1981	61.4	25.7	12.9
1986	62.2	25.1	12.7
1991	60.7	24.5	14.8
1996	60.1	23.6	16.3
2001	59.4	23.0	17.7

of Allophones in 1991. Table 5 shows that the increase was of the order of two percentage points more Allophones in 1991 than in the censuses of 1971 through 1986, where the parallel structure discussed above did not exist. As this parallel structure was maintained in the 1996 census long questionnaire, and a similar arrangement also held in 2001, the same large gap appears repeatedly between the proportion of Allophones according to the 20% sample and the other 80% of households in the two latest censuses (see Table 5).

In all, between 1981 and 1991 the new parallel structure introduced in 1991 would have produced an inflated enumeration of the Allophone population as compared to previous censuses; the adding of "at home" may have improved the reliability of the answers from F born outside Quebec and New Brunswick and T everywhere; but the condition "still understand" and the added instruction related to this would have impacted the mother tongue data in an opposite direction, as it encouraged deeply assimilated Allophones, for example, to answer English as their mother tongue. Of

these three factors the first appears to have been preeminent, so that mother tongue shift from T to A was reversed compared to that observed between 1971 and 1981, inverting the gap between their decrease rates.

Table 6: Rate of decrease (in %) between 1981 and 1991 of selected birth cohorts, by birth region and census mother tongue

Birth region	Age in 1981	Total	A	F	T
CA	15-24	3.71	4.27	3.69	-4.83
	25-34	1.51	2.19	0.56	-3.63
	35-44	2.38	2.73	1.53	4.41
	45-54	6.61	6.75	6.03	8.25
QC	15-24	4.37	10.90	3.62	-4.69
	25-34	1.59	5.59	1.05	-2.13
	35-44	2.37	5.29	1.99	4.70
	45-54	7.25	12.64	6.62	-4.22
CA-QC	15-24	3.43	3.85	4.12	-4.86
	25-34	1.48	1.98	-2.59	-3.79
	35-44	2.38	2.56	-1.24	4.40
	45-54	6.30	6.33	2.72	8.93
NB	15-24	4.35	4.61	4.24	-54.14
	25-34	0.62	2.25	-1.86	-51.33
	35-44	3.01	4.97	-0.12	-35.58
	45-54	6.67	8.39	3.87	-14.04
CA-QCNB	15-24	3.38	3.83	4.07	-4.76
	25-34	1.53	1.97	-2.98	-3.65
	35-44	2.34	2.44	-1.78	4.48
	45-54	6.27	6.22	2.22	8.96
ON	15-24	3.39	4.51	2.64	-13.20
	25-34	1.65	2.27	-2.24	-8.48
	35-44	1.97	2.30	-1.23	0.77
	45-54	6.30	6.30	5.97	6.99
CA-QCNBON	15-24	3.37	3.20	8.38	4.58
	25-34	1.42	1.70	-4.79	-0.95
	35-44	2.62	2.56	-2.89	5.26
	45-54	6.25	6.16	-4.32	9.39

Similar reversal was observed in the enumeration of F in 1991 through the inflation of Francophones born in all regions under study (see Table 6). While further explanations for this inflation remain to be explored, it has already been shown in the National Census Test of November 1988 that the new module of language questions, which was eventually implemented in 1991 census, is prone to create an inflation of

Francophones living in the province of Quebec and in the rest of Canada ([41], Table F1 and F2).

Table 7: Rate of decrease (in %) between 1991 and 2001 of selected birth cohorts, by birth region and census mother tongue

Birth region	Age in 1981	Total	A	F	T
CA	15-24	6.66	6.98	5.09	9.86
	25-34	2.20	2.18	1.28	8.10
	35-44	3.02	3.03	2.57	7.53
	45-54	6.69	6.63	6.20	12.07
QC	15-24	5.88	11.26	5.06	6.50
	25-34	1.90	5.16	1.25	7.50
	35-44	2.54	3.63	2.36	5.16
	45-54	6.42	8.90	6.11	8.72
CA-QC	15-24	6.94	6.76	5.33	10.74
	25-34	2.32	2.01	1.48	8.23
	35-44	3.24	2.99	3.86	7.77
	45-54	6.83	6.49	6.75	12.24
NB	15-24	7.29	8.33	4.58	42.09
	25-34	0.53	1.53	-1.16	-12.60
	35-44	3.93	3.49	4.63	6.03
	45-54	7.79	8.16	7.02	36.20
CA-QCNB	15-24	6.93	6.71	5.67	10.63
	25-34	2.41	2.02	2.65	8.29
	35-44	3.20	2.97	3.44	7.78
	45-54	6.77	6.41	6.63	12.18
ON	15-24	6.46	6.22	3.94	10.64
	25-34	2.08	1.66	1.92	7.68
	35-44	2.89	2.77	2.63	6.51
	45-54	6.83	6.83	6.24	8.85
CA-QCNBON	15-24	7.39	7.16	11.67	10.62
	25-34	2.74	2.35	4.99	9.10
	35-44	3.47	3.15	5.37	8.54
	45-54	6.72	6.07	7.39	12.91

In 2001 a question concerning secondary use of language at home on a regular basis was added to the language module, partially replacing the mother tongue question in the parallel structure, and leaving respondents to indicate their mother tongue after expressing their knowledge of official languages and of non-official languages and their principal and secondary uses of languages at home. Furthermore, for the first time "Français" preceded "Anglais" in all questions and answer areas throughout

the language section of the French version of the census questionnaire. This, together with question bias, and better improved coverage for Francophone than for other mother tongue groups in 2001, relative to 1991 (see Table 1), may have contributed substantially in the inflation of F for Quebec and for the whole of Canada, as Table 7 suggests. For the cohorts aged 35 to 44 and 45 to 54 born in other regions, changes in mother tongue profile with respect to F and NF over the last ten-year period can be shown to be statistically identical, according to a test discussed in section 2.3.2. Thus enumeration of F among these mature cohorts between 1991 and 2001 may be considered as comparable.

2.3 Questionnaire factors concerning home language

The home language question in Canadian censuses is not biased, like that for mother tongue, in favour of assimilating languages, i.e., English and French. Consequently only questionnaire changes may contribute to explaining comparability breaks in home language data. Questionnaire changes may cause comparability problems through the different way that language groups respond to them. Some language groups can be more sensitive to such changes than others.

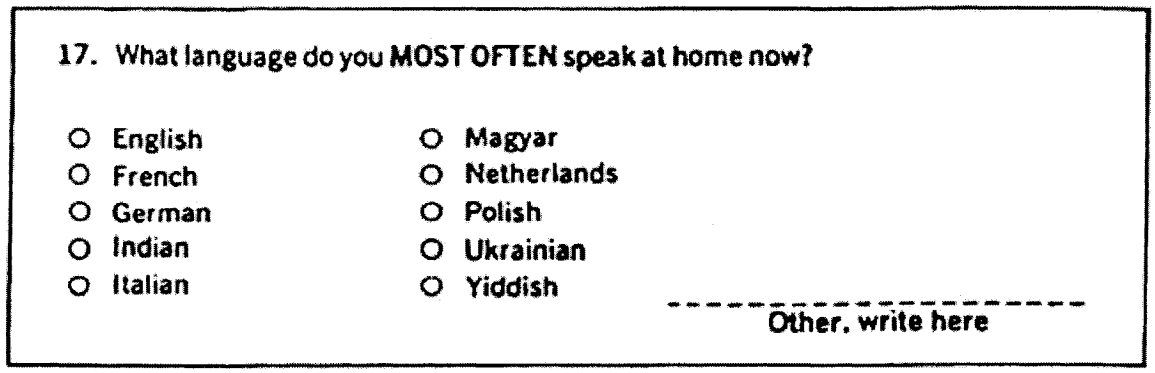
2.3.1 Questionnaire changes concerning home language

From Figure 3 we can see that the main difference between the home language question in 1971 and that in 1981 lies in the wording. In 1981 the qualification "MOST OFTEN" used in 1971 was relegated to a follow-up question added in parentheses, an additional "yourself" was introduced, and single answers were explicitly solicited by adding "Mark one box only". Aside from this, several non-official languages listed for selection in 1971 were removed in 1981, and the provided options "English" and "French" occupied slightly more space than the other languages in the layout. In all, however, changes in the modified wording of the question between 1971 and 1981 remained rather minimal.

