PROSODIC RHYTHM IN REGIONAL VARIETIES OF FRENCH IN NEW BRUNSWICK (CANADA)

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ABSTRACT

This paper reports the results of a study of rhythm in four regional varieties of French spoken in New Brunswick, Canada's only officially bilingual (English-French) province. The demographic concentrations of French speakers vary across these varieties. Reading data from 140 native speakers were used to examine cross-regional patterns in speech timing. Rhythm metrics for vocalic, consonantal and syllabic intervals were applied. Significant regional differences were found for VarcoV and %V metrics. The metrics place the regional varieties along a continuum of more to less syllable-timed rhythms. The association of these regional differences in prosodic rhythm with the demographic concentrations of French speakers is discussed.

Keywords: Acadian French, rhythm metrics, vowel deletion, language contact, regional variation

1. INTRODUCTION

This paper investigates prosodic rhythm in four regional varieties of French spoken in New Brunswick, Canada, where French is in contact with English. We apply rhythm metrics to gauge durational variation across these varieties.

Historically, researchers proposed that languages could be classified as stress-, syllable- and mora-timed, as based on the perception of isochronous grouping units ([1]). Lack of empirical evidence for isochrony lead to the development of rhythm metrics (RMs) in the late 1990s ([21], [24]). These measures focus on variability in the durations of vocalic, consonantal and syllabic intervals. Certain metrics measure the variability of pairs of immediately adjacent intervals, while others quantify variation in intervals over entire utterances. These RMs have been used for comparisons among many languages and dialects, and have shown that languages can be placed along a continuum that separates syllable-timed languages, such as French, and stress-timed languages, such as English.

More recently, some researchers have taken a multidimensional view of rhythm, arguing that languages have co-existing rhythms at different prosodic levels ([12], [20], [23]). Thus, a language can simultaneously tend toward syllable timing on one dimension and toward stress timing on another dimension. Some of these models have looked beyond segment-based RMs to include timing at the syllabic, foot and phrasal levels ([3], [23]). Others measure acoustic cues such as intensity and f0 ([7], [8], [11], [15]) that play a role in speech rhythm. Finally, others propose weighted indices that combine several RMs ([8], [13]).

It is important to mention that a number of studies ([2] and [25], among others) point to shortcomings of the rhythm-metric approach. These include issues of reliability, stability and the dependence of RMs on sentence composition. Nevertheless, RMs continue to provide a framework for the study of variation in rhythm.

Rhythmic properties of contact varieties often show a transfer of prosodic features. For example, many studies of rhythm in English, a stress-timing language, report that contact varieties are less stress-timed – that is, more syllable-timed – than varieties spoken by monolingual speakers of British or American English ([12], [14], [26], [27]). Similarly, studies of rhythm in French, a syllable-timing language, reveal that speakers of contact varieties have less syllable-timed speech than Franco-dominant speakers ([9], [10]). A notable exception is rhythm in Ontario (Canada) French ([16]): speakers in regions where there is a higher degree of contact with English have a more syllable-timed rhythm than those from regions with a lower degree of contact.

In our study of cross-variety timing variation in New Brunswick French we expect to find differences in the degree of syllable-timing. Our hypothesis is that varieties with greater contact with English will display some effects of stress-timing and will be less syllable-timed than those varieties that have less contact with English. Specifically, the greater-contact (putatively less syllable-timed) varieties will display greater variability of vocalic interval durations (higher VarcoV), consonantal interval durations (higher deltaC) and syllabic durations (higher VarcoSYLL), and a lower proportion of vocalic material in the speech signal (%V).

2. FRENCH IN NEW BRUNSWICK

New Brunswick is Canada's only officially bilingual (English-French) province. Francophones, who represent about one-third of the total population of 750,000, live mainly in the northern and eastern parts of the province. However, demographic concentrations of French speakers vary considerably across these regions ([19]). A recent dialectometric study ([5]) finds that there are four regional varieties. The two northern varieties have very high concentrations of francophones: NorthWest (94%), NorthEast (84%). The southern varieties have lower concentrations: rural-SouthEast (70%), and Moncton-SouthEast (26% to 42%), which includes the urban area of Moncton and some adjoining rural areas that have low concentrations of Francophones. Speakers from the NorthWest region called themselves *Brayons* and/or *francophones*; those from the other three regions identify as *Acadiens*.

