

FROM SEGMENTAL DURATION PROPERTIES TO RHYTHMIC STRUCTURE: A STUDY OF INTERACTIONS BETWEEN HIGH AND LOW LEVEL CONSTRAINTS

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ABSTRACT

This study deals with the temporal structure of utterances in a variety of Canadian French spoken in the province of Quebec. In order to illustrate the way segment intrinsic durations could influence the temporal structure on which prosody takes place in Quebec French, data from read utterances and spontaneous speech were gathered and compared to results from a previous study on the variety spoken in France. The observations confirmed the preservation of a length distinction in spontaneous speech in Quebec French and showed how segmental features are apt to change the durational frame of a stress group. By so doing, the results brought up the question of the merits of using general claims about French stress patterning, segmental phonology, and syllable division for the study of Canadian French prosody. We demonstrated that the stress group, instead of the lexical units, can be used to capture segment intrinsic duration properties.

INTRODUCTION

The vowel system of Canadian French maintained eight long vowels that is: four nasals /ɛ̃ ɑ̃ ɔ̃ œ̃/ and four long oral vowels /ɔ o œ/. Results from previous studies showed that these long vowels keep their intrinsic durations under stress, in closed syllables (categorical rule), and in closed or open penultimate syllables (optional rule) [1]. On the other hand, short vowels can be lengthened by /ʒ ʁ v z/ in closed stressed syllables (categorical rule) and in penultimate closed syllables as well as in open syllables when the vowel and the lengthening consonant belong to the same morpheme (optional rule in both cases). In this paper's framework, we will discuss the effect of phonologically motivated length distinctions on the temporal structure of words and stress groups.

The presence of length distinction is known as having a certain effect on the rhythm of the Canadian varieties of spoken French. Compared to the variety from France, Canadian French shows regularly audible penultimate lengthenings [2] [3]. Furthermore, the length distinction in Canadian French is known as a source of variation for intrinsic vowel durations [4] [5] [14]. In order to make a description of the temporal structure on which prosody takes place in a variety of French spoken in the province of Quebec, we present the results of three different studies. The first one illustrates the difference in vowel intrinsic durations in French from France and French spoken in the province of Quebec. The second presents examples of temporal properties preservation in read sentences and paragraphs in Quebec

French. The last study deals with temporal properties in spontaneous speech in this variety.

1. EXPERIMENT 1

The results of this first experiment are used here to illustrate the effect of the differences between French of Quebec and French from France on the temporal organisation of lexical units of one or two syllables [5] [6]. Two speakers, one from the province of Quebec and one from France, were asked to read carrier sentences containing target words (see [6] for results of the same test for two more speakers). Results showed that the French subject produced longer vowels for /ɑ ɔ œ/ only in CVC stressed words but not when the target vowels were in penultimate open or closed syllables. By contrast, the Quebec speaker still produced a distinction for short and long vowels under these same conditions. Both subjects produced longer durations for nasal vowels in stressed and unstressed syllables.

Figure 1 illustrates the duration values for long /ɑ ɔ/ and short /a ε/ vowels in closed and open penultimate syllables. The first set of CVCV stimuli (2) is made of a «CVC» lexical morpheme followed by a suffix (ex: *fêter*). The second set of CVCV (3) was made of words or nonsense units without «CVC» morpheme.

Vowels durations in penultimate syllables

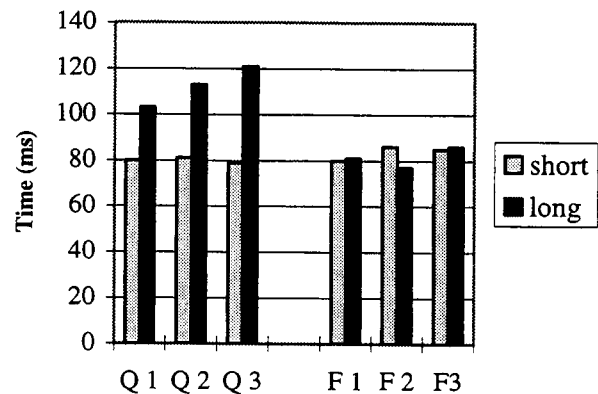


Figure 1: Differences in average durations for long and short oral vowels in CVCCV (1), CVCV (2 and 3) words pronounced by France (F) and a Quebec (Q) subjects. n=120 tokens.