Ten years later the official languages obtained more space in the answer area, as

Figure 3: Home language questions in the 1971 and 1981 censuses

1971



1981

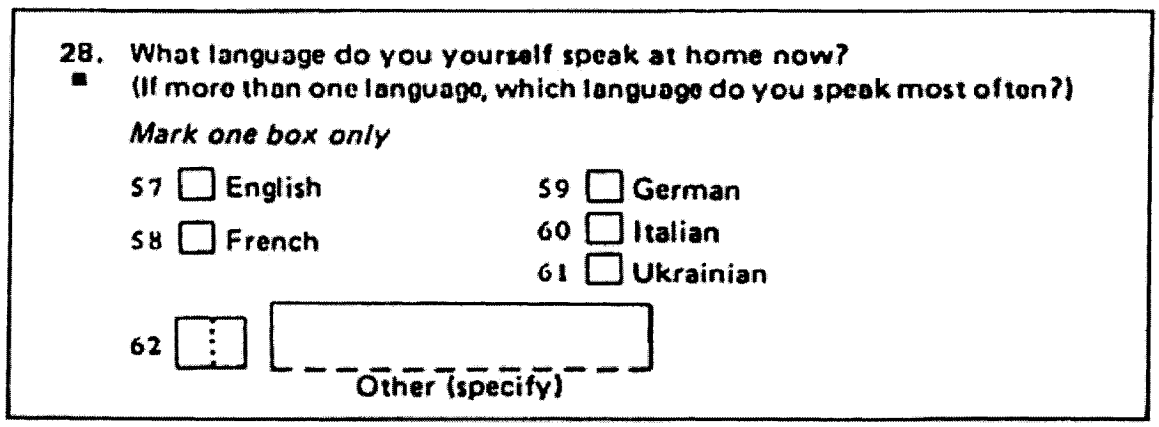
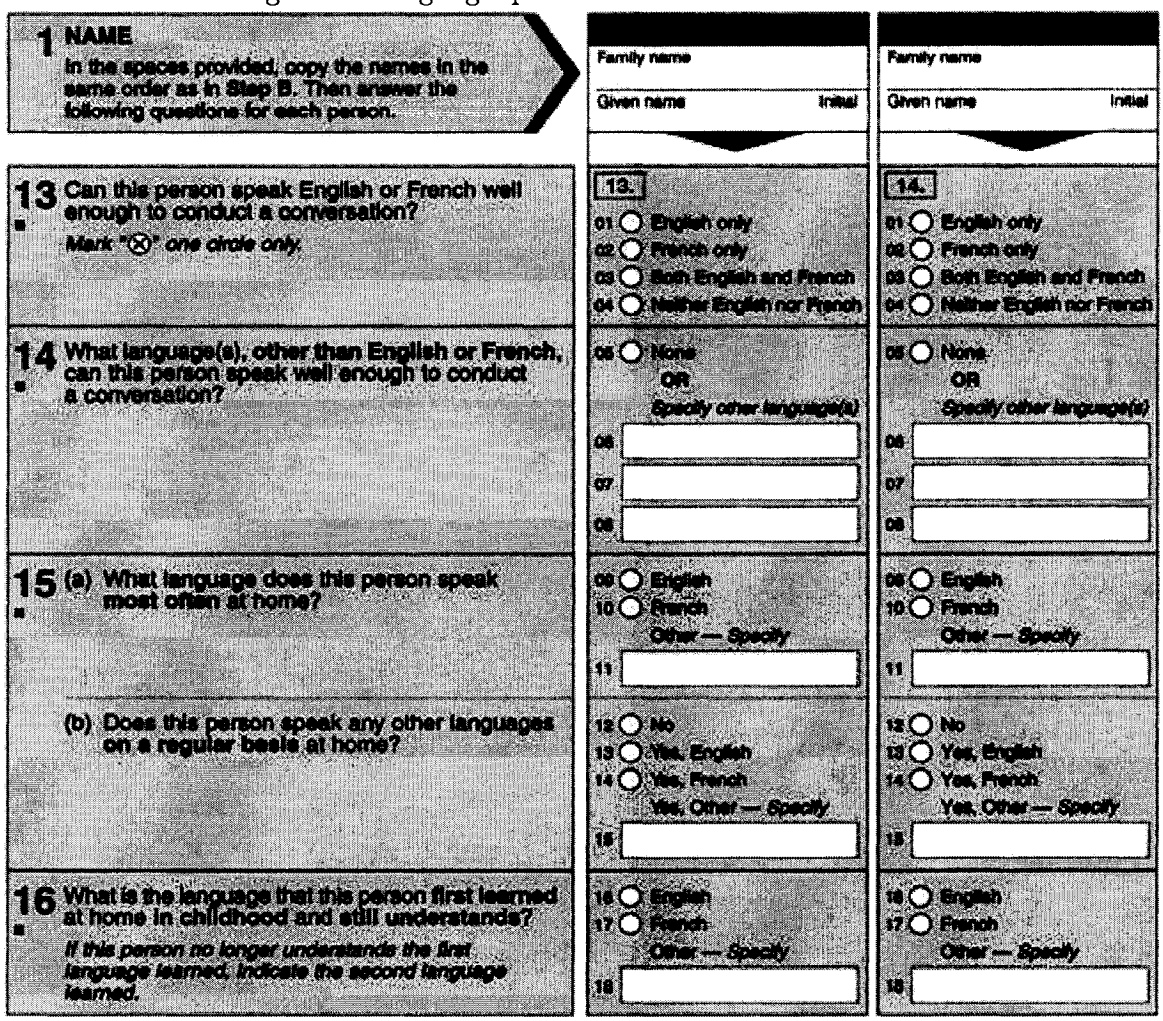


Figure 4: Language questions in the 2001 census



languages other than English and French which had been listed on the 1981 questionnaire were all removed in 1991. In addition, the home language question in 1991 was simplified to an analogue of that in 1971, with the words "most often" being reintroduced and bolded, though not in upper case (Figure 2). Above all, for the first time all of the language questions were gathered together on the same page. This new design for language questions was maintained in the 2001 census questionnaire, though a new, supplementary question regarding secondary home language use "on a regular basis" was then added just after the main home language question (Figure 4).

2.3.2 A generalized procedure to test language shift

The method we use to examine the comparability problem among the Canadian home language data is based on an empirical theory regarding possible stable language behavior of the three major home language groups. Various researchers have postulated that, to all intents and purposes, language shift ceases to be operative beyond a certain age. Castonguay has hypothesized that net language shift from French to English is very rare beyond 35 or 40 years of age ([5], pp. 63-73). Lachapelle and Henripin have considered that significant shift ceases to occur somewhere between 30 and 50 years of age ([25], p. 121). Using indirect methods of estimation, de Vries has established that shift to Finnish as a principal language (not necessarily at home) among Swedish mother-tongue Finns became very infrequent after the age of thirty-five, and insignificant beyond the age of forty-five ([12], pp. 146-148). In the following sections we shall examine these opinions and specify, as far as possible, the age threshold beyond which language shift comes inactive. Our method is based on a statistical test, which we now set up as follows.

Suppose we are interested in a set of people named X living in a given geographic area. According to a given linguistic criterion, X is classified into r disjoint subgroups. Denote N as the total population of X. Let X_1, X_2 stand for X living in G at times $t = t_1$ and $t = t_2$, and denote their populations as N_{1+} and N_{2+}. We designate their linguistic subgroups at time $t = t_i$ as $X_{i1}, X_{i2}, \ldots, X_{ir}$, and denote the populations of

these subgroups as $N_{i1}, N_{i2}, \ldots, N_{ir}$, respectively.

Define p_{ij} as the proportion of the population of the jth subgroup of X to the total population of X_i at the time $t = t_i$, that is,

$$p_{ij} = \frac{N_{ij}}{N_i}, \; for \; i = 1, 2 \; and \; j = 1, 2, \ldots, r. \ldots \tag{1}$$

Let us first suppose that from time $t = t_1$ to $t = t_2$, there is no demographic change and no net language shift between any two subgroups. By "net language shift" we refer to a net gain or loss in the population of any subgroup over this period caused by members changing their linguistic character, and "demographic change" refers to change through births, deaths, immigration and emigration. We should obtain

$$N_1 = N_2 \; and \; N_{1j} = N_{2j}, \; for \; j = 1, 2, \ldots, r. \tag{2}$$

Now let us only consider the case where no net shift happens during the observed period. Assuming that these subgroups are all subject to the same degree of demographic change, we have

$$\frac{N_{21}}{N_{11}} = \frac{N_{22}}{N_{12}} = \cdots = \frac{N_{2r}}{N_{1r}} = \frac{N_2}{N_1}, \tag{3}$$

whence

$$p_{1j} = p_{2j}, \; for \; j = 1, 2, \ldots, r. \tag{4}$$

However, (4) will be nullified if net language shift happens between two or more subgroups. Therefore, under the assumption of uniform demographic change, to test whether any net shift happens from time t_1 to t_2 is equivalent to testing whether p_{1j} equals to p_{2j} for all $j = 1, 2, \ldots, r$. This can be expressed as follows.

$$H_0 : p_{1j} = p_{2j}, \; for \; j = 1, 2, \ldots, r$$

$$H_1 : For \; at \; least \; one \; \text{“}k\text{”}, \; p_{1k} \neq p_{2k}. \tag{5}$$

Suppose, next, that we have two simple random samples s_1 and s_2 comprised

respectively of n_{i+} individuals randomly drawn from X_i at time $t = t_i$ for $i = 1, 2$. Suppose also that the number of people in s_i who fall into subgroup j as n_{ij}, for $j = 1, 2, \ldots, r$. We then set up the following contingency table:

Table 8: Sampled population of linguistic subgroups at two censuses

Sampled Population of Linguistic Subgroups	*Subgroup* 1	*Subgroup* 2	...	*Subgroup r*	Sum
$t = t_1$	n_{11}	n_{12}	...	n_{1r}	n_{1+}
$t = t_2$	n_{21}	n_{22}	...	n_{2r}	n_{2+}
Sum	n_{+1}	n_{+2}	...	n_{+r}	n_{++}

Now $n_i = (n_{i1}, n_{i2}, \ldots, n_{ir})$ follows a multivariate hypergeometric distribution. The expected value of n_{ij} hence comes to be $n_{i+} * \frac{N_{ij}}{N_i}$, that is, $n_{i+} * p_{ij}$. When N_i tends to infinity with $\frac{N_{ij}}{N_i} = p_{ij}$ constant, n_i tends to the multinomial distribution with parameters $(p_{i1}, p_{i2}, \ldots, p_{ir})$ which satisfy $\sum_{j=1}^{r} p_{ij} = 1$. Suppose the p_{ij} are known, then Pearson's χ^2 test statistic will be formed as follows:

$$T = \sum_{i=1}^{2} \sum_{j=1}^{r} \frac{(n_{ij} - n_{i+} * p_{ij})^2}{n_{i+} * p_{ij}}$$

Karl Pearson has shown in 1900 that $\sum_{j=1}^{r} \frac{(n_{ij} - n_{i+} * p_{ij})^2}{n_{i+} * p_{ij}}$ follows a χ^2 distribution with $r - 1$ degrees of freedom.