An earlier phonetic study ([22]) of the Moncton-SouthEast variety notes the "uneven" (*haché*, *heurté*) character of the rhythm. Qualitative observations suggest that this impression is due in part to variable vowel durations and to a strong articulatory or gestural effort on consonants that occur in the onsets of certain stressed syllables.

3. METHODOLOGY

3.1. Speakers and speech materials

Speech materials are from a corpus ([6]) used for research on the automatic speech recognition of French spoken in New Brunswick. The corpus consists of recordings by 140 native speakers of French from across the francophone regions.

The speakers are stratified by age and gender. There are two age groups: younger adults (mean: 20.8 years; Std. Dev.: 2.6) and older adults (mean: 48.3 years; Std. Dev.: 6.7). Each age group has an equal number of males and females. Although the number of speakers in the four regional varieties is uneven, each variety has a fairly large representation in the corpus: NorthWest (26), NorthEast (56), Moncton-SE (43), rural-SE (15).

3.2. Procedures and measurements

For the present study, we analyzed the two "calibration" sentences that contain segmental shibboleths. These two sentences, which were read by all 140 speakers, contain about 115 segments.

Je viens de lire dans l'Acadie Nouvelle qu'un pêcheur de Caraquet va monter une petite agence de voyage. C'est le même gars qui, l'année passée, a vendu sa maison à cinq Français d'Europe.

Sentences were segmented into vowels and consonants following generally accepted segmentation criteria. Syllables were identified using phonological as well as phonetic criteria (needed, for example, in cases of liaison). The analysis includes almost 14,000 segmental intervals (6,670 vocalic and 7,100 consonantal) and 6,814 syllables.

Durations for vocalic intervals, consonantal intervals and syllables (in msec) were extracted using a Praat script. Four rhythm metrics – VarcoV, %V, deltaC, VarcoSYLL – were calculated for each speaker using Mathlab.

3.3. Statistical analysis

One-way ANOVAs with regional variety as the independent variable were carried out on speakers' RM scores. The Tukey method (for unequal cell sizes) was used for post hoc comparisons among the four regional varieties. Age and gender were not included as independent variables in the ANOVAs. A follow-up exploratory study ran factor analyses of subjects-by-segments matrices (with segmental durations as entries in the matrices); varimax rotation was applied.

4. RESULTS

Results are presented in two parts. Section 4.1 reports the main results: applications of the rhythm metrics, and the ANOVA and post hoc testing for regional differences. Section 4.2 briefly presents some findings of the exploratory factor analyses.

Articulation rates, which exclude pauses and hesitations, show no differences among the four varieties ($p<0.567$).

4.1. Rhythm metrics

The error bar plots in Figures 1 and 2 summarize the results for the four RMs. The error bars show means and 95% confidence intervals.

Significant statistical differences among regional varieties were found for VarcoV: ($F(3,136)=3.302$, $p<.022$) (see Figure 1). Post hoc comparisons indicate a difference between NorthWest and Moncton-SE ($p<.013$); the NorthWest variety has lower VarcoV scores.

Significant differences among regional varieties were also found for %V: ($F(3,136)=3.232$, $p<.024$) (see Figure 1). Post hoc comparisons indicate differences between the NorthWest and rural-SE varieties ($p<.048$) and between NorthWest and Moncton-SE varieties ($p<.057$). In both comparisons

the NorthWest variety has lower %V scores than the southern varieties.

Figure 1: Error bar plots showing differences among four regional varieties on VarcoV and %V.

