

PROSODIC MARKERS OF REGIONAL GROUP MEMBERSHIP: THE CASE OF THE FRENCH OF QUEBEC VERSUS FRANCE

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ABSTRACT

The present study focuses on the influence of prosodic markers in the perception of regional variation. Our objective is twofold: on the one hand, we propose to evaluate how prosodic components play a part in the regional recognition of French speakers of Quebec and France. On the other hand, we plan to identify a set of prosodic markers of the geographical origin. The analysis was carried within a listener-oriented framework. Accordingly, we postulate that the prosodic parameters are declared “markers” only if they are perceived, by judges, as components associated with one or another of the two geographical origins. The results highlight the positive role of prosody in regional recognition. It is also shown that register, defined as the pitch height, constitutes the principal marker of origin. More detailed analysis performed in an ambiguous acoustical space revealed the importance of the pitch range exploited by speakers, as well as the melodic configurations of unaccented syllable sequences.

1. INTRODUCTION

It is a well documented fact that the speech signal is modified by several characteristics of the speaker. Pathology, emotional state, and group membership, for instance, are just a few of such characteristics. The resulting linguistic variation appears at the segmental level, as well as in the prosodic domain. The link between linguistic and non-linguistic information can thus be captured by the concept of “markers”, defined as linguistic cues which indicate various biological, psychological and social information about the speaker [4]. These markers are of first importance in speech verbal interactions.

2. PROBLEM

In the more specific area of geographical group membership decoding, several languages have been under investigation [1]. Following the same trend, research conducted on the two varieties of French from Quebec and France highlighted many prosodic and phonetic realizations which differ between the two dialects. Based upon the analysis of produced speech, these studies do not allow researchers to clearly circumscribe the elements triggering, at the perceptual level, the recognition of the France or Quebec French “accent”.

Nevertheless, previous work on prosodic elements has suggested the link between suprasegmental parameters and perceptual markers of French regional group membership. While some invoked the slow rhythm of a speaker of Quebec French [3], and some others referred to the high average pitch (fundamental frequency) of European French, the methodological processes involved greatly vary from one author to the other. Trying to objectively evaluate the realization of register as the

average pitch height, for professional broadcasters, Bissonnette (1997) [2] has shown that the average value is indeed higher for French speakers, whereas the mean pitch range is not. But the question remains the following: are these factors still active at the perceptual level? In other words, are these acoustical parameters still conveying information as to regional group affiliation when decoded by the receptor in the speech signal? We claim that not only the prosodic component as its own is relevant in the evaluation of geographical origin, but also that a subset of suprasegmental parameters exist (melodic configurations, rhythm, duration), which are carrying dialectal information. They are decoded by the human receptor as regional cues.

3. METHODOLOGY

3.1 Corpus. The analyzed corpus, borrowed from Bissonnette (1997), is made of 100 utterances pronounced by ten professional news readers (five Quebec speakers and five French speakers). Each speaker produced ten sentences, of a length varying from 8 syllables to 87 syllables. The average length is 37.71 syllables. The sequences, segmented on Computerized Speech Lab (CSL) speech analysis software, have been delexicalized by a triangular low-pass filter having a cut frequency of 250 Hz. The signal was thus becoming unintelligible, since formant information was being wiped out. Acoustical measurements have been extracted from the delexicalized signal: fundamental frequency has been automatically computed by CSL measurement algorithm for each 5 ms frame. The entire corpus has also been transcribed following the prosodic labeling system of P. Mertens [6]. The analysis was performed on a set of 27 acoustical parameters. Among these, only two appeared to be relevant: register and pitch contours carried by unaccented syllables. According to Bissonnette (1997), we define register as the average value of fundamental frequency, within a certain range of the spectrum. The latter will be referred to as the “pitch range”, and the former will be associated to the “pitch height”. In order to take into account the logarithmic scale of Hertz units, the pitch height has been computed by the geometrical mean of F0 values, per sentence. We calculated the pitch range by the interval of semitones between the average F0 values of accented syllables and unaccented syllables, within an utterance. With regard to pitch contours, it is assumed that Mertens’ label sequences of unaccented syllables are grouped under three categories [7]: flat, rising and falling curves.

