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Guest Editor's Introduction

TECHNOLOGY FOR SPECIAL NEEDS

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Human beings use technology to perform all types of tasks. An important issue related to this unquestionable fact is that technologies must be designed so that they can be used by all types of people without any discrimination of age, educational level, abilities, health conditions, and so forth. The term *accessibility* has been proposed to refer to the parameter that measures the degree to which technology use is not limited by any physical or cognitive barrier. Accessibility is an essential component of the *usability* parameter that refers to the ease with which a user can learn to operate, prepare inputs for, and interpret outputs of a system or component (International Organization for Standardization [ISO],1998).

Accessibility is an issue related to users that have some kind of physical or psychological characteristics that impose any number of barriers to technology use. For example, there are people such as paraplegics with some physical limitations for interacting with a personal computer. It is evident that the input systems of the interface designed for a paraplegic cannot be those that are found commonly in the devices of general use. Other obvious examples of users with special needs are those that have some sensorial deficits, like blindness or deafness.

People with mental disabilities also face many challenges in today's complex technological environment and in the pace in which life and technological advancements take place. These people can have difficulties, for example, reading signs when they are on the street, at the post office, or in a hospital. In order to help mentally disabled individuals avoid the problems in situations that can seem trivial to many people (such as finding the washbasin in a public place), technological aids are needed.

A special user group for which accessibility is an essential parameter is the elderly. The increasing number of elderly people in our societies and the changes in the social structures in caring for them that have occurred in recent decades causes us to recognize the necessity for designing a variety of technologies for attending to them in their daily activities (Czaja & Lee, 2003).

Diversity in Research Perspectives, Needs and Contexts

In this issue of *Human Technology*, we have collected six papers that cover some important aspects in the design of accessible technology. Vanderheiden (2003) defines accessible

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technology as being able to be used by people with special conditions either directly or with assisting components that would allow them to overcome their limiting conditions. According to this definition, there are two characteristics that accessible technology must have: (a) It cannot have a characteristic that limits its use by people who have some disability; in other words, present an inflexible barrier that limits its use by people with impaired movement or sensorial input; and (b) It should be designed with some special component so that a person with some special motor or cognitive limitation can use it. The research presented in these papers provides examples of both characteristics. One example of the first characteristic can be seen in the paper by Väyrynen, Röning, and Alakärppä. The authors conducted an extensive series of field and usability studies to understand users' needs before designing new technologies. The authors acknowledge a very important aspect of these studies: the identification of user limitations for using new technologies.

With respect to the second characteristic, the paper by Mauri, Granollers, Lorés, and García addresses the important design issue of providing specialized input devices for people with severe movement restrictions, like people with cerebral palsy. They proposed that computer vision-based interaction could be the solution for these users. Therefore, the authors present two possible devices, the Facial Mouse and the WebColor Detector, that show promising results after user evaluation. In the same line of thinking, Garay, Cearreta, López, and Fajardo address the design of devices for communicating emotions for those people who, due to some kind of disability, are *emotionally handicapped* (Gershenfeld, 2000). They designed a multimodal and multistage affective mediation system for people affected by mobility and speech impairments. The system, called *Gestele,* is a promising prototype that adds information related to the user's emotions. This is a step forward in reaching an effective way for affective mediation for those people who are challenged in expressing their own or in interpreting others' emotions.

Designing technology for people with special needs must be done while taking into consideration four basic facts:

(a) It must start by detecting the special needs of particular users. Not all handicapped people are the same, even when some people are classified within the same category. For example, two quadriplegics could have different movement impairments.

(b) Technology must solve user problems, but never create new problems. This means, for example, new technology that is too invasive, or that monitors the movements too closely, should be used only when strictly necessary.

(c) Technological systems must be simple, economically accessible, and easy to learn.

(d) The systems should fit into the user's environment, be fun to use, respectful of their privacy, and so forth.

The system for assisting senior citizens in their homes through the use of a small robot that was designed and described by Baillie and Schatz in their paper is a good example of how a device designed for helping the elderly should not affect the fixtures or fittings of their homes.

