Pause Duration of Disfluent Speech

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ABSTRACT

This work has the goal of comparing the pause duration in the disfluent speech and normal speech. Disfluency and normal spontaneous speech was recorded in a context were the subjects had to describe a scene from each other. The pause determination algorithm is presented. The automatic pause determinations allowed the measure of percentage of silence along the record of several minutes of speech. The stuttering scale is used to compare the severity of the subject. As expected, the percentage of speech pauses parameters is rather different in subjects with and without disfluent speech, but it does not seem that it is proportional to the severity of the disfluency.

Keywords: Disfluent Speech, Speech Disorder, Speech Pause Duration, Stuttered Speech, Stuttering, Stuttering Scale

INTRODUCTION

The speech is essential to communication between human beings, enabling the exchange of different cultures and allowing personal development and cultural of mankind.

To produce the human voice it is necessary that the air is pulled out of the lungs, through the throat and vocal cords being projected by the mouth.

Considering the analysis of the speech signal, three states may be referred for the representation of the speech, among them the silence, i.e. when no speech is produced, and the vocal cords are relaxed, the unvoiced speech, where the vocal cords do not vibrate, and the glottis is still open and the voiced speech, where there is vibration of the vocal cords that do vary the degree of opening of the glottis and consequently the volume of air flow that passes through it.

For a given language, there are a set of phonemes that characterize the language. These phonemes can be divided in vowels and consonants. The vowels group contains the oral, nasal and semi-vowels or glides. The consonants are divided in plosive, liquid, fricatives and vibrant. The plosive vowels are composed by the occlusive part (almost or completely occlusion of sound) and by the plosive part followed by the vowel. Anyhow each of these phonemes can

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be voiced or unvoiced. The voiced sounds are produced with the vibration of the vocal cord, and the unvoiced sounds are produced without vibration of the vocal cords and with the glottis open. The voiced sounds generally have low frequency energy and in opposition unvoiced sounds has a higher frequency energy.

The frequency of vibration of the vocal cords is known as the fundamental frequency (F0), which is controlled by the states of tension and length of the vocal cords. Greater tension and length correspond to higher frequency tones, (Seeley, Stephens & Tate, 2006).

Within the speech disorders, the disfluency is one of the most fascinating areas of study. This disturbance of fluency is found in all parts of the world regardless of race, socioeconomic levels and degrees of schooling.

The disfluencies, also known as stutter, is seen as a disorder in which the fluency of speech is hampered by blockades, interjections, involuntary repetitions, prolongations of sounds and/or silent pauses (Jakubovicz, 2009a). In addition to the changes in the rhythm of speech, it also may occur disturbances associated with body movements, such as wink, twisting of the head, foot tapping, among others. These movements may arise spontaneously, or as a way to free the blockade that prevents speaking (Ribeiro, 2003).

Van Lieshout, Hulstijn and Peters (2004) stated that the motor abilities (speech production system) of stutterers are limited in motion. And Peters, Hulstijn and Van Lieshout (2000) affirmed that these motor abilities could be represented in a continuous way from the normal to a deviant behavior. The cited limited motor abilities (Van Lieshout, Hulstijn & Peters 2004) means that differences between the speech of stutterers and speech from fluent persons are not permanent and happen mainly when the stutter motor system (stutterer) control is destabilized. This means that the fluent speech of persons who stutter may already have differences to the speech of fluent persons.

Another feature that can influence the stuttering level of a stutterer is the speech rate. Hirsch (2007) stated that the increase of the speech rate is a destabilizing factor of the stutter motor system. He also stated that in the face of fast speech rate the stutterers do not show the ‘undershoot phenomenon’. The undershoot of vowel targets in fluent persons underlies a movement amplitude reduction of the motor system, so as to make up for the added cost required by the accelerated speech rate.

Other authors Yaruss (1999) and Sawyer, Chon and Ambrose (2009) stated that the speech production is also perturbed by the phonological complexity. That perturbation of the motor system control was found for Spanish and English adult stutterers (Howell & Au-Yeung, 2007; Howell, Au-Yeung, Yaruss & Eldridge, 2006). A sequence of clusters at the beginning of words also increases the disfluency in adult stutterers (Howell, Au-Yeung, and Sackin, 2000). Regarding this references it can also be stated that the motor behavior of stutterers may also show differences from one language to another.

In this study, one of the forms, the silent pauses and indirectly the blockades will be measured in order to evaluate their ability to identify or classify the speech disorder.

Jakubovicz (2009a) divided the disfluencies into four types, and they were: abnormal fluency, the stutter, organic disprosody (without prosody) and taquilalia. According to Peña-Casanova (1997) the stutter is classified into only three types: tonic, clonic seizures and mixed. Finally, according to Wendell Johnson (as cited in Jakubovicz, 2009b) the disfluency can be classified into eight categories: interjections, repetition of sounds, repetition of syllables, repetition of words, repetition of phrases, review of the sentence, incomplete phrases or words and broken long sounds.

Typically, the frequency of stuttering is measured by counting the number of stutters that are judged to occur in a sample and reporting this as a proportion of the total amount of speech that occurred. In other words, the percentage of syllables spoken that were stuttered (Costello & Ingham, 1984). The preferred denominator is the number of syllables spoken (as opposed to words) because it more accurately depicts...
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