3.2 Perceptual tests. In order to evaluate the link between such objective acoustical values and regional cues, the filtered corpus has been submitted, during a perceptual test, to a group of 108 subjects (24 males, 84 females), young francophone college students in the area of French studies. The subjects, from 18 to 25

years old, had no knowledge of French phonetics and minimal instructions had been released, as to the objective of the test. The task was to determine, by choosing a symbol on an answer sheet, the geographical origin (Quebec or France) of the speaker of each filtered sentence of the corpus. The utterances were presented in random order. The choices of answers (4) involved certainty degrees, as shown below (translated from French):

- a) I am sure the speaker is from Quebec;
- b) I am not sure, but I think the speaker is from Quebec;
- c) I am not sure, but I think the speaker is from France;
- d) I am sure the speaker is from France;

4. RESULTS AND DISCUSSION

4.1 Role of the prosodic component. First and foremost, the results of the perceptual test enable us to evaluate the incidence of prosody as a whole on the recognition of geographical origin (Quebec and France). For statistical and obvious practical reasons, results have been mapped to numerical values: (1)=Quebec origin (sure), (2)=Quebec origin (not sure), (3)=France origin (not sure), (4)=France origin (sure). A simple evaluation of central tendencies indices (mean and standard deviation) is show in Table 1. Note that QF sentences refer to the 50 sequences uttered by Quebec speakers, whereas EF refers to the others, produced by European speakers from France.

	Mean	Std deviation
Real QF sentences	2.37	0.45
Real EF sentences	2.63	0.45

Table 1: Perceived origin related to real origin for each speaker.

The mean values of Table 1 are statistically significant, according to a *t* test ($p=0.0048$). If one considers that the median value (2.5) is a mid point corresponding to the neutral position between the four types of perception, a score over 2.5 indicates a French perception and a score under 2.5 is related to a Quebec perception. Therefore, our hypothesis is confirmed, since the real QF utterances are associated to an average score (2.37) under 2.5, whereas the EF sentences correspond to a value (2.63) over 2.5. From this first preliminary table, we can thus postulate that the prosodic component itself, without any segmental information, is sufficient for the subjects to recognize the geographical origin of Quebec and France speakers.

However, a closer look at the distribution of the data, in terms of average score of perceived origin (between 1 and 4) for each sentence, reveals that a few sentences produced by speakers from Quebec are perceived French, whereas a subset of utterances pronounced by French are perceived as produced by a Quebec speaker. Considering the listener-oriented framework in which this study is conducted, it is of first importance to consider a grouping of data based on the choices of the judges, rather than a rate of “correct” answers. Table 2 shows the means and standard deviations of the perceived origin scores. Similarly, are considered “perceived QF” (Quebec French) the sentences for which the average score is under 2.5 (the median); “perceived EF” (European French) are those associated with an average score over 2.5. We also include in the table the distinction between the real origin (for each subgroup of “perceived QF” and “perceived EF”).

	Mean	Std deviation
Real EF perceived QF	2.16	0.25
Real QF perceived QF	2.10	0.24
Total perceived QF	2.11	0.24
Real QF perceived EF	2.89	0.23
Real EF perceived EF	2.91	0.26
Total perceived EF	2.90	0.25

Table 2: Perceived origin related to real and perceived origin.

Table 2 shows that the distinction between perceived QF / perceived EF, without considering the real origin, creates two groups of sentences which most likely share common prosodic features. One could thus postulate that judges have selected these features as cues to their choice of origin (“accent”). The following section will investigate the nature and the role of these factors.

4.2 Identification of markers. Results of the perceptual test enable us to evaluate the incidence of several acoustical parameters as to the processes of perception and decoding of regional group membership. However, our results, gathered from a sole test in which all factors are confounded, can not stand for absolute claims. Further perceptual tests are planned, in which only one factor is artificially modified, all other factors being equal, in order to determine the incidence of a variation on the perceived origin scores.

The acoustical analysis consisted in the evaluation of a set of 27 parameters, as described above. If one considers, in the first place, the relation between each parameter with the average perceived origin scores, only the register (pitch height and range) shows a relevant statistically significant difference. Figure 1 and 2 provide an accurate picture of the behavior of the two acoustical factors discussed. The total values must be seen in the middle column. Thus, we compare the same groups of sentences as shown earlier, that is to say, groups of sentences associated to an average perceived origin score over 2.5 (groups “per. EF”) or under 2.5 (groups “per. QF”).