We could and should approach the design of technology for people with special needs from different perspectives and methodologies. Väyrynen et al. used a multidisciplinary approach in which elderly users of videotelephonic services are viewed as active partners in the design of sociotechnical systems from which they benefit. The authors used a user-centered, participatory usability methodology, called PERDA, in which users (including elderly users and the people that provide services to them), designers, and a wide group of

professionals that included ergonomists, psychologists, anthropologists, and so on, analyzed together the technology in the different phases of the iteration process. The aim of this methodology was the discovery of users' needs, the characteristics of the technologies that could satisfy those needs, and the design errors that could limit their use by the elderly. The methodology included all methods and techniques used in the many different disciplines of the research team.

Ojel-Jarmillo and Cañas present a different approach. They took a particular usability problem, the calls that users of telecare devices make by error, and tried to find a design solution by analyzing the cognitive characteristics of elderly users in relation to the device's characteristics. Their analysis allowed them to propose a hypothesis that could be tested by an experiment. The results of their experiment showed that changing a specific design characteristic can reduce the number of erroneous calls made.

The number of contexts in which people with special needs live and for which technology could be designed to make their lives easier is enormous. This fact simply means that this field is broader and deeper than many might think. However, an important technological environment in which accessibility must be taken into account is education. Nowadays, computer-based learning is being integrated into educational systems all over the world. Therefore, technology designed for providing learning environments must consider that learners could have a wide range of health conditions and disabilities. In addition, technology is now a key learning tool used specifically for individuals with cognitive and/or physical disabilities. This reality was addressed by Maguire, Elton, Osman, and Nicolle in their paper. They described an IT-based Virtual Learning Environment that supports learners with severe cognitive and physical disabilities. The design of this environment is a very good example of how accessibility in today's technology can lead to creative solutions for various needs. For example, tutors using this system could modify input device settings to suit different students' needs. There could not be any better example of the meaning of accessibility.

The Benefits of Technology for All in Modern Living

These six papers represent only some of the aspects of the multifaceted issue of access to technology by people challenged by mainstream interfaces, although they are some important ones. However, we must note that the topics addressed in the papers point to the fact that this field is open to many new technological developments, as well as that these issues regarding, questions about, and possibilities for making the technological benefits available for the diversity of people and needs should be the first item on the research agendas of designers, ergonomists, human factors specialists, and other professionals involved in designing human technology. All of these topics revolve around a central idea: Disabled people need technology to perform their daily activities by themselves just as nondisabled people do. For example, people with psychological or physical disabilities have social lives in which they participate in social and interpersonal encounters, just as other people do.

In a quality program of care for disabled people, the days include meetings and training sessions. In addition, the special needs individuals often must be reminded of things, such as, for example, when to take their medicines. Since there is a shortage of caretakers, and the few people in these roles rarely have enough time to address every need of their clients, disabled people need to be able to remember or address needs by themselves. That is to say, they need to be able to take better control of their own time and knowledge about their activities. Many

disabled people want to be able to live alone but they need technologies to assist in controlling potentially dangerous tools in the home, such as gas furnaces, electrical equipment, and open faucets. They also want to have the possibility of moving around and visiting the places that are of interest to them. These desires and needs of members of our societies provide ample reasons for designing devices to help them in carrying out all their daily activities.

In reading the papers that follow, I have a suggestion for the readers' consideration. It is becoming ever more clear that there can be a confluence of objectives between the designers of devices for disabled people and the designers of new devices for everyday situations. For example, Vanderheiden (1998) suggests that some aspects of accessibility to the Internet for disabled people are similar to those that must be considered in the design of mobile systems for accessing the Internet (e.g., PCs with Internet designed to be used in cars). Also, if we think about the design of technology that helps disabled people to live independently and visit places of interest, we could recognize that the important research effort for developing systems that locate geographical positions (as the GPS, or systems of global positioning, do) could be easily incorporated into technology for people with special needs.

This issue of *Human Technology* provides further encouragement for all designers, engineers, and others involved in technological development to see the mutual benefit of approaching accessibility and usability from a global perspective. Everyone in our societies benefits when universal design and the needs of the users serve as the foundation for creative new approaches to technology.

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