However, our census language data are derived from large samples drawn without replacement. For this kind of sample, Rao has pointed out that it is necessary to modify $\frac{(n_{ij} - n_{i+} * p_{ij})^2}{n_{i+} * p_{ij}}$ using the finite population correction, by multiplying it by the factor $(1 - sample\ ratio)^{-1}$ ([34], p. 223). Since the samples are drawn independently at different times, the degrees of freedom of T are $2(r-1)$. When the p_{ij}s are unknown, we replace them in the formula for T by their maximum likelihood estimators (MLE) $\hat{p_{ij}} = \frac{n_{+j}}{n_{++}}$, and then $T's$ degrees of freedom reduce to $r - 1$ ([16], pp. 556-558; [2], pp. 516-518). Under the test level of 0.05, when the test statistic T is less than $\chi^2_{0.95}(r - 1)$, we claim that the null hypothesis can not be rejected.

2.3.3 Notes on the test procedure

For the above test procedure to be valid, demographic change should be uniform over all subgroups. This can partially be satisfied by utilizing data for non-immigrant birth cohorts, which entirely eliminates demographic change due to birth or immigration. The impact of non-immigrants returning to Canada can also be considered to be negligible. Among all subgroups, the rates of decline in population caused by the other two components of demographic change, namely, death and emigration, also need to be the same[4]. This could be assumed to be roughly true for middle-aged Canadian-born cohorts, say, aged 35 to 64, firstly because we are essentially dealing with persons of English, French and Other languages made up of persons who are born in Canada, and, secondly, because a difference in mortality or emigration rates at such an age may be considered to be slight. One may argue that indigenous people living on Indian reserves form an important component of t (the non-official home language population) and may cause mortality inequality between t and the official home language populations, since people living on reserves have a lowest life expectancy on average. But such residents have been excluded from the sample universe of our customized data. Although indigenous people living outside Indian reserves are included in our sample universe, we can still consider their possible impact on the mortality rate of t to be negligible, since most of them speak English as main home language. On the other hand, their population is too small, relative to the rest of the English home language population, to influence significantly the mortality rate of a.

In addition, we have to bear in mind that, instead of being real counts from the sampled households, our census data are a set of weighted estimates obtained by a statistical estimation procedure which varies over censuses ([47], pp. 6-7). Due to the lack of necessary information on these procedures, it is impossible to retrieve the exact original sample data from our customized census data ([4]). For the same reason we have to ignore the complex sample design and consider it as simple random sampling[5].

[4]According to Réjean Lachapelle, director of Statistics Canada's Demography Division, data for comparing mortality rates and emigration rates by mother tongue in Canada do not exist.

[5]Rao and Scott have presented a more appropriate chi-square test dealing with the case when

However, Lachapelle considers that the weights should be very close to the reciprocal of the sample ratio at the national level and at the level of the provinces[6]. Hence we can multiply our census data by the respective sample ratio to approximately recapture the sample data.

2.3.4 Testing the hypothesis

Now let us apply the test discussed above to the empirical hypothesis, as described in 2.3.2, for two consecutive censuses during which no change has occurred at all in the language questions. Fortunately, this can be tested between 1991 and 1996, since for these censuses the questions concerning language are perfectly identical[7]. Although we do not have the data for 1991 and 1996 by 5-year age groups for each of the birth regions analyzed above, we do have the customized 1991 and 1996 data for non-immigrants in the whole of Canada, with which we may verify our expectation. Here the total population is classified by main home language into three linguistic subgroups: those who speak English as main home language, those who speak French and those who speak Other languages. We recall that we denote them as a, f and t, as in section 1.4.

From Table 9 we can see that, given the conditions discussed in Section 2.3.3 are satisfied, net language shift among a, f and t is very significantly active for the young cohorts from 0 to 39, as well as for the old cohorts beyond 64 years of age. For the 40-44 and 60-64 cohorts, net language shift is also active but to a less significant extent. However, for the three cohorts from 45 to 59, it can be claimed, that at least for the whole of Canada, the home language profile of the test cohorts is stable throughout the five years between 1991 and 1996. If the components of demographic change (death and emigration) had a uniform effect on the three non-immigrant, middle-aged, language subgroups during this period, it can be concluded that none

the original sample data and the sample design are known ([34]).

[6]According to a telephone conversation with Réjean Lachapelle in February, 2006.

[7]Although from Table 1 one may argue that the net undercoverage rates between the two censuses are not identical, in particular for Quebec, we may practically consider the differential coverage errors as occurring mainly among young adults and adolescents and thus being of lesser importance for the middle-aged cohorts.

Table 9: Testing stability of the home language profiles, Canada, 1991 and 1996

Age in 1991	Census	a	f	t	Chi^2 of a	Chi^2 of f	Chi^2 of t	$Chi^2 \& p-value$
0-4	1991	260618	81702	24815	58.7052	0.4877	810.8381	1733.6543
	1996	269622	82667	17570	58.2729	0.4841	804.8663	0.0000
5-9	1991	260404	83487	13456	13.5435	0.3633	245.1889	516.7652
	1996	265225	83637	10463	13.4690	0.3613	243.8392	0.0000
10-14	1991	245486	90248	10468	2.6520	0.3723	39.4100	85.0241
	1996	246034	89592	9314	2.6618	0.3737	39.5542	0.0000
15-19	1991	243162	81962	9116	1.0929	0.5806	10.0426	23.9016
	1996	234705	78424	8242	1.1367	0.6039	10.4448	0.0000
20-24	1991	244356	82046	7834	4.3270	0.0000	153.2012	318.7167
	1996	240629	80181	5836	4.4276	0.0000	156.7610	0.0000
25-29	1991	283254	104806	5175	1.0438	0.2297	107.5397	217.5970
	1996	284304	105112	3925	1.0435	0.2296	107.5107	0.0000
30-34	1991	293418	115908	3419	0.0231	0.3957	27.9166	57.0094
	1996	290101	114921	2851	0.0234	0.4004	28.2501	0.0000
35-39	1991	256631	106732	2114	0.0140	0.0592	9.7649	19.8098
	1996	253296	105442	1838	0.0142	0.0600	9.8976	0.0000
40-44	1991	218457	95729	1390	0.0809	0.3841	2.6083	6.1987
	1996	214569	94469	1262	0.0822	0.3906	2.6526	0.0451
45-49	1991	163155	80714	1116	0.1176	0.3188	0.4444	1.7922
	1996	157477	78308	1040	0.1217	0.3298	0.4598	0.4082
50-54	1991	131107	61863	1183	0.0146	0.0401	0.0308	0.1748
	1996	125327	59259	1121	0.0153	0.0419	0.0322	0.9163
55-59	1991	121207	56563	1276	0.0157	0.0097	0.3270	0.7246
	1996	114854	53522	1173	0.0166	0.0102	0.3453	0.6961
60-64	1991	116617	53512	1305	0.6399	0.9569	1.7946	7.1059
	1996	106937	48469	1110	0.7009	1.0481	1.9656	0.0286
65-69	1991	105587	46228	1260	1.3093	2.6963	0.3404	9.4061
	1996	91305	39119	1048	1.5245	3.1393	0.3963	0.0091
70-74	1991	87305	33922	1290	3.2203	6.5241	3.3387	29.6678
	1996	69723	26012	915	4.0822	8.2702	4.2322	0.0000
75-79	1991	63587	23354	1192	8.8717	21.1782	3.2923	83.4513
	1996	43435	14506	702	13.3330	31.8282	4.9479	0.0000
80+	1991	45607	18527	1139	3.5080	7.2611	1.3077	39.8209
	1996	20368	7598	447	8.0589	16.6809	3.0043	0.0000

of the three language groups shows a significant net gain or net loss in these cohorts through home language shift. This supplies strong support for the null hypothesis that no net home language shift occurs among cohorts initially aged 45-54 over their next ten years of life.

It is necessary to add that as far as the cohorts aged 65 and over are concerned, most probably the test results reflect the fact that the conditions of equal mortality and emigration are not well satisfied for these people, rather than the fact that they show a real net language shift occurring during this last period of life. For example, de Vries has suggested that mortality may play a significant role as a confounding factor regarding language shift among elderly persons, in holding that mortality inequality between Finnish-speakers and Swedish-speakers is probably the cause for language shift observed in the highest age-categories, instead of Finnish-speakers really shifting to Swedish in their old age ([12], p. 148). On the other hand, however, forced changes in linguistic environment for health reasons, such as taking up residence in old persons' homes, or moving into their children's homes, may force shift to reappear independently of one's wishes as a formerly independent adult[8].