We noticed that the Quebec speaker maintained the length distinction in penultimate syllables while French subject does not. The same behaviour was observed with two more subjects [6].

We use here two excerpts of read sentences to illustrate the differences between temporal structures according to the spoken type of French. The portion held by the target vowel /ɜ/ in the total duration of the utterance is larger in Quebec French in the CVC word as well as in the CVCV word. This phenomenon, we presented in figure 2, shows a first property of something we will call the surface «temporal skeleton» of Quebec French., which is the presence of longer vowels in unstressed positions.

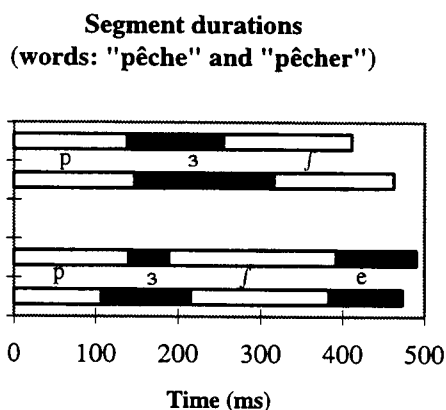


Figure 2: Temporal structure of the words «pêche» (fishing) and «pêcher» (to fish), produced by a speaker from France (FS) and one from the province of Quebec (QS). Exerpts from read sentences.

Statistical analysis were performed in order to find some informations about temporal organisation inside CVC syllables. We hypothesized that closer links inside syllables were apt to provoke negative duration adjustments between segment durations. In order to make the observations from previous studies more precise, [4] [7] we performed a regression test on the timing of the onset and the nucleus, and on the timing of the nucleus and the coda inside the CVC words uttered by those two speakers. According to the results we brought out, a closer link was found between the onset and the nucleus ($p < 0.0001$) in the syllables produced by the speaker from France while, for the speaker of the province of Quebec, relevant timing adjustments were found between rhyme components only ($p < 0.0001$). Inside the CVC syllables we tested, there were global CV->C adjustments for the French speaker while the Quebec speaker produced C->VC adjustments[5].

In addition to the differences we observed in the surface temporal skeleton of these two varieties of spoken French, it seems that the speakers do not share a common strategy for timing adjustments inside syllables. More tests are still to be performed on CVCV words.

2. EXPERIMENT 2

The second experiment was designed to test the persistency of intrinsic durational properties of long oral vowels in read paragraphs. For this experiment, we asked two subjects, a male and a female, both

from the Quebec City area to read two versions of a paragraph, and two sets of sentences. The reading tasks included CVC words and CVCV words. Again, the CVC and CVCV words were used as carrier structures in which the first vowel constitutes the target unit. These units were either short oral, long oral or nasal vowels. All the tasks were performed in a random order for both subjects, in separate recording sessions. We will present results gathered in CVCV words only.

As shown in figure 3. both speakers produced length distinctions between short, long and nasal vowels. However, intrinsic duration differences were more subtle in the paragraphs than in the carrier sentences.

Average vowel durations in CVCV words

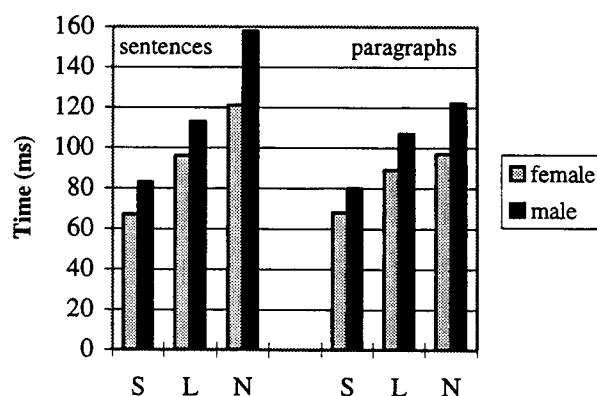


Figure 3: Average durations for short (S), long (L) and nasal (N) vowels in CVCV words in sentences and paragraphs read by two Quebec speakers. n= 96 tokens.

