

Chapter 25

Experiences Using a Free Tool for Voice Therapy based on Speech Technologies

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ABSTRACT

This chapter reports the results after two years of deployment of PreLingua, a free computer-based tool for voice therapy, in different educational institutions. PreLingua gathers a set of activities that use speech processing techniques and an adapted interface to train patients who present speech development delays or special voice needs in the environment of special education. Its visual interface is especially designed for children with cognitive disabilities and maps relevant voice parameters like intensity, vocal onset, durations of sounds, fundamental frequency, and formant frequencies to visually attractive graphics. Reports of successful results of the use of PreLingua have been gathered in several countries by audiologists, speech therapists, and other professionals in the fields of voice therapy, and also, in other fields such as early stimulation, mutism, and attention-deficit disorders. This chapter brings together the experiences of these professionals on the use of the tool and how the use of an interface paradigm that maps acoustic features directly to visual elements in a screen can provide improvements in voice disorders in patients with cognitive and speech delays.

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INTRODUCTION

Different disorders or pathologies can reduce the ability of an individual to control the production of voice. These disorders may be caused by structural anomalies, such as weakness of laryngeal structures or muscles; by pathological conditions including vocal nodules, polyps or vocal fold thickening, by vocal abuse or vocal misuse, and by certain cases of disabilities (Kenneth, 1966; Kornilov, 2004). The main consequence of these disorders is the reduction in the communication skills of those who suffer them, which eventually excludes them from normal social relationships and lowers their standard of living. In many cases, voice therapy is the solution to train or to educate the patient's altered voice via extensive interaction with a skilled therapist. In general, alterations of the voice are any acoustical disturbance which affects the quality of parameters of the voice such as intensity, fundamental frequency, durations of sounds, formants, or various combinations of them (Arias and Estape, 2005; Aronso, 1993).

As the first step of the treatment, the patient must be examined by a speech therapist, where the consultation between them may result in the recommendation of voice therapy as the appropriate solution to the disorder or pathology. Therapists have developed through the years a handful of techniques aimed to train the different voice skills; for instance, to work vocalic articulation, patient and therapist sit in front of a mirror to work the tongue movements through imitation, or they blow up balloons to work blowing abilities. In general, the time required to provide this therapy for a single patient can make it impractical when working with a large population, and access to voice therapy becomes costly and time consuming.

Computer-based tools can be helpful for this purpose. This kind of tools are based on robust techniques of signal processing and speech technologies like voice activity detection, energy estimation, tracking of fundamental frequency,

and formant estimation. By combining these techniques, the tools allow to work different parameters in voice therapy like voiced/unvoiced sounds, voice intensity, tone modulation, rhythm, vocal onset and sound duration. Therapists can, in some cases, use them to provide enhanced treatment to some of their patients. However, the resources are not always sufficient to provide the acquisition of voice skills in individuals with handicaps due to the price of computer-aided tools for voice therapy, the limitations for the training of vocalic articulation and the lack of available tools for the different languages, including Spanish.

The work presented here describes the set of interactive tools that were developed to reduce the time and the level of computer expertise required from the therapist for providing the interactive component of the therapy. This tool, called PreLingua, uses speech processing to train patients with speech development delays, or special voice needs of handicapped individuals in a special education environment. The tool covers the first stage of language acquisition (phonatory skills) and includes voice activity detection, the control of voice intensity, blow, vocal onset, phonation time, tone, and, vocalic articulation activity in Spanish language. Its visual interface does not require any previous configuration and is especially designed for children and people with cognitive disabilities by using attractive graphics representing important voice parameters in real time, and in the vocalic articulation, an special avatar was designed in order to make the children understand how to locate their articulatory structures in the generation of the Spanish vowels (Rodriguez et al., 2010).

To test the effectiveness of PreLingua, a study was conducted in two schools for special education in Spain and Latin America, the results show that PreLingua can actually help patients with speech disorders to improve their voice capabilities, and its interface is really easy to use, very motivating and understandable to young users. As PreLingua is a free tool available on line, it is possible to benefit

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