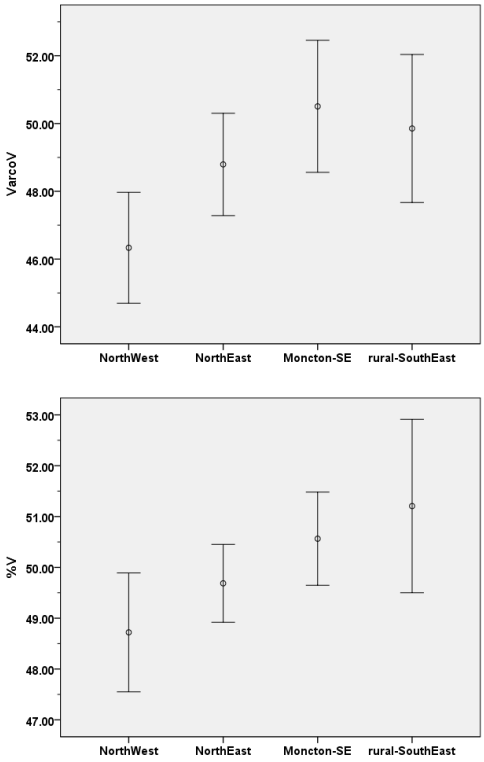
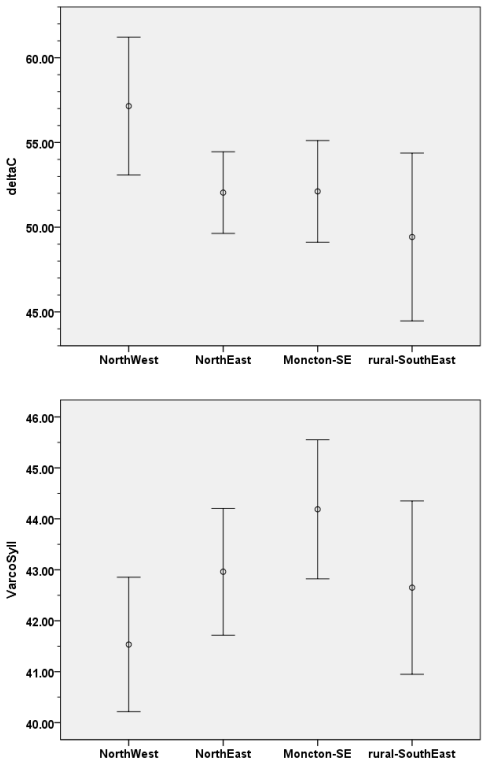


Figure 2: Error bar plots showing differences among four regional varieties on deltaC and VarcoSYLL.



As determined by ANOVA, there were no significant statistical differences among varieties for both deltaC and VarcoSYLL (see Figure 2). The p values failed to reach a significance level of $p<.05$: delta C ($F(3,136) = 2.674$, $p<.050$); VarcoSYLL ($F(3,136) = 2.220$, $p<.089$).

4.2. Some patterns of segmental durations

A follow-up exploratory study ran factor analyses of subjects-by-segments matrices, with segmental durations as entries in the matrices. These analyses identified several groups of segments that make large contributions to the variance in durational patterns. We briefly report results for one of these groups of segments.

The factor analyses identified two processes of vowel deletion. One is the deletion of /i, y/ in the context of the /t, d/ consonants that can assibilate to [ʦ, ʤ]; for example, *Acadi̲e Nouvelle* [akadinuvɛl, akadnuvɛl, akadznuvɛl]. There are three cases in the corpus, and the overall rate of /i, y/ deletion is 16.4% (total N = 69/420). The other process is schwa deletion, as in *de lire* [dəliR, dliR]. This optional rule is widely found in French. Of the six occurrences of schwa in the corpus four show variation, and the overall rate of schwa deletion for these cases is 6.6% (N = 37/560).

Table 1 summarizes the relative frequencies of the deletion of these vowels. Deletion rates for both vowels display the same descending order across varieties: the NorthWest has the highest rates, followed by NorthEast and Moncton-SE; the rural-SE has the lowest deletion rates.

Table 1: Relative frequencies of vowel deletions for four regional varieties.

	/i, y/ deletion	schwa deletion
NorthWest	59.0%	10.6%
NorthEast	10.1%	6.7%
Moncton-SE	3.9%	5.8%
rural-SE	2.2%	1.7%

5. DISCUSSION

The RM scores in Figures 1 and 2 are in line with scores reported for European and Canadian varieties of French (for example, [16], [24], [29]). This similarity suggests that all four New Brunswick French varieties are syllable-timed.