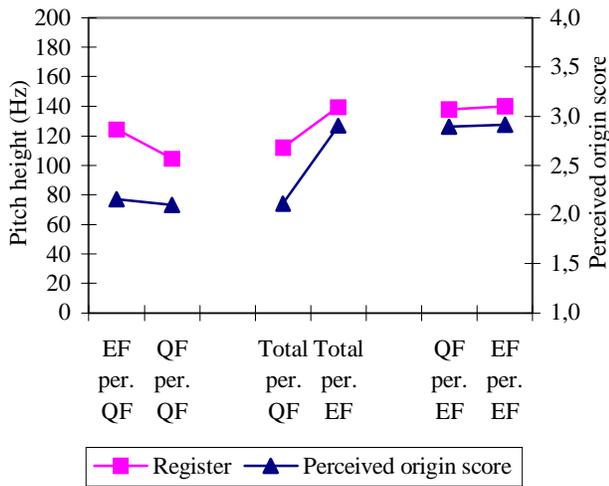


Figure 1: Average pitch height and perceived origin scores.

It appears that high F0 values are associated with high perceived origin scores (“Total per. EF”), and low pitch height is related to a lower score (“Total per. QF”). Statistically, this factor is the most relevant, compared to the others. Furthermore, the similarity between the two values for the group of “perceived QF” (left column), on the one hand, and for the group of “perceived EF” (right column), on the other hand, reinforces the hypothesis of the existence of perceptually relevant cues, shared by sentences of each group. Another way to look at the register is to observe the factor of the pitch range, which exhibits significant distinctions as well (Figure 2).

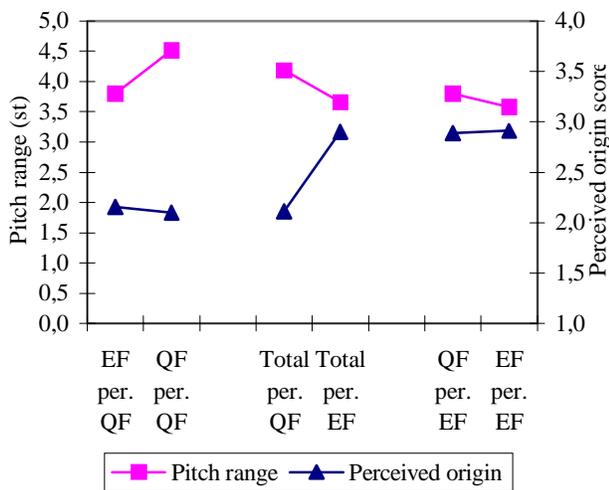


Figure 2: Average pitch range and perceived origin scores.

Figure 2 reveals that pitch range is higher for the groups of sentences perceived from Quebec (“per. QF”), and lower for the

sequences perceived European French (“per. EF”). This reflects the negative correlation between perceived origin scores and pitch range.

It seems clear at this point that register constitutes a marker of first importance in geographical origin recognition. Since most markers, by definition, are equivocal and ambiguous [4], one could detect secondary markers, for which the action could have been masked (hidden) by the very strong action of our first marker (register as pitch height). In order to analyze these secondary actions, we isolated the best identified sentences of the corpus, that is the sentences for which at least 60% of the subjects agreed on the origin (Quebec or France). The sequences also correspond to those associated to the highest (most French) and the lowest (most Quebec) perceived origin scores. A total of 71 utterances were retained. Table 3 presents the values of the means and the standard deviations for the factors of register (pitch height, pitch range). One last factor appeared, at this stage, to be an important parameter, when considering the results in the sub-corpus. Indeed, melodic configurations, estimated by the percentage of flat, rising and falling curves carried by unaccented syllable sequences, are grouped in Table 3 as well. The average percentage is calculated on the overall number of curves, for each sentence.

	Perceived EF	Perceived QF
Average pitch height	141.55	108.68
Average pitch range	3.26	4.12
% of flat curves	66	52
% of rising curves	14	18
% of falling curves	20	30

Table 3: Average values of relevant acoustical parameters for the sub-corpus.

Table 3 reflects a few relations between acoustical factors and perception. The values corresponding to the average pitch height and range confirm the correlation between these parameters and perceived origin score. Moreover, it appears that a high percentage of flat F0 curves is perceived European French, and a lower percentage of falling F0 curves is perceived as being produced by a speaker from Quebec. The following section deals with these results.