As the changes in questionnaire concerning home language were relatively minor between 1971 and 1981, testing the stability of the home language data of these two censuses for the Canadian-born 45-54 cohorts can provide a further opportunity to verify our null hypothesis. Table 10 summarizes the test results for these cohorts for the three major birth regions where f represents a significant part of the total population, namely, Canada, Quebec, and the complementary region Canada minus Quebec. Table 10 confirms that between 1971 and 1981, there was no significant net home language shift among cohorts aged 45-54 in 1971, for each of the three birth regions. Together with the results for the 1991-1996 period, this can be considered to verify the validity of our null hypothesis just about as soundly as possible using census data.

We therefore formulate as a theory that Canadian-born birth cohorts aged forty-five to fifty-four cease to carry out language shift, as they grow older up to the

[8]Those who live in private old persons' homes have not been excluded from the sample universe of our customized data.

Table 10: P-values of the modified Pearson's chi-squared statistic for test cohorts aged 45-54 at first census, first decade

Birth region	1971 - 1981
CA	0.5321
QC	0.2995
CA-QC	0.5161

ages of fifty-five to sixty-four. In other words, no net language shift should exist among cohorts initially aged 45 to 54 over the following ten years. Hence it can be claimed that a comparability break exists in home language data when we observe the occurrence of home language shift among such cohorts. In the following section we shall examine the occurrence of such a comparability break between 1981 and 1991 in particular, and again between 1991 and 2001.

2.3.5 Testing for comparability breaks in the home language data

Table 11: P-values of the modified Pearson's chi-squared statistic for test cohorts aged 45-54 at first census, last two decades

Birth region	1981 - 1991	1991 - 2001
CA	0.0000	0.0000
QC	0.0000	0.0101
CA-QC	0.0000	0.0000

Table 11 shows that on the contrary to the test results in Tables 9 and 10, over the period from 1981 to 1991, net home language shift appears to be significant for cohorts aged 45-54 in 1981. Furthermore, the second half of Table 11 shows that during the last ten-year period under consideration, net home language shift appears to also remain active among cohorts aged 45-54 in 1991. The unexpected and highly

statistically significant net home language shift observed among 45-54 cohorts in the three birth regions during these last two ten-year periods implies that there are very likely problems of historical comparability in the series of home language data from the censuses of 1981 to 2001.

Castonguay initiated the study of the association between changes in the 2001 census questionnaire and the comparability break emerging between the 2001 census language data and those collected previously. In [9] (p. 10) he explained that "the second pair of questions on primary and secondary languages spoken at home, (Figure 1 below, questions 15a and 15b) may conceivably have been taken to echo the first pair of questions on the knowledge of official and non-official languages, the first regarding English or French exclusively (question 13), and the second regarding 'language(s), **other than English or French**' (question 14)". More explicitly, he argued that this parallelism, created by the new questionnaire design introduced in 1991, apparently led question 15a to be understood by some respondents as concerning only the possible use of English or French at home, instead of the main home language, while the same respondents considered question 15b[9] as dealing with the use of non-official languages at home. Therefore, it can be expected that some people, previously in t, reported English or French instead as their main home language in 2001, and put their true main home language (presuming that they had really remained in t) in answer to the secondary home language question, leading to a jump in net main home language shift from t to a or f. This can be confirmed by comparing the rates of decrease of populations of the three home language groups listed in Table 12.

In the same presentation, Castonguay also pointed out that the similar parallel structure of language questions, in which the role of question 15b in 2001 was played in 1991 by the mother tongue question, might "supply a reasonable explanation for the comparability break between the 1991 language data and those from 1971 through 1986". As we have shown in section 2.2.3, after first answering the pair of questions on the knowledge of official languages and on the knowledge of non-official languages, some respondents may have subsequently understood the question on main home language as regarding the use of official languages at home, and taken the mother tongue

[9]Note the phrase "other languages" in the formulation of 15b: see Figure 4.

Table 12: Rate of decrease (in %) over ten years of cohorts aged 45-54 at first census, by main home language

Birth region	Total	a	f	t
Between 1981 and 1991				
CA	6.61	5.98	6.79	39.62
QC	7.25	11.25	6.51	25.24
CA-QC	6.30	5.58	9.02	40.77
Between 1991 and 2001				
CA	6.69	6.85	6.16	19.84
QC	6.42	8.29	6.12	20.75
CA-QC	6.83	6.75	6.60	19.77

question as concerning non-official languages. With respect to main home language data, some people normally in t might have thus reported English or French as their main home language, leading to an inflation of f for Quebec and an exaggerated increase in a for the rest of Canada (Table 12), while putting their true home language as answer to the mother tongue question. In all, distortions in enumeration of home language groups in 1991 contributed to "an artificial leap in assimilation rates of language minorities of all kinds", which was already "visible in the results of the National Census Test of November 1988"([6]; [41], Tables F1 and F2).

2.3.6 Impact of the detected comparability breaks on French home language speakers

We have seen that the comparability break between 1981 and 1991 led to an artificial increase in net home language shift from t to a among the 45-54 cohorts for all three major birth regions. We note that among the test cohorts born in Quebec, the increase in net shift from a to f over this decade also appears significant in terms of the absolute number, considering that the population of t is much too small (Table 12). It was also shown that during the next ten-year period, supplementary net shift from t to a was again generated by another comparability break in 2001 (Table 12). However, as our main concern in the present study is to analyze language shift trends

regarding the French-speaking population, it is necessary to explore in greater depth what impact, if any, the comparability breaks identified above have on the census data regarding f for the birth regions identified in 1.5. This will be examined through the same test procedure presented in 2.3.2. This time the whole set of people is classified into only two subgroups, according to whether they mainly speak French at home or not. We denote the complementary group of f as nf. The test results for the 45-54 birth cohorts for each ten-year period are summarized by birth region in Table 13.

Table 13: P-values of the modified Pearson's chi-squared statistic for testing stability of the home language profile of cohorts aged 45-54 at first census, for each of the three decades from 1971 to 2001

Birth region	1971 - 1981	1981 - 1991	1991 - 2001
CA	0.3935	0.5330	0.0424
QC	0.4735	0.0000	0.0115
CA-QC	0.7366	0.0075	0.8136
NB	0.9580	0.8062	0.2759
CA-QCNB	0.3926	0.0024	0.9919
ON	0.8653	0.0000	0.1281
CA-QCNBON	0.7996	0.1627	0.0073

We notice from Table 13 that during the first ten-year period, the language profiles with respect to f and nf are stable in all birth regions, which confirms what Table 10 already strongly suggested, namely, that no significant net shift between f and nf occurred and, hence, that for all regions the enumeration of f and nf in 1971 is comparable to that in 1981. This is fairly trivial, assuming that changes in coverage error and data processing were negligible, since we have already seen that, at least, the changes concerning the home language question were minor between these two censuses.

Comparing language data for the 1981 and 1991 censuses, Table 13 shows that for cohorts aged 45-54 at the first census who were born in the whole of Canada, born in New Brunswick, and born in Canada minus Quebec, New Brunswick, and Ontario, there is no significant net language shift between f and nf. For the same cohorts born in the four other regions, including Quebec and Ontario, significant net language

shift occurs between f and nf. While it may appear contradictory that no language shift has occurred at the level of persons born in Canada when a comparability break exists both in Quebec and Canada, it is because the increase in language shift among the test cohort born in Quebec and among that born in the rest of Canada go in opposite directions, and so cancel out at the level of the whole of Canada, as we shall see below.

Based on our theory that no net language shift should happen to cohorts initially aged 45 to 54 over the following 10 years, we are led to conclude that the comparability break between 1981 and 1991 census data did bias the enumeration of f born in Quebec, in Ontario, in Canada outside Quebec, and in Canada minus Quebec and New Brunswick. Recalling our previous analysis of the impact of changes in questionnaire in 1991, which has already shown that such changes were prone to encourage respondents to give official languages in answer to the main home language question, thus producing an artificial increase in the population of the majority language groups, we know that the 1981-1991 comparability break led to an inflation of f born in Quebec. From the fact that the cohort aged 45 to 54 born in the union of Quebec and Canada outside Quebec, that is, in Canada, shows no significant net language shift between f and nf, it follows that for the cohort born in Canada outside Quebec, the comparability break should lead to a deflation of f. As there is no significant shift of f in New Brunswick, this deflation of f can be expected in Canada minus Quebec and New Brunswick, and so in Ontario. Table 14 confirms all of these expectations[10].

