Chapter 57
On the Use of Speech Technologies to Achieve Inclusive Education for People with Intellectual Disabilities

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ABSTRACT

New technologies have demonstrated a great potential to improve the social, labour, and educational integration of people with special needs. That is why there is a special interest of academia and industry to develop tools to assist this people, improving their autonomy and quality of life. Usually, intellectual disabilities are linked with speech and language disorders. In this chapter, the authors present a review on the efforts directed towards designing and developing speech technologies adapted to people with intellectual disabilities. Also, they describe the work they have conducted to study how to gather speech resources, which can be used to build speech-based systems that help them to communicate more effectively.

INTRODUCTION

According to the World Health Organization, the 15% of the world population is affected by some physical, mental or sensorial disability, which hinders their personal development and social integration, education or employment (WHO-11). The research area of inclusive education was introduced to avoid such situation by aiming at the maximum development of every student. In order to do so, it is necessary to identify and define guidelines for the students with special educational needs.

These students require during all their schooling period a certain support and specific education attention. Brennan (1984) stated that it is possible to identify a special education need when a deficiency (physical, sensorial, intellectual, emotional,

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social or any combination of these) affects learning up to the point that partial or full access to special curriculums is necessary.

The Warnock Report (Aguilar, 1991; Warnock, 1979) establishes that this must be done paying particular attention to the social structure and emotional climate in which education takes place, favouring the cohesion of all members of the community.

Such social implications in special needs education and inclusive education in general, make it necessary to emphasize communication and dialogue. However, many intellectually impaired people have difficulties communicating because of speech problems derived from their disability.

Speech technologies specially oriented to people with disabilities aims at improving their quality of life, increasing their autonomy and facilitating their capacity to communicate with other people. In this chapter we make a review on how speech technologies can help students with special educational needs interact with other people, reducing the impact of their disability. We will pay special attention to the recent work carried out in our research team in the study of speech resources for intellectually impaired users.

COMMUNICATION, LANGUAGE, AND SPEECH IMPAIRMENTS

The primary means of human communication is the oral language, as it allows individuals to express and understand ideas, thoughts, feelings, knowledge and activities. As highlighted by (Vila, 2008), language is a very powerful tool, "a specifically human communicative behaviour that plays important functions in a cognitive level, social and communication, allowing humans to make explicit their intentions, stabilize them, change them in regulations very complex of human action and enter to a positive plain of cognitive and behavioural auto regulation, which cannot be reached without language" (Puyuelo, 1997).

Language is acquired by learning through the interaction of biological, cognitive, psychosocial and environmental agents (Puyuelo, 2003) and it is started at birth (Montoya, 2009). (Miretti, 2003) defines three learning stages:

- **Pre-linguistic level:** From birth up to twelve months. Babies transfer information through the tone, intensity and rhythm of crying.
- **Linguistic level:** Between twelve months and five years. It is a period when vocabulary acquisition grows quickly learning more phonemes, although phonologic development is not complete until the next level (Puyuelo, 2000).
- **Pure verbal level:** Between five and twelve years. The meaning of words is symbolized and abstractions are built as required in the learning process of mathematics.

With children, language assessment must be executed according to evolutionary principles. Any deviation of the expected conduct is an indicative of pathology (Lezak, 1983; National, 2011). The pathologies of human communication are usually classified into four areas (Gutierrez-, 2003). Firstly, phonopathies which are voice alterations such as rhinophonia, rhinolalia, dysphonia, aphonia or dysodia (Perello, 1973). The second class are speech disorders: dyslalias, dysarthria and diglossia. (Perello, 1990). Thirdly, there are the modifications of the emission rhythm of spoken language: arrhythmias, dysrhythmias, bradyphasia, bradyarthia, physiological dysphemia, and persistent dysphemia (Serra, 1982). The fourth group is comprised of logopathies. This field is the largest since it deals with all aspects of human communication. It includes simple or severe language delay, oral language delay (aphasia, dysphasia, perturbation of psychic origin, autism, mental trauma...), written language delay (agraphia, dysgraphia, dysorthography, agrammatism), read language