4.3 Ambiguous acoustical space. The analysis of the results on the basis of perceived origin, for the entire corpus, as well as for the 71 sentences of the sub-corpus, clearly show that register constitutes the main marker of regional group membership recognition, between Quebec and France, for our judges. As discussed earlier, the strong correlation between register (average pitch height) and perceived origin scores suggests that some other parameters are playing a secondary role, when register values are similar. Multivariate statistical analysis did not highlight any relevant correlations. However, distribution of register values for the sub-corpus reveals that a few sentences are associated to an average pitch height located between 100 and 125 Hz (in geographical means). This space, corresponding to 1.5 semitone, could be considered as hardly perceived. Among these sentences, six have been identified to a French origin, whereas five have been associated to a Quebec speaker. Most likely, pitch height

was not used, in these cases, as a cue to evaluate origin. Despite the small number of utterances (11) in the subset of sequences in this space, it may be a fruitful approach to examine the values of other acoustical elements.

First, the average pitch range, in semitone, suggests a distinction between sentences perceived as French (lower pitch range), opposed to sequences associated to an “accent” from Quebec (higher pitch range), as in Figure 3.

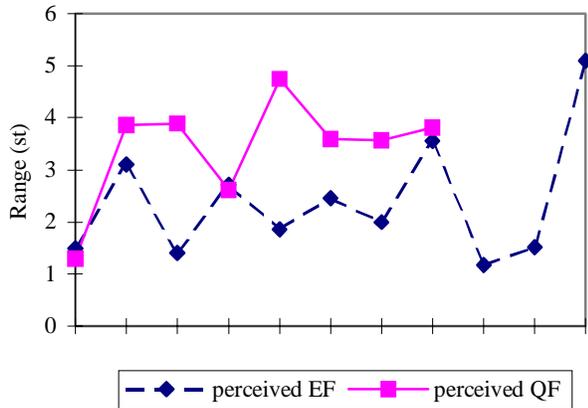


Figure 3: Pitch range for each sentence (ambiguous acoustical space).

Second, as to percentage of flat, rising and falling fundamental frequency curves, distributions show a tendency to identify as being from Quebec the utterances formed by a great number of falling curves. On the contrary, an important percentage of flat curves suggests a French perception (Figure 4).

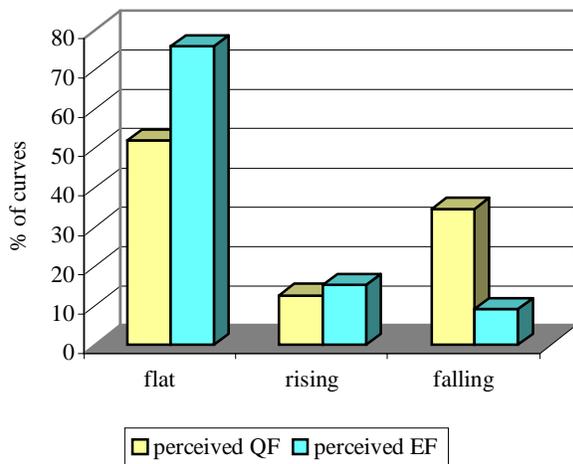


Figure 4: Percentage of flat, rising and falling F0 curves (ambiguous acoustical space).

4.4 Hierarchical ranking of markers. Considering the results presented earlier, we can now build a hierarchy of prosodic markers of regional group membership perception, for the French of Quebec and France. The ordering of the markers comes from the value of the Pearson correlation coefficient (score and factor). Note that the tests have revealed no statistical correlation among the three factors involved.

- 1—> Pitch height
- 2 --> F0 contours (flat curves: $r = 0.61$, falling: $r = -0.60$)
- 2---> Pitch range ($r = -0.57$)

To summarize, the results of the acoustical analysis performed on the filtered sentences, compared to the perceived origin scores, confirm the existence of perceptual prosodic markers, for the corpus under investigation. Moreover, it is noticeable that the relevant factors retained are related to fundamental frequency only. Needless to say, such a model could be of great interest for automatic speech recognition as well as speech synthesis.

5. CONCLUSION

This paper was intended to put light on the issue of geographical origin recognition, in particular for Quebec and France French varieties. We have shown that prosodic markers, related to regional group membership of speakers from Quebec as opposed to France, are very well conveyed by speech signal. For the time being, these results are only valid for 18-35 year-old subjects from Quebec, when evaluating professional readers. Further perceptual tests with different groups will be performed.

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