3. RESULTS FROM SPONTANEOUS SPEECH

According to previous results, one could expect that the differences observed between each vowel category (short, long and nasal) might be even thinner in spontaneous speech than it was in read paragraphs if these differences are not phonologically motivated [8] [9] [10] [14]. We present now two series of results gathered from spontaneous speech excerpts extracted from sociolinguistic interviews made in the Chicoutimi-Jonquière area (province of Quebec). The first data are average durations of short, long and nasal vowels produced by twelve speakers. The vowels were extracted from final stress groups of intonational phrases. Vowels were in an unstressed position, that is the syllable before the penultimate syllable.¹

Surprisingly, the length difference between short and long oral vowels is still present even in the syllable before the penultimate one. However, the difference between long oral and nasal vowels has almost disappeared.

Vowel average durations in spontaneous speech

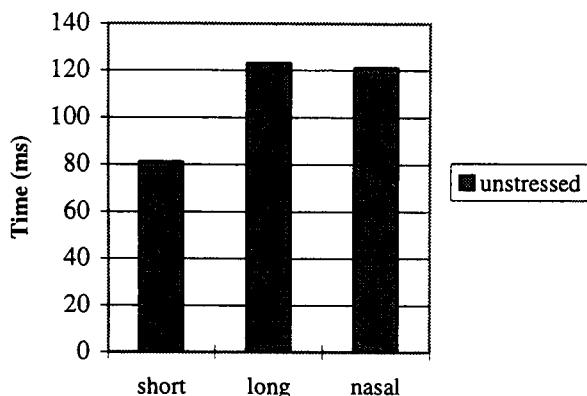


Figure 4: Average durations for the three vowel categories in unstressed position inside a stress group. Exerpts from spontaneous speech produced by twelve speakers. n=324 tokens.

We observed similar behaviours for length distinction in almost each syllable from a string of six (intonational phrase) on which we made measurements. Besides, the length distinction between long and short oral vowels is absent in final open syllables in Quebec French.

This data reveals that the intrinsic duration properties of vowels could be maintained in various positions inside a stress group. This highlights the fact that length differences, even if they arise from phonological distinctions operating in a lexical domain, should not be considered unstable and should be taken into account in the study of prosody. Since stress groups frequently overflow the word dimension we still have to find the best unit to capture the characteristics of what we call the «surface temporal skeleton» in Quebec variety of spoken French. For the moment, we believe that units such as stress groups or prosodic words could be used.

The second series of results we present is made of excerpts of individual productions in spontaneous speech. Figure 5 shows two excerpts from the same utterance, that is, the last stress group and the one preceding. All the vowels were nasals whose behaviour is similar to long ones in Quebec French [11]. We selected an utterance containing nasal vowels since we had no excerpts in which long oral vowels were following one after another. Besides, this kind of utterance made exclusively of long vowels is almost impossible to find.

The resulting frame shows that nasal vowels hold an important portion of the total utterance duration. The characteristic of this temporal frame is that vowel length seems to make possible the production of audible frequency modulations in spontaneous speech. The resulting tonal pattern associated with longer vowel and syllable durations sometimes provokes a stress shifting [12].

Temporal structure in spontaneous speech (nasal vowels)

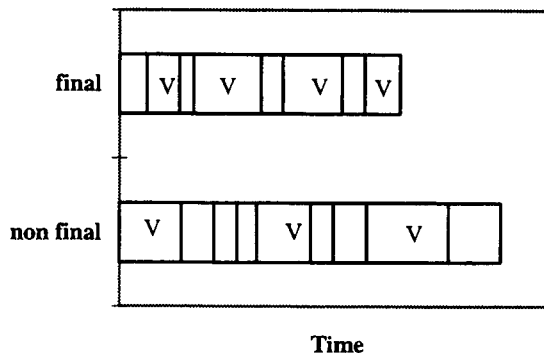


Figure 5: Temporal structure of two stress groups from the excerpt «entre trente cinq» (non final) «puis cinquante ans» (final) (*Between thirty five and fifty years old*). The letter V indicates a vowel.