We can also observe from Table 13 that unexpected net language shift between f and nf only happened between 1991 and 2001 to a mild extent among the 45-54 test cohorts born in Canada, while such cohorts born in Quebec and born in Canada minus Quebec, New Brunswick and Ontario experienced a more significant degree of unexpected shift. It is understandable that artificial net language shift may have occurred to a lesser extent than between 1981 and 1991, for the changes in questionnaire concerning main home language between the last two censuses were less important, when compared to the profound reform of language questions in 1991. The net language shift between f and nf for Quebec can be explained by a similar

[10] $d(*) = \frac{\textit{population of } * \textit{ in the first census} - \textit{population of } * \textit{ in the second census}}{\textit{population of } * \textit{ in the first census}} * 100\%$

Table 14: Rate of decrease (in %) of the population of the f and nf test cohorts, 1981-1991

Birth region	Census	f	nf	d(f)	d(nf)	d(Total)
CA	1981	118040	256679	6.79	6.53	6.61
	1991	110027	239930			
QC	1981	104956	18247	6.51	11.49	7.25
	1991	98123	16151			
CA-QC	1981	13084	238432	9.02	6.15	6.30
	1991	11904	223779			
NB	1981	4897	10772	7.02	6.51	6.67
	1991	4553	10071			
CA-QCNB	1981	8187	227661	10.21	6.13	6.27
	1991	7351	213709			
ON	1981	5955	97451	13.06	5.89	6.30
	1991	5177	91716			
CA-QCNBON	1981	2233	130210	2.69	6.31	6.25
	1991	2173	121992			

logic to that in 1991, namely, that the new two-tiered form of the home language question in 2001 led some people previously in nf to report f in 2001 as their main home language. This is especially so because of another significant change in the 2001 questionnaire, namely, "the simultaneous permutation of 'anglais' and 'français' everywhere in the French-language questionnaire" ([9], p. 14) between 1996 and 2001. The fact that "français" has been given priority over "anglais" in all census language questions and their answer areas for the first time in census history in 2001, is no doubt related to the inflation of shift from nf to f for Quebec. On the contrary, the comparability break in 2001 gave birth to a deflation of f for Canada minus Quebec, New Brunswick and Ontario, where the French version of the questionnaire is scarcely used, as suggested by Table 15. As far as the other birth regions are concerned, the enumeration of f appears not to have been significantly affected, and hence may be considered to be comparable to the population of f in 1991. We may add, however, that Table 15 also suggests that there might have been a mild degree of shift from nf to f in Ontario and New Brunswick, where the French version of the questionnaire is substantially used, a situation akin to that observed in Quebec, and likewise related

Table 15: Rate of decrease (in %) between 1991 and 2001 for the f and nf among test cohorts aged 45-54 at first census

Birth region	Census	f	nf	d(f)	d(nf)	d(total)
CA	1991	142555	295599	6.16	6.95	6.69
	2001	133769	275056			
QC	1991	128332	19349	6.12	8.45	6.42
	2001	120484	17714			
CA-QC	1991	14224	276251	6.60	6.84	6.83
	2001	13285	257342			
NB	1991	5916	13115	6.39	8.43	7.79
	2001	5538	12010			
CA-QCNB	1991	8308	263136	6.75	6.77	6.77
	2001	7747	245332			
ON	1991	6365	113458	4.59	6.95	6.83
	2001	6073	105570			
CA-QCNBON	1991	1943	149677	13.84	6.62	6.72
	2001	1674	139762			

to the new priority given to "français" over "anglais" in the French questionnaire.

2.4 Comparability breaks since 1971

Overall, under the assumption of uniform demographic changes for the three home language test cohorts aged 45 to 54, we can conclude that census home language data has been impacted, as summed up in Table 16, as a result of comparability problems caused by, though possibly not limited to, the questionnaire factors discussed in Section 2.3. We have also established in Section 2.2 that the built-in bias in the census mother tongue question, namely, the condition "still understands", has resulted in a deflation of Francophones born outside Quebec and New Brunswick all through the censuses from 1971 to 2001; that questionnaire changes in 1991 appear to have created a general inflation of F relative to 1981; and that changes made in the 2001 census questions probably contributed to the inflation of F for Canada and Quebec as compared to 1991. Based on these evaluations we shall adjust our customized census data in the following chapter.

Table 16: Impact of comparability problems on French home language counts, in 1991 and 2001, by birth region

Impacts on f	1981 - 1991	1991 - 2001
Inflation	QC	CA QC
Deflation	CA-QC ON CA-QCNB	CA-QCNBON

Chapter 3

Language Shift Trends

3.1 Neutralizing comparability breaks in the vitality index

Using $\frac{f}{F} = \frac{\frac{f}{total\ population}}{\frac{F}{total\ population}}$, we can calculate the vitality index for French by using the proportion of Francophones and the proportion of French-home-language speakers in the total population. We choose the vitality index of a cohort aged 45 to 54 at a given census to measure the vitality of French among people born in a given region, for the following reasons.

First, the vitality index of French for the whole population at a given census is a combination of the vitality indices of all age groups, weighted by their corresponding proportions among the total population. As net language shift is normally quite rare among infants and young children, vitality indices of the younger age groups should be close to 1. It can therefore be expected that a minority population whose age structure contains a higher proportion of infants would automatically show a higher vitality index, than an older minority population. In other words, the vitality index of an aging language minority which is subject to assimilation, such as the French-speaking population, will automatically decrease as time goes by, just because of the impact of its age structure on language shift for the total minority population. From this perspective, the vitality index of French for the whole French-speaking population

is not an appropriate indicator with which to follow language shift trends.

Secondly, as we have established in section 2.3.4, the proportion of people who speak French mainly at home to the total population should stabilize once this cohort reaches the ages of 45 to 54. Thirdly, the proportion of Francophones to the total population for a birth cohort aged 45 to 54 is most probably impacted by net mother tongue shift than any older cohorts. Thus the 45 to 54 cohort is old enough to have registered the full effect of language shift, yet young enough to alleviate at least some of the impact of mother tongue shift.

For the same reasons, the difference between one and the vitality index of a French minority cohort aged 45 to 54 at a given census will also best reflect the overall impact of assimilation on that cohort(see Section 1.3) as it went through the period in life during which language shift is significantly active. The cohort aged 45 to 54 will thus be used as a "reference" cohort to follow the vitality indices and language shift trends concerning French for the various birth regions.

However, from Chapter 2 we know that for several birth regions, the values of both f and F in the census data show comparability problems, quite likely related to questionnaire factors. The corresponding proportions for the 45 to 54 age cohorts need, therefore, to be modified, in order to adequately compare the vitality indices for French at different censuses, and draw more reliable language shift trends concerning the French-speaking populations.

We shall use the following approach to modify the vitality indices. First let us introduce some notation. Denote the population of f among a given ten-year birth cohort aged from a to b at a first census as ${}_{I}f_{ab}$, and let ${}_{II}f_{ab}$ stands for the population of f among a birth cohort aged from a to b at a second census ten years after. Similarly, we use ${}_{I}F_{ab}$ and ${}_{II}F_{ab}$ to represent the population of Francophones in cohorts aged from a to b at the first and second censuses. Also, we denote the total population of this cohort at the first census as ${}_{I}P_{ab}$, and that at the second census as ${}_{II}P_{ab}$. Now let us select a "yardstick" cohort, that is, a birth cohort which appears to remain relatively stable in terms of language behaviour over ten years when the census data are reasonably comparable.

For the home language data, we could choose the cohort aged 45-54 in the first

census as a yardstick, since we have established in section 2.3.4 that $\frac{{}_{I}f_{4554}}{{}_{I}P_{4554}}$ should normally remain unchanged over the following ten years, that is,

$$\frac{{}_{I}f_{4554}}{{}_{I}P_{4554}} = \frac{{}_{II}f_{5564}}{{}_{II}P_{5564}}. \tag{6}$$

Now for any two consecutive decennial censuses for which a comparability break has been identified in Chapter 2, say *census I* and *census II*, let us denote the bias in the proportion of f to the total population at census II as compared to census I by ${}_{I}b_{II}$. This relative bias can be approximately estimated by $\frac{{}_{II}f_{5564}}{{}_{II}P_{5564}} - \frac{{}_{I}f_{4554}}{{}_{I}P_{4554}}$. Under the assumption that the bias made to the proportion is uniform for mature cohorts born in a given region, say, those aged 45 to 64, to improve data comparability between censuses, we could subtract ${}_{I}b_{II}$ from the proportions of the matured age groups at *census II*. This provides the modified proportions of f to the total population for the mature cohorts.

As far as census mother tongue data is concerned, under the assumption of uniform demographic changes among A, F, and T, it should hold that $\frac{{}_{II}F_{5564}}{{}_{II}P_{5564}} = \frac{{}_{I}F_{4554}}{{}_{I}P_{4554}}$. We could similarly take the 45 to 54 cohort as yardstick, and use $\frac{{}_{II}F_{5564}}{{}_{II}P_{5564}} - \frac{{}_{I}F_{4554}}{{}_{I}P_{4554}}$ to estimate the impact of comparability problems, caused in particular by the questionnaire factors. Using the proportions for f and F adjusted in this way, we can then obtain adjusted vitality indices of the reference cohorts for French from 1971 to 2001, relative to the level in 1971.

These adjustments being made, we may consider that we have obtained more comparable vitality indices for French among the mature cohorts. Due to the different impacts of comparability breaks on the census mother tongue data as well as on the home language data in different birth regions, we shall carry out the adjustment of the corresponding proportions and analyze the resulted language shift trends concerning French not only for the whole of Canada, but also separately for each of the important birth regions.

