Towards an inclusive future

Impact and wider potential of information and communication technologies

Edited by Patrick R.W. Roe

Swiss Federal Institute of Technology of Lausanne

Laboratory of Electromagnetics and Acoustics (LEMA-EPFL)

Accessibility for All to Services and Terminals for Next Generation Networks

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Foreword

Technological innovation has brought immense benefits to our society and economy. Information and communication technologies (ICT) now play a key role in all our daily lives, in our work, education, use of public services and in our homes. New possibilities emerge of products and services that are flexible, quick, adaptable to our preferences, reliable and robust.

Yet these same technological advances can present significant barriers to some of the very people able to benefit most from these services and, without the right support, can even add to the exclusion many people suffer. Key decisions made when designing and developing technological products and services will dictate whether some groups, like people with disabilities, will be able to use them or not.

About 15% of Europeans report difficulties performing daily life activities due to some form of disability. With the demographic change towards an ageing population, this figure will significantly increase in the coming years. Older people are often confronted with multiple minor disabilities which can prevent them from enjoying the benefits that technology offers. As a result, people with disabilities are one of the largest groups at risk of exclusion within the Information Society in Europe.

It is estimated that only 10% of persons over 65 years of age use internet compared with 65% of people aged between 16-24. This restricts their possibilities of buying cheaper products, booking trips on line or having access to relevant information, including social and health services. Furthermore, accessibility barriers in products and devices prevents older people and people with disabilities from fully enjoying digital TV, using mobile phones and accessing remote services having a direct impact in the quality of their daily lives.

Moreover, the employment rate of people with disabilities is 20% lower than the average population. Accessible technologies can play a key role in improving this situation, making the difference for individuals with disabilities between being unemployed and enjoying full employment between being a tax payer or recipient of social benefits.

The recent United Nations convention on the rights of people with disabilities clearly states that accessibility is a matter of human rights. In the 21st century, it will be increasingly difficult to conceive of achieving rights of access to education, employment health care and equal opportunities without ensuring accessible technology.

Technology penetrates ever more in our daily lives. It is crucial that we create solutions that are usable and accessible for everyone, regardless of their abilities. This is not just about meeting the needs of a small part of the population. In fact, evidence suggests that facilitating access to the information society for people with disabilities benefits many more people in the general population, for example as it drives innovation towards easier to use products and websites.

Last year, all Member States agreed on a declaration in Riga committing themselves to take concrete steps to build an Inclusive Information Society and setting clear targets for

the coming years. To achieve these objectives, it is important to make everyone aware that eAccessibility is a positive factor for the competitiveness of our industries. Technology is pointless unless it ultimately meets the needs of society. This must be fully reflected in the European policies for building the Information Society. eAccessibility is thus essential to achieving an inclusive society and key for the success of the i2010 initiative, A European Information Society for Growth and Employment.

European funding on research and development for accessible technologies and services is not the only precondition to building an information society for all. To ensure that everyone has the opportunity to benefit from these impressive technological advances, it is also essential to create a legal and economic environment in which these European socio-economic objectives can be achieved. The various factors that can contribute to the risk of exclusion are indeed often interrelated, like poverty, low level of education, unemployment, disability and old age. These need to be addressed in a consistent and coherent policy framework.

A truly inclusive Information Society must be socially and economically sustainable. For many years, accessibility efforts have been concentrated on removing existing barriers. But this is not enough. COST 219 activities have been pioneers in preventing eAccessibility problems by promoting a Design for All approach for telecommunication products and services.

This book addresses the accessibility of next generation ICT networks and services running on them. Some of the specific issues in this context are: how to ensure accessibility to new IP based communication solutions? What features do we need to build in next generation networks to ensure real time multimodal conversations? How to ensure the accessibility of emergency numbers? Next generation networks offer immense opportunities for having, besides voice, good quality real time video communication using sign language and text, including for example display in real time virtual Braille. This would open up new communication opportunities in particular for deaf-blind persons.

The time is ripe for addressing these issues, asking questions such as the ones above. This book will certainly contribute to the debate and stimulate the implementation of accessible solutions in next generation networks. I welcome this important contribution to the telecommunications field and to the construction of an Inclusive Information Society in Europe.

Viviane Reding

Member of the European Commission
for Information Society and Media

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1. Introduction

Patrick Roe

There is no question that over the last twenty years, since the inception of the original COST 219 Action, a considerable shift in attitude and awareness has occurred towards including people with disabilities and older people in all aspects of society.

From a situation of ignorance and overall lack of awareness, there is now a general acceptance at a political, societal and even to a certain extent at an industrial level that it is no longer acceptable to develop products and services that will exclude a substantial proportion of the population, including people with disabilities and older people.

This is not to say that all issues have been resolved, far from it. For example, one of the aspects that still needs to be conveyed to all stakeholders is that embracing the Design for All principle is not a one off effort but an ongoing and permanent commitment over the longer term. However at least there is now a state of recognition that these issues have to be addressed and a realisation that if these complex issues are suitably handled with appropriate strategies and policies, there are exciting potential rewards to be gained. Indeed, with the well-publicised ageing of the population the issue of technology at the service of older people is seen as an opportunity and an integral part of future strategies in tackling the problem of how to keep people in their homes for as long as possible (chapter 3).

A crucial and recurring theme throughout the book is that it is vital to design products and services right from the beginning that can be used by the broadest possible section of the population (Design for All approach discussed in chapters 3, 4, 5, 6, and 7, for example).

The purpose of this book is to give the reader an overall picture of the current situation with the latest trends in products and services that can be used by as many people as possible including people with disabilities and older people (chapter 2). One example from section 2.3.2 will show how remote sign language interpretation using 3G telephony had a high take up when priced affordably. Other examples presented in chapter 2 include showing how new technologies can help with safe navigation (section 2.2.1) and how the potential of broadband can be fulfilled in providing useful new services (section 2.3.1). Some of the latest issues concerning relay services and text telephony are discussed in sections 2.3.3 and 2.4

There is also a presentation of the latest possibilities of using speech processing (section 2.2.2). This technology has been promising much for many years, and the reader will be able to assess the degree of maturity it has now reached whilst being able to appreciate the potential for using it in applications for people with disabilities.

Another very important emerging technology/area is that of Ambient Intelligence (AmI). The potential implications for all citizens are immense. In chapter 4, the reader will get an insight into the exciting new possibilities that AmI could offer people with disabilities and older people. The approach used has been to take the ISTAG (IST Advisory Group) scenarios (with some adaptations) and to analyse what would happen if people with disabilities were introduced into the scenarios. In this way, it has been possible to carry out a detailed analysis of some of the implications and possibilities of AmI for people with disabilities. This should help all potential users answer the question, "The Future is here, can I live with it?" Ethical issues related to AmI, which are of course of particular relevance to all disadvantaged groups, are discussed in section 4.3.

An important component in this gathering groundswell of awareness is the willingness of governments, both at national and EU level, to introduce new laws and/or regulation, backed up by standardisation, so as to ensure equal rights of all citizens in relation to access and use of technology.

A comprehensive review of the current situation is given in chapter 5, where the reader will be able to gather a clear idea of the available choices within the review of Framework Directives and the potential impact these decisions will have on people with disabilities. The EU is clearly at an important regulatory crossroads with the next few years being crucial in determining which is to be the future direction of regulation. This chapter indicates how the interest of disadvantaged users can be protected within this Framework Directives review without hampering innovation and investment.

An additional key issue raised in chapter 5 is that of certification, be it self-declaration certification, certification/accreditation of suppliers or third-party certification schemes. The various options and their implications are discussed leading on quite naturally to chapter 6 where an overview can be found of current trends in accessibility evaluation and what types of evaluation and usability assessment are currently being carried out by test houses. The reader will be able to gather information about a mobile phone evaluation toolkit developed within the framework of COST 219ter (section 6.3) which is a simple methodology for

assessing the accessibility of a mobile phone. The best time to use this toolkit would be while testing/checking other protocols and design issues. A case study from Portugal of how evaluation may change the design is also given in section 6.4.

Despite the growing awareness and increasing technological possibilities, offered for example by broadband, there is still widespread frustration that more truly accessible and usable products are not appearing on the market. To try and understand the reasons for this lack of products and services COST 219ter resolved to employ the Interactive Management (IM) methodology with the triggering question "Considering the availability of powerful broadband technologies and the development of relevant scenarios, what are the obstacles that prevent us from producing more practical applications?". The intriguing results and ensuing roadmap from of these two (IM) workshops are described in detail in chapter 7. Without revealing too much, it is possible to say that the process yielded some unexpected results. For example, the roadmap on page 293 shows that some very fundamental issues, such the difficulty in turning a statement of user needs into design requirements, still needs to be resolved in order for there to be more practical applications and products on the market.

This roadmap also highlights some of the challenges that still lie ahead on the road to inclusion. The momentum is surging ahead pushing all components of our society including, users, disability organisations, regulatory authorities, legislators, standardisation bodies, civil servants, governments and industry towards having to grapple with new issues and break new ground. There is no turning back now and by the end of this book, the reader should have a better appreciation of the point we have reached on this road towards a truly inclusive future.

Note from the Editor

Although the Members of COST 219ter are well aware of the WHO "International Classification of Disability, Functioning and Health (ICF)", the terminology used through out the book is not wholly consistent. This is partly for reasons of style but also partly reflects the various opinions and preferences of the authors, amongst whom no consensus was reached (and probably never will be) on what were the most acceptable terms to be used. The Editor decided to respect this variety of usage and hopes that no offence is taken by anyone.

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I would personally like to like to thank all the authors for their most valuable contributions written in most cases in busy circumstances under heavy workloads. This effort is much appreciated. I would particularly like to thank the lead authors of each chapter, without whom this book would never have been finished on time and a special thanks to John Gill for his advice and support throughout the whole process.

Patrick R.W. Roe

Editor

2. Current examples of existing products and services for people with disabilities

2.1 Introduction

Julio Abascal and Patrick Roe

This chapter brings together a number of examples of good practice that have been chosen with the objective of providing some insight on the possible evolution from current telecommunication technologies to future "intelligent environment" services. The main aim is to give a snapshot of current trends in services that are accessible to people with disabilities and to discuss the possible impact on people with physical, sensory or cognitive restrictions (that may be due to a disability, ageing or to the special conditions or equipment they use). The emphasis is on presenting current services and how they are likely to evolve in the future to show what the potential impact could be on people with disabilities and elderly users. This will also serve as a baseline of what is the current situation in comparison to the possible future scenarios discussed in chapter 4.

The chapter is structured into four main sections (apart from this introduction): 2.2. New technologies to help people with disabilities and elderly people; 2.3. New remote services; 2.4. Evolution of text telephony; and 2.5. User participation in technology. A summary of the contents is given below.

Section 2.2 New technologies to help people with disabilities and elderly people

Technological advancement in the field of robotics has provided devices and techniques for sensoring, positioning, mapping, navigating, etc. These techniques have made it possible to develop devices to help people with physical, sensorial or cognitive restrictions to navigate both outdoors and indoors. The section "Safe navigation with modern technology" makes a detailed description of current technology to support human navigation and discusses the possibilities for the near future.

It is known that speech is the main means of communication between people. Nevertheless a number of users with disabilities experience restrictions in their speech capacity that limit their communication skills. Current speech technology is able to translate text-to-voice and voice-to-text (the latter still without enough quality and reliability), enabling the design of diverse mediation devices and

services. These include, for instance, reading texts aloud for people with sight restrictions, and controlling devices in a more natural way through the voice. The section entitled "Speech processing for people with disabilities" reviews current and more particularly, future applications of speech technologies that can enhance the communication of elderly people and people with disabilities.

Section 2.3 New remote services

Broadband communication technologies are already available. They can sustain advanced services to support people with disabilities and elderly people. Relay services, virtual communities, enhanced communication, etc., are being successfully tested in a number of countries. The section entitled "Novel broadband-based services: new opportunities for people with disabilities" describes seven trials of advanced broadband-based support services, conducted by the National Post and Telecom Agency in Sweden (Post- och telestyrelsen, PTS), to test the validity of current and future broadband telecommunications services in providing remote support that is tuned to the needs of specific groups of people with disabilities.

Relay services usually act as communication mediators between users, one of whom at least has a disability that prevents them from using standard communication devices or services. These services are able to translate from signs-to-voice (and vice versa), from text-to-voice (and vice versa), etc. They can also provide other services such as the description of a received image to a blind person. Some pre-existent relay services may be enhanced, universalised and made less expensive by means of the currently available advanced telecommunication technologies. The section entitled "Access to video relay services through the pocket Interpreter (3G) and Internet (IP)" presents two experiences developed by the Swedish National Post and Telecom Agency: The IP access project, a video telephony relay service based on IP and the pocket interpreter for mobile video communication, both for signing deaf people.

Efficient use of relay services requires that a number of steps be closely followed in order to speed up the service. The section entitled "Convenient invocation of relay services" describes the best way to invoke various relay services currently existing in Sweden. These experiences may be taken as examples of good practice that help optimise the design of the access to future relay services.

The rise of Short Message Services (SMS) tied to the expansion of mobile telephony, is frequently associated in our minds to young people. Short messages are cheaper than voice calls and don't require that both interlocutors are simultaneously engaged. Nevertheless, SMS can be also useful for other groups of the population. A remarkable application of SMS is shown in section "Ways of

using mobile telephones by people with dementia", revealing that elderly people with cognitive restrictions can take advantage of this technology for verbal, text or symbol communication and support.

SMS technology is also used in the "Implementation of an SMS-based emergency service in Finland" to allow not only deaf people, but any other user, to contact the universal 112 emergency service sending emergency text messages. After making contact the user receives an acknowledgement message and can be located for assistance.

Section 2