Figure 6 presents two excerpts from the same speaker but, this time, only the last vowel of the final group was lengthened by a final /s/. Compared to the data in figure 5, the next figure reveals that the portion held by vowels is smaller. If compared, now, to the data in figure 1, one could observe the similarity of the temporal pattern in figure 6 (non final) and the temporal pattern of the word «pêcher» as pronounced by the French speaker (see FS cvcv in figure 1).

Temporal structure in spontaneous speech (short vowels)

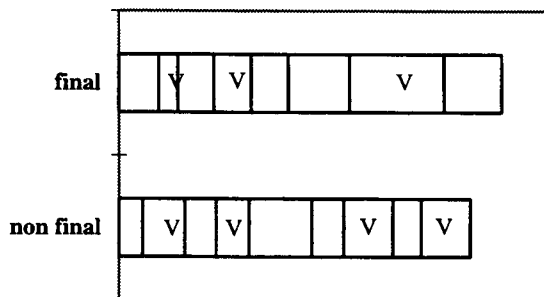


Figure 6: Temporal structure of two stress groups from the excerpt «des Esquimaux» (non final) «du Pôle Nord» (final) (*Eskimos from North Pole*). The letter V indicates a vowel. One should notice that, in this last example, the long vowel /o/ in the word «Pôle» was pronounced as a /ɔ/.

DISCUSSION

The aim of this study was to show how vowel length distinctions influence the temporal frame on which prosody takes place. We established that the «surface temporal skeleton» was different from

one type of spoken French to another. These observations raise questions about the way general claims concerning stress pattern, segmental phonology and, maybe, syllable division in French can take into account the characteristics of Canadian variety, particularly the variety on which we worked, spoken in the province of Quebec.

First, the length distinction we still observe in Canadian French is not in usage anymore in the variety from France.¹¹ A way to predict the presence of a long vowel in an utterance is through the lexicon since most of them appear in CVC words onto which a suffix can be added. This is probably the reason why many previous studies present the length distinction as effective only in closed stressed syllables. However, more recent data provided evidence for the preservation of length distinction in closed or open syllables, stressed or not [1] [5].

Since the Canadian French vowel system contains eight long vowels, the question one should ask is about the merits of taking into account the presence of the length distinction in establishing the metrical weight of a syllable? The metrical model proposed by Dell (1984) for French does not include any specification on phonologically motivated segment durations [13]. In fact, these specifications would not be helpful if the lengthening we can observe in many syllables has no effect on stress patterning, for example.

The rhythm of Canadian French is characterized by the frequent lengthening of penultimate syllables, a phenomenon known as «pretonic lengthening» [2] [3]. Recent works on pretonic lengthening properties reveal that stress shifting can be provoked by an increased duration of the penultimate syllable, mainly following vowel length [12] [15]. Moreover, the capacity to produce penultimate lengthening seems to expand to short vowels [11]. In these particular cases, where stress shifting is less frequent, the behaviour of short vowels is similar to that of the long vowels, which is well established in Canadian French. So, it seems to be relevant to take into account the phonological duration feature in the establishment of the metrical weight of a syllable in Quebec French at least. More data from other varieties spoken in Canada have to be gathered in order to characterize segmental feature.

Finally, we mentioned in the introduction that another source of vowel lengthening was provided by the consonants /ʁ ʒ v z/ following a short vowel in a closed syllable. These consonants can increase the vowel duration in an open syllable as long as the vowel and the consonant belong to the same morpheme. Again, the canonical way of dividing an utterance into syllables in French does not include any specification about the morphological composition. Since the lengthening effect of /ʁ ʒ v z/ is optional in open syllables, more investigations have to be conducted to evaluate the relevance of such a specification.

ACKNOWLEDGMENT

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¹ Words structure and syllable boundaries were not controlled. The choice of this position was motivated by the necessity to avoid a syllable bearing the stress.

¹¹ We do not take into account the dialects of France in which a length distinction is still preserved.