3.2 Adjusted vitality trends by region

3.2.1 Canada

Unadjusted proportions concerning French from 1991 to 2001 are listed in Table 17. Numbers in the tables of this chapter are rounded off, other than exact values. In this table and the remainder of this chapter, we use the abbreviations $p_F = \frac{F}{total\ population}$, $and\ p_f = \frac{f}{total\ population}$.

As we have shown in Chapter 2, the enumeration of F was slightly under-estimated in 1981 mainly as a consequence of net mother tongue shift from F to NF. Then, because of a combination of factors including net mother tongue shift and the parallel structure in the questionnaire design introduced in 1991, it was over-estimated in 1991 relative to 1981. The proportion of Francophones in 2001 also appears to have been inflated relative to 1991, possibly as a result of a similar parallelism and the new priority given to "Français" over "Anglais" in the French version of census questionnaire, including greater improvement in coverage for Francophones than for the other two mother tongue groups as compared to 1991(Table 1). We need therefore to adjust the corresponding proportions in the last two censuses by the approach we described above.

Taking the 45 to 54 cohort as yardstick cohort for measuring bias in mother tongue data, from Table 17 we have ${}_{1971}b_{1981} = -0.0024$, which can be considered as an approximate estimate for the deflation among the mature cohorts. Then we repeat this correction procedure to the proportions in 1991 and those in 2001 based on the adjusted proportions in the previous censuses. The results are presented in the first half of Table 2.

As for f, its value for the whole of Canada in 2001 has been shown to be slightly overestimated in section 2.3.6 (see also Table 16). It is therefore only necessary to modify the corresponding proportions in 2001. Taking the 45-54 cohort as yardstick, we have ${}_{1991}b_{2001} = 0.018$. Deducting this value from the proportions in 2001, we have the second half of Table 18. From Table 18 we get the adjusted vitality indices for French among the reference cohorts, as listed in Table 19.

Table 19 shows that over the 30 years under examination, the vitality of French

Table 17: Unadjusted proportions for French by age group, born in Canada, 1971-2001

	p_F				p_f			
age at census	1971	1981	1991	2001	1971	1981	1991	2000
45-54	0.3156	0.3362	0.3506	0.3199	0.2942	0.3150	0.3254	0.2981
55-64	0.3089	0.3132	0.3383	0.3525	0.2912	0.2949	0.3144	0.3272

Table 18: Adjusted proportions for French by age group, born in Canada, 1971- 2001

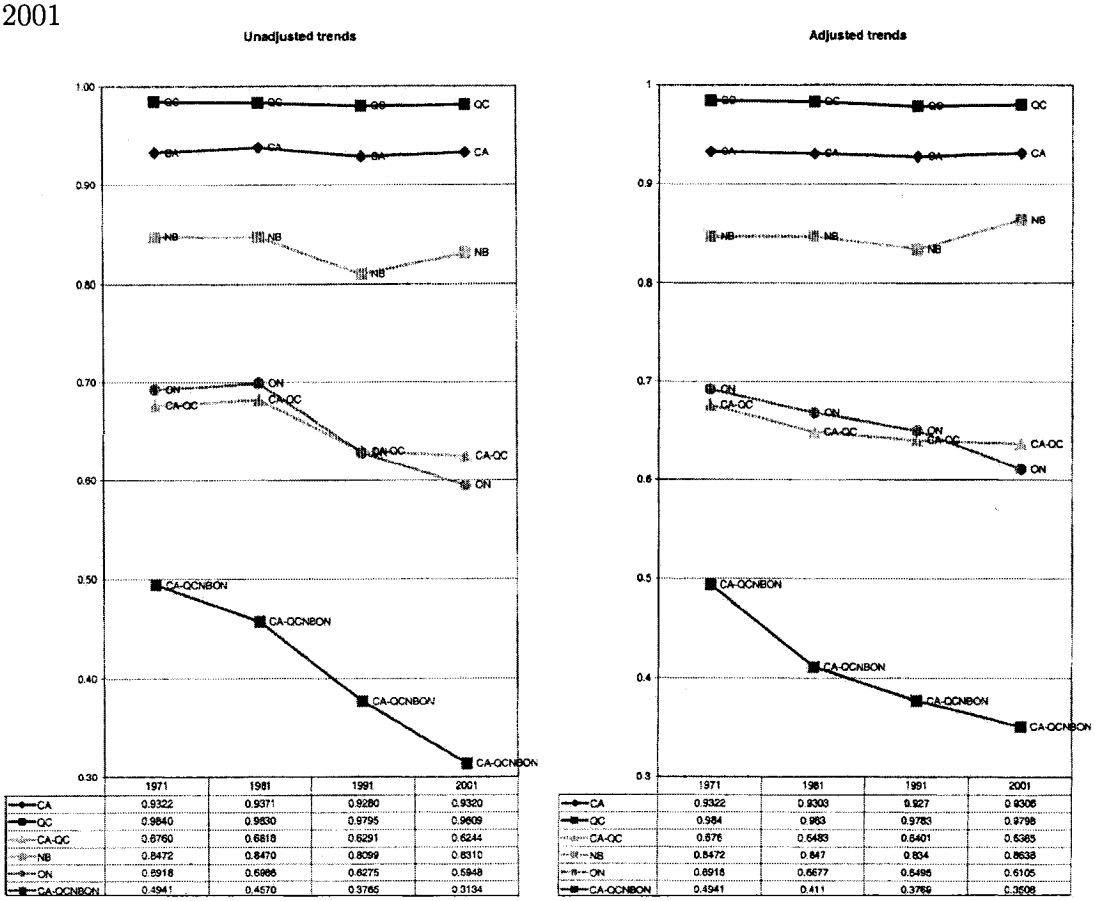
	p_F				p_f			
age at census	1971	1981	1991	2001	1971	1981	1991	2001
45-54	0.3156	0.3386	0.3510	0.3184	0.2942	0.3150	0.3254	0.2963
55-64	0.3089	0.3156	0.3386	0.3510	0.2912	0.2949	0.3144	0.3254

has always been below the maintenance level. This goes in line with the observation made by de Vries in 1994 to the effect that "the French language communities virtually all lost through net language shift"([15], p. 63). We also see that the vitality index continued to decrease slightly and steadily from 1971 to 1991, then rebounded in 2001. It is noteworthy that this trend is much different from the see-saw trend that we might draw from the unadjusted proportions (see Figure 5). To better appreciate this upturn, important regions within Canada need to be examined separately. We begin by breaking Canada up into Quebec and Canada minus Quebec.

Table 19: Adjusted vitality indices regarding the French-speaking population born in Canada, 1971- 2001

age at census	1971	1981	1991	2001
45-54	0.9322	0.9303	0.9270	0.9306

Figure 5: Comparison of adjusted and unadjusted vitality indices for French, 1971-2001



3.2.2 Quebec and Canada minus Quebec

Quebec

For people born in Quebec, the unadjusted proportions for French mother tongue as well as for French home language data are listed in Table 20. We have established in Chapter 2 that for these persons, the enumeration of F in 1991 was inflated relative to 1981. Similar inflation has also been observed in 2001 as compared to 1991.

Taking the cohort aged 45 to 54 in 1981 as yardstick, we have ${}_{1981}b_{1991} = 0.0058$ as the estimate for the inflation in 1991. Based on the adjusted proportions for F in 1991, we then adjust the p_Fs in 2001 with the cohort aged 45 to 54 in 1991.

We also know that inflation of f occurred in the 1991 and 2001 censuses among the population born in Quebec(Table 16). The inflation in 1991 can be approximated as 0.0068, by taking the cohort aged 45 to 54 in 1981 as yardstick. The p_f in 2001 also requires adjustment to be comparable with the adjusted proportion in 1991. Taking the 45 to 54 cohort in 1991 as yardstick, and repeating the same process, we obtain Table 21 and the vitality indices in Table 22.

Table 20: Unadjusted proportions for French by age group, born in Quebec, 1971-2001

	p_F				p_f			
age at census	1971	1981	1991	2001	1971	1981	1991	2001
45-54	0.8543	0.8667	0.8872	0.8736	0.8407	0.8519	0.8690	0.857
55-64	0.8383	0.8524	0.8725	0.8901	0.8266	0.8398	0.8587	0.8718

Table 21: Adjusted proportions for French by age group, born in Quebec, 1971- 2001

	p_F				p_f			
age at census	1971	1981	1991	2001	1971	1981	1991	2001
45-54	0.8543	0.8667	0.8813	0.8648	0.8407	0.8519	0.8622	0.8474
55-64	0.8383	0.8524	0.8667	0.8813	0.8266	0.8398	0.8519	0.8622

Table 22: Adjusted vitality index of the French-speaking population born in Quebec, 1971- 2001

age at census	1971	1981	1991	2001
45-54	0.9840	0.9830	0.9783	0.9798

Table 22 shows that after 20 years of increase in net shift rate (a decrease in vitality is equivalent to an increase in net language shift away from French) which had weakened the language maintenance among the French-speaking population born in Quebec, the vitality index rebounded in 2001, in parallel with what we observed above for Canada.

Canada minus Quebec

For the population born in the rest of Canada, we have the unadjusted proportions for French mother tongue and French home language listed in Table 23. As we have established in Chapter 2, the Francophone population born outside Quebec was in 1981 under-enumerated relative to 1991, due to net mother tongue shift, while it was inflated in 1991 relative to 1981, mainly as a result of the profound changes in questionnaire design.