Significant differences among regions were found for two rhythm metrics. Results for VarcoV confirm our hypothesis: the NorthWest variety has the smallest variability in vocalic intervals – and is hence

more syllable-timed – while the Moncton-SE variety has larger variability in vocalic interval duration – and is less syllable-timed. However, results for the %V metric do not support our hypothesis: it is one of the southern varieties, rural-SE, that is the most syllable-timed because it has the highest %V scores; the NorthWest variety has the lowest %V scores and is less syllable-timed.

These apparently "contradictory" patterns, where RMs do not vary uniformly across different varieties, have been noted in other studies (for example, [18] and [25]). Our strategy to clarify the situation has been to look at durations of individual segments. In the present study, it was possible to carry out follow-up exploratory factor analyses of all segmental durations in the data because the size of the speech materials (approximately 115 segments) is manageable. As well, all 140 speakers read exactly the same sentences, so there is a good control of phonological and semantic structures. This analysis pointed to several characteristics including vowel deletions.

Table 1 shows that NorthWest speakers have the highest rates of both /i, y/ and schwa deletion. These deletions contribute to lower the total proportion of vocalic intervals (i.e., lower %V scores). Rural-SE speakers have the lowest rates of vowel deletion (higher %V scores); NorthWest speakers have the highest rate of vowel deletion, (lower %V scores). In addition, vowel deletions create longer consonantal intervals, which can contribute to higher consonantal interval variability, and to higher deltaC scores. In fact, the NorthWest variety has some of the highest scores on this consonantal metric, and the rural-SE variety has some of the lowest scores (see Figure 2).

The high frequency of /i y/ deletion in the NorthWest variety is likely due to the region's close geographical proximity to Québec. The southern varieties are, geographically, much further away. Laurentian (Québec) French has an optional rule of high vowel devoicing and deletion, which is found in contexts such as those where /t, d/ assibilation has occurred ([28]). Given the high frequency of this assibilation in the NorthWest variety – compared with the other regions (see [4]) – the transfer of this segmental process between dialects has a notable effect on speech timing.

Other characteristics identified in the exploratory study (but not reported here) include vowel lengthening at phrasal boundaries and shortening of certain vowels in unstressed positions. Both processes are more common in the southern varieties, which have greater variability in vocalic durations and higher VarcoV scores.

In terms of a multidimensional view of speech rhythm, the individual varieties are using different processes in order to realize stress timing. On the one hand, vowel deletion is a strategy used by the NorthWest variety. On the other hand, vowel lengthening and shortening are used more frequently by the southern varieties. These processes lead to timing patterns that display different degrees of syllable timing in the regional varieties.

The association between degree of language contact and degree of syllable timing is more complex than the simple correlation proposed in our hypothesis. Both VarcoV and %V metrics establish identical continua of regions – NorthWest, NorthEast, two southern regions – which follow a scale of highest to lowest demographic concentrations of French speakers. However, using English-French contact to explain the positions of varieties on these continua is confounded with factors such as contact with other French dialects. Furthermore, this suggests that explanations need to be sensitive to individual phonological processes.

This research contributes to a broader discussion of RMs. Results confirm the importance of VarcoV and %V as reliable metrics that can discriminate among language varieties; [17] notes a similar finding for other varieties of Romance languages. Perhaps more important is the recommendation that the relation between RMs and sources of timing variation needs to be studied more closely. Interpretation of RM scores, especially in cases where there are "contradictory" patterns of RM scores, can be improved by identifying specific processes that affect timing.

6. CONCLUSION

Prosodic rhythm in the four regional varieties of New Brunswick French can be described as syllable-timed. The main differences among these varieties appear on two vocalic metrics, VarcoV and %V, which indicate different degrees of syllable timing among varieties. In the NorthWest variety, vowel deletion appears to be a strategy that realizes a more stress-timed rhythm. The metrics place the varieties on a continuum: the NorthWest variety is at one end, two southern varieties are at the other end, and the NorthEast variety is in an intermediate position. Explaining this continuum in terms of the demographic concentration of French speakers requires further research.

ACKNOWLEDGMENTS

The authors gratefully acknowledge the support of the Natural Sciences and Engineering Research Council of Canada and the Social Sciences and Humanities Research Council of Canada.

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