

SPECTRAL MOMENTS TO DESCRIBE FRICATIVE EMERGENCE OF FRENCH-QUEBEC CHILDREN

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1 Introduction

In the study of fricatives, various acoustic measurements have been described to objectively classify these consonants. One of the measures most used by researchers is the analysis of spectral moments [1 - 4]. Spectral moments describe the distribution of frequencies in an area of the spectrum, with the aim of identifying the energy concentration patterns [2, 5]. There are four spectral moments used to describe these patterns: center of gravity, standard deviation, skewness and kurtosis [2]. The acquisition of fricative consonants is well documented in English-speaking children [6]. However, studies conducted in languages other than English, such as Japanese, have revealed differences in the order of acquisition of these consonants, independent of the status of the speech sounds in the phonology of the language and despite little articulatory variance [7, 8]. These differences would indicate that some phonological development trends are language-specific [9]. Studies carried out in the area of production show that the realization of fricative consonants is different between children and adults [2, 5]. In addition, there is evidence of great articulatory variability among subjects in children [10]. In this study, we aim to obtain acoustic measurements that describe the phonetic-phonological development of fricative consonants in French from Quebec.

2 Method

2.1 Participants

This cross-sectional study is developed on the data of 47 monolingual children, divided into 6 age groups: 2;6, 3;0, 3;6, 4;0 and 4;6, from Quebec City, Canada. According to the parent's report, the children recruited presented typical cognitive, motor and linguistic development. The Peabody Picture Vocabulary Test (PPVT), in its French version [11], was used to screen for typical language development.

2.2 Methods

The evaluation was conducted in a room with sound treatment. Audio recording was performed with a lapel microphone inserted in a child-friendly vest (Audio Technica 600) connected to an audio preamplifier, connected to a computer (44.1 kHz sample rate, 16 bits per sample). The

children were evaluated by a trained research assistant. The children's productions of the fricative consonants were obtained through a picture naming task. Subsequently, the recorded observations were labelled and transcribed phonetically, with a double entry of 10% of the corpus.

2.3 Analysis

An acoustic analysis of the target words was performed using PRAAT [12]. A window of 200 ms was used to see each targeted word and measurements were taken in that window size. To determine the beginning and the end of each fricative, the segmentation decisions considered the simultaneous consultation of the waveform and the wideband spectrogram, the occurrence of high frequency aperiodic noise and the rapid increase of cross by zero [3,4]. The statistical analysis was developed with R [13] for two reasons: first, due to the use of variables to fixed effects and to random effects; second, to better manage the possible missing values due to the complexity of recording data with children.

3 Results

The analysis by mixed models show an effect of the point of articulation on the center of gravity and on the duration. Moreover, the analyses showed an effect of the point of articulation on the standard deviation. An effect of the voiceless on the center of gravity and on the duration is also observed.

4 Discussion

Preliminary results indicate that the centre of gravity is the most robust spectral moment to classify the fricative consonants [4] of these French-speaking preschool-aged children. This result coincides with previous literature, which suggests a common key acoustic cue for fricatives. On the other hand, duration, a measure often described as secondary [4], appears to be an important indicator for the classification of fricative consonants produced by these French-speaking children, which suggests a language-specific cue is also in play.

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