Firstly, we take the cohort aged 45 to 54 in 1981 as yardstick, and obtain ${}_{1971}b_{1981} = -0.0039$ as the estimate for the deflation in 1981. In the same way we adjust the p_Fs in 1991 and in 2001 with the yardstick cohorts aged 45 to 54 aged respectively in the last two censuses.

We also know that an artificial deflation of f occurred in 1991 (Table 16), which can be approximated as 0.0015, by taking the cohort aged 45 to 54 in 1981 as yardstick. While the unadjusted enumeration of f in 1991 appears comparable to 2001, it still requires adjustment to be comparable with the adjusted enumeration in 1991. Taking the 45 to 54 cohort in 1991 as yardstick and repeating the same process we have Table 24 and hence the vitality indices in Table 25.

Table 23: Unadjusted proportions for French by age group, born in Canada minus Quebec, 1971- 2001

	p_F				p_f			
age at census	1971	1981	1991	2001	1971	1981	1991	2001
45-54	0.0767	0.0763	0.0778	0.0641	0.0519	0.0520	0.0490	0.0400
55-64	0.0727	0.0728	0.0792	0.0779	0.0524	0.0520	0.0505	0.0491

From Table 25 we see that net loss of the French-speaking population through language shift has been aggravated among people born in Canada outside Quebec, in contrast to a somewhat anomalous trend of $\frac{f}{F}$ as derived from the unadjusted proportions (see Figure 5). We shall now investigate whether this is a uniform trend through all of the component regions of major importance, which, taken together, make up this birth region, namely, New Brunswick, Ontario, and Canada minus Quebec, New Brunswick, and Ontario.

Table 24: Adjusted proportions for French by age group, born in Canada minus Quebec, 1971- 2001

	p_F				p_f			
age at census	1971	1981	1991	2001	1971	1981	1991	2001
45-54	0.0767	0.0802	0.0789	0.0651	0.0519	0.0520	0.0505	0.0414
55-64	0.0727	0.0767	0.0802	0.0789	0.0524	0.0520	0.0520	0.0505

Table 25: Adjusted vitality indices regarding the French-speaking population born in Canada minus Quebec, 1971- 2001

age at census	1971	1981	1991	2001
45-54	0.6760	0.6483	0.6401	0.6365

3.2.3 New Brunswick, Ontario, and the rest of Canada

New Brunswick

Table 26: Unadjusted proportions for French by age group, born in New Brunswick, 1971-2001

	p_F				p_f			
age at census	1971	1981	1991	2001	1971	1981	1991	2001
45-54	0.3455	0.3690	0.3838	0.3783	0.2927	0.3125	0.3108	0.3144
55-64	0.3195	0.3374	0.3801	0.3870	0.2826	0.293	0.3114	0.3156

It has been shown in Chapter 2 that an inflation of F occurred in 1991, which can be approximated as 0.0111, by taking the cohort aged 45 to 54 in 1981 as yardstick. While the unadjusted enumeration of F in 1991 appears comparable to 2001 (Table 26), it still requires adjustment to be comparable with the adjusted enumeration in 1991. Taking the 45 to 54 cohort in 1991 as yardstick and repeating the same process we have Table 27 (since f requires no adjustment: see Table 16) and hence the vitality indices in Table 28.

Table 28 shows that although language vitality of French declines from 1971 to 1991, the net maintenance rate of French rebounded in 2001 to its highest level

Table 27: Adjusted proportions for French by age group, born in New Brunswick, 1971-2001

	p_F				p_f			
age at census	1971	1981	1991	2001	1971	1981	1991	2001
45-54	0.3455	0.3690	0.3727	0.3640	0.2927	0.3125	0.3108	0.3144
55-64	0.3195	0.3374	0.3690	0.3727	0.2826	0.2930	0.3114	0.3156

Table 28: Adjusted vitality indices regarding the French-speaking population born in New Brunswick, 1971-2001

age at census	1971	1981	1991	2001
45-54	0.8472	0.8470	0.8340	0.8636

over the last 30 years. In addition, the adjusted vitality index for French varies less irregularly than the unadjusted values (Figure 5) for New Brunswick.

Ontario

Table 29: Unadjusted proportions for French by age group, born in Ontario, 1971-2001

	p_F				p_f			
age at census	1971	1981	1991	2001	1971	1981	1991	2001
45-54	0.0803	0.0824	0.0846	0.0668	0.0556	0.0576	0.0531	0.0398
55-64	0.0743	0.0765	0.0827	0.0852	0.0541	0.0554	0.0534	0.0544

Table 29 lists the unadjusted proportions for French mother tongue and home language for the Ontario-born. Chapter 2 has established that the Francophone population born in this region was under-enumerated in 1981, due to net mother tongue shift. This necessitates adjustment using the usual routine, and subsequently lead to the usual follow-up adjustments of the p_Fs in 1991 and 2001.

We also know that deflation of f occurred in 1991, which can be approximated as 0.0042, using the cohort aged 45 to 54 in 1981 as yardstick. Then we make the necessary adjustments in the usual way, and get the vitality indices in Table 31.

Table 30: Adjusted proportions for French by age group, born in Ontario, 1971-2001

	p_F				p_f			
age at census	1971	1981	1991	2001	1971	1981	1991	2001
45-54	0.0803	0.0862	0.0882	0.0698	0.0556	0.0576	0.0573	0.0426
55-64	0.0743	0.0803	0.0862	0.0882	0.0541	0.0554	0.0576	0.0573

Table 31: Adjusted vitality indices regarding the French-speaking population born in Ontario, 1971-2001

age at census	1971	1981	1991	2001
45-54	0.6918	0.6677	0.6495	0.6105

We see from Table 31 that the language vitality of French among this largest French minority outside Quebec declines steadily and relatively rapidly over the last 30 years, indicating an increase in the power of assimilation of English. We also notice the see-saw trend obtained from the unadjusted p_Fs and p_fs (see Figure 5), which appears much more irregular than the adjusted vitality trend and can hardly be explained by fluctuating social and political conditions.

The rest of Canada

Table 32: Unadjusted proportions for French by age group, born in Canada minus Quebec, New Brunswick, and Ontario, 1971-2001

	p_F				p_f			
age at census	1971	1981	1991	2001	1971	1981	1991	2001
45-54	0.0429	0.0369	0.034	0.0243	0.0212	0.0169	0.0128	0.0076
55-64	0.0414	0.0388	0.041	0.0338	0.0230	0.0211	0.0175	0.0118

Unadjusted proportions are listed in Table 32. In Chapter 2 we showed that the Francophone population was under-enumerated in 1981, due to net mother tongue shift, while it was inflated in 1991 relative to 1981, mainly as a result of the profound changes in questionnaire. We also know that a deflation of f occurred in 2001, which

can be approximated as 0.0010, by taking the cohort aged 45 to 54 in 1981 as yardstick. Carrying out the necessary adjustments in the usual way, we have Tables 33 and 34.

Table 33: Adjusted proportions for French by age group, born in Canada minus Quebec, New Brunswick, and Ontario, 1971-2001

	p_F				p_f			
age at census	1971	1981	1991	2001	1971	1981	1991	2001
45-54	0.0429	0.0410	0.0340	0.0245	0.0212	0.0169	0.0128	0.0086
55-64	0.0414	0.0429	0.0410	0.0340	0.0230	0.0211	0.0175	0.0128

Table 34: Adjusted vitality index of French, born in Canada minus Quebec, New Brunswick, and Ontario, 1971-2001

age at census	1971	1981	1991	2001
45-54	0.4941	0.4110	0.3769	0.3508

From Tables 33 and 34, we notice that not only the vitality index but also the proportions of Francophone and people speaking French mainly at home among the total population in the older cohorts born in this region declined rapidly and consistently over the 30 years from 1971 to 2001. The adjusted trend appears less abrupt, and is more reasonable than the unadjusted trend (Figure 5), in that the adjusted trend tends asymptotically towards $\frac{f}{F} = 0$, whereas the adjusted trend suggests $\frac{f}{F}$ is heading for negative values, which are impossible.

3.3 Discussion of adjusted trends

3.3.1 Canada, Quebec and Canada minus Quebec

Canada

The language vitality trend shown in Table 19 appears to suggest that the Canadian government's language planning policies and consequent programs aimed at promoting the use of French in Canada (for details, see [21]) have helped the Francophone

population to resist the power of Anglicization to such a extent, that net language shift to the detriment of French has been slowed down and even somewhat alleviated. However, it might not be appropriate to draw such a conclusion, due to the following analysis and considerations.

Quebec

We saw in Table 22 that the language vitality index of French rebounded in 2001 after 20 years of slight but consistent decline. The language legislation and language planning policies promulgated by the Quebec government, aimed at improving the status of French (for details, see [23], pp. 133-140) might be one reason for this improvement. Also, the increasing territorial segregation between the English community and the French community from 1971 to 1991 ([15], p. 45), foreseen by Lachapelle and Henripin in the 1980s ([25], p. xxxii), has apparently continued through 2001, as Table 35 suggests[1]. This might have benefited the maintenance of French.

Table 35: Proportion of Quebec-born Francophones among Canadian-born Francophones, by age group, 1971-2001

Age at census	1971	1981	1991	2001
0-14	0.8535	0.8687	0.8778	0.8865
15-24	0.8559	0.8660	0.8666	0.8740
25-34	0.8512	0.8653	0.8666	0.8669
35-44	0.8415	0.8569	0.8611	0.8669
45-54	0.8316	0.8477	0.8528	0.8629
55-64	0.8373	0.8393	0.8423	0.8537
65+	0.8379	0.8410	0.8292	0.8380

However, full, i.e., an index of 1.00, vitality for the French language among the Quebec-born has not been achieved yet, in spite of a situation, in which, according to some observers, "language planning by the successive Quebec governments has transformed the society from an English-dominant to a French-dominant one"([23],

[1]This table is based on our customized data. Because the impact of comparability breaks on mother tongue data for Quebec-born Francophones consists of the main part of the same impact for Canadian born Francophones, it can be assumed that distortions left on these proportions by comparability problems become negligible.

p. 127). As "Quebec could no longer rely on its high fertility rate to counterbalance the growth of the English-speaking population"([23], p. 134), effective Francization of people of other mother tongues has been considered as an important solution in view of preserving the importance of French in the province. Nonetheless, the slight increase of the French vitality index shown in Table 22 suggests, that it will still take some time for the French-speaking population born in Quebec to attain the equivalent of full language maintenance, and more time still before an appreciable net gain from assimilating native-born people of other mother tongues is obtained.

Canada minus Quebec

Table 25 shows a consistent decrease in the vitality of French among people born outside Quebec. Reasons for such a trend might be, but are not limited to, the decreasing proportion of Francophones born outside Quebec among all the Francophone born in Canada (see Table 35) which resulted from the increasing linguistic polarization of the two official language communities, as well as the "subtractive Bilingualism and subsequent 'Anglicization'"([15], p. 49) existing in this region. De Vries pointed out that "the proportionately small francophone minorities outside Quebec have been eroding fairly rapidly through a process of language shift to English", in which bilingualism works as a necessary condition for language shift ([15], p. 66). The adjusted French vitality trend apparently supports that "a variety of federal and provincial policies appears to have been largely ineffective in reversing these sustained demolinguistic processes working against the French language outside Quebec"([15], p. 52).

A short summary

This decrease in vitality index for Canada minus Quebec, together with the increase of the vitality index regarding French in 2001 for the whole of Canada (see subsection 3.2.1), which appears even greater than the increase observed for Quebec, lends more weight to the conclusion that while the increase in vitality among the majority of Francophones, namely, Francophones born in Quebec, did help to improve the French vitality index for the whole of Canada, it is mainly the increasing concentration of

Francophones inside Quebec, and energetic Quebec language policies favouring the use of French, that improved the weight of Quebec-born Francophones among the total Francophone population, and subsequently led to an increase in the vitality index for the whole of Canada.

3.3.2 New Brunswick, Ontario and the rest of Canada

For New Brunswick, "where Francophones have obtained language rights equal to those of anglophones "([26], p. 209) and have gained more in "institutional completeness than any other provincial francophone minority"([8], p. 70), we notice that unlike the situation as a whole outside of Quebec, the French-speaking minority population born there has maintained its relative weight in the province throughout the period under observation. Such an improvement, in contrast to the trend observed for Canada minus Quebec, might be taken as a success in reversing the previously established language shift trend working against French, probably as a result of the greater progress for the Francophone communities in the field of education since 1969 ([26], p. 193), since " the availability of French schools has been an influential source of vitality"([26], p. 209).

The steady and consistent decrease in net language maintenance of French among the Ontario-born is due no doubt in part to the steady and relatively rapid decline in the relative weight of the French-speaking minority in this region ([30], pp. 146-151), since "demographic concentration conditions the extent to which francophones can develop a separate economic base, are present in the local government institutions, and hence can create a French environment for themselves"([31], p. 114).

Mougeon and Beniak have also pointed out the very basic causes of language shift, such as "migration with consequent 'minoritization' and subordination, industrialization, urbanization, secularization, etc."([31], p. 115). In addition, they documented societal bilingualism as one of the primary causes of shift to English in the Franco-Ontarian community ([31], p. 114), for the reason that "the acquisition of English by members of the French language minorities makes it more difficult for them to maintain their cognitive and communicative skills in French"([15], p. 49). After analyzing

continuity indices in 1971 and 1986 for Ontario, de Vries deduced that "even the sizeable francophone regional minorities in Ontario are increasingly becoming vulnerable to language shift to English, despite the gradual improvements in the language rights granted by the government of Ontario"([15], p. 64). Our finding appears to uphold this vulnerability regarding the French-speaking population.

For the population born in the rest of Canada, steady and appreciable decrease in the language vitality of French is shown in Table 34. More than 30 years after the promulgation of the Official Language Act, only a population equivalent to around one third of them speak French mainly at home, once they have reached the age of our reference cohort. Again this trend is partly related to a general and consistent decline in weight of the total Francophone and French-home-language populations among the people living in Prince Edward Island, Nova Scotia, Manitoba, and Saskatchewan ([30], pp. 144-153). It remains to be seen, however, whether the French minority communities born in this region "are probably bound for extinction in a generation"([15], p. 66), as the provinces of Alberta and British Columbia in particular continue to attract, among other new residents, French-speaking migrants from Quebec and outside Canada.

Chapter 4

Conclusion

In this study we have examined the historical comparability of Canadian census data on language maintenance and language shift for decennial censuses from 1971 to 2001. We have established a theory that under the assumption of uniform demographic changes for the three home language groups a, f, and t aged 45 to 54 over the following ten years, birth cohorts aged 45 to 54 cease to carry out language shift, as they grow older up to the ages of 55 to 64. With this theory we have been able to conclude that census home language data has been impacted, as listed in Table 16, as a result of comparability problems caused by, while possibly not limited to, questionnaire factors. We have also found that questionnaire bias, namely, "still understands" in census mother tongue definition has resulted in under-enumeration of the number of Francophones born outside Quebec and New Brunswick all through the censuses from 1971 to 2001, while the change in questionnaire design made in 1991 appears to have contributed to an inflation of F relative to 1981. We have seen too that changes made in the 2001 census questionnaire might have contributed to the inflation of F born in Canada and in Quebec as compared to 1991.

The language shift trends concerning the French-speaking population have been established in Chapter 3 by a set of vitality indices for reference cohorts, derived from corresponding proportions of Francophones and of French-home-language speakers in the total population adjusted on the basis of the knowledge obtained in testing the comparability of the mother tongue and home language data. We saw that for the

whole of Canada, the vitality index of French rebounded in 2001 after consistently decreasing from 1971 to 1991. This is likely related to the relatively high language vitality of Quebec-born Francophones and the increasing weight of this group among the whole Francophone population born in Canada, rather than indicating a nation-wide reversal of the earlier language shift trend which was unfavourable to French. For the provinces of Quebec and New Brunswick, we have observed that an increase in vitality index occurred recently, which may be taken as an improvement of the use of the French language after many years of efforts of promoting French. As far as other regions are concerned, the vitality of French went down continuously, which again confirms their precarious position under sustained assimilation.

However, we must admit, that due to the lack of independent evidence for the uniform demographic change assumption of the cohorts aged 45 to 54 over a ten-year period, our evaluations are subject to error to a certain extent. We also have to bear in mind that while we have established a strong association between comparability breaks and questionnaire factors, it remain possible that other factors, e.g. significant change in coverage error per language group, have also contributed to the comparability problems observed. Moreover, the assumption made for adjusting respective proportions, namely, that impacts of the observed comparability breaks are uniform among cohorts aged from 45 to 64 born in the same region, remains to be further explored. It would also be interesting to continue to follow the vitality trends as more recently born cohorts grow older, to better appreciate the efficiency of the many language laws implemented since the 1960s.

We understand, too, that to only consider born-in-region cohorts has a disadvantage, with respect to evaluating the language shift trends concerning the population living in a given region. However, this is the price to pay to eliminate the impact of inter-provincial migration and to better understand the regularity and irregularity underlying the Canadian census language data, in order to identify comparability breaks and make the necessary adjustments.

In spite of the potential confounding factors and untested assumptions, a consistent set of language questions is still desirable in order to maximize the validity and

historical comparability of Canadian census language data. To reduce the bias resulting from the questionnaire factors that have been pointed out, we suggest in closing that, with respect to the language module in 2001, the first pair of questions could be merged into a single question: "What language(s) can this person speak well enough to conduct a conversation?", while offering "English", "French", and "Other-specify" in its answer area. This would eliminate the contamination of the questions on home language(s) and mother tongue by the present pair of questions on knowledge of official and non-official languages. Furthermore, in the census mother tongue question, "still understands" and the follow-up requirement concerning the second language learned should be removed, to eliminate the bias caused by net mother tongue shift. Or this question could be phrased in two parts: a)What is the language that this person first learned at home in childhood? b)Does this person still understand that language? This would yield the same information as the present contorted question, while supplying a stable basis upon which to observe the full extent of language maintenance and shift in Canadian society.

Glossary

Anglophone: Person with English as mother tongue.

Francophone: Person with French as mother tongue.

Allophone: Person with a non-official language as mother tongue.

Non-official Language: In Canada, any language other than English or French.

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