

## Chapter 34

# ICTs for Orientation and Mobility for Blind People: A State of the Art

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### ABSTRACT

*Orientation and mobility are two fields of applications of the so-called Assistive Products, in which we can find a high growth in the last ten years. In this group, the so-called Electronic Travel Aids have a capital importance. These applications are focused on helping blind people in the following aspects of their daily lives, among others: avoiding crashing against obstacles, guiding through unknown environments, giving relevant information of the environment, helping blind people “see” by touch devices, electrodes, sounds, etc. Commercial, but also experimental technology has been intensely applied in this field to provide assistive products, which helps in ways that were unexpected some years ago. The authors provide an introduction to this field and a taxonomy of the available assistive products for the orientation and mobility. Finally, they detail advantages and disadvantages of several paradigmatic proposals to provide a global point of view of the state of the art in orientation and mobility technology for this group of users.*

### INTRODUCTION

An “Assistive Product” (AP from now on) is “any product (including devices, equipments, instruments, technology, and software) produced specially or available in the market, to prevent,

compensate, control, reduce or neutralize deficiencies, limitations in activity and restrictions in participation” (AENOR, 2007). This means a specific application of technology to enhance the live quality of people. In such a wide definition, almost every technology could be taken as AP, like cars, computers or houses.

DOI: 10.4018/978-1-4666-3986-7.ch034

In practical terms, the concept of AP is applied to technology out into practice to solve problems in people with some kind of temporal or permanent disability. The WHO states APs as “Any product (including devices, equipment, instruments and software), especially produced or generally available, used by or for persons with disability (Heerkens, Bougie, & Vrankrijker, 2010):

- For participation;
- To protect, support, train, measure or substitute for body functions / structures and activities; or
- To prevent impairments, activity limitations or participation restrictions”.

From an economical point of view, the limited market of application of APs has worked as a constraint for their development under capitalism. The limited population of disabled people is an impediment to develop scale economics in production. We can clearly see the importance of “extra-market” motivations to develop and distribute this kind of technological products, as proposed in (Edyburn, 2004). This is the main reason why most of the presented APs in this work are prototypes. Hence, social institutions should invest in this and many other social-valued fields of research, development and innovation. These collectives cannot wait for the market, which may not even arrive.

In this chapter, we will focus on the blind people, more specifically on the ICT concerning their mobility and orientation. Our aim is to present relevant aspects of this issue, as well as a state of the art review about such technology applied in this field.

For a global understanding purpose, we present the last report about blindness from the WHO (WHO, 2009):

- About 314 million people are visually impaired worldwide; 45 million of them are blind.
- Most people with visual impairment are old, and females are more at risk at every age, in every part of the world.
- About 87% of the world’s visually impaired live in developing countries.
- The number of people blinded by infectious diseases has been greatly reduced, but age-related impairment is increasing.
- Cataract remains the leading cause of blindness globally, except in the most developed countries.
- Correction of refractive errors could give normal vision to more than 12 million children (ages 5 to 15).
- About 85% of all visual impairment is avoidable globally.

## **ORIENTATION AND MOBILITY: AN APPROACH**

Moving in a 3D space requires orientation and navigation capabilities (Mast & Zaehle, 2008). For that purpose, we are able to gather, interpret and build up knowledge of our environment in a multifaceted skill (Long & Hill, 1997). The set of skills, techniques, and strategies used by blind people to travel independent and safely are known as Orientation and Mobility (O&M) (La Grow, 2010).

It is crucial to remark the difference between orientation and mobility, although they often appear in the same acronym as O&M. Regarding Martínez and Moss, *Orientation* means to “know where he (she) is in space and where he (she) wants to go”, while *mobility* is to be “able to carry out a plan to get there” (Martinez, 1998). A similar classification was proposed by Petrie et al. (1997) as “macronavigation” and “micronavigation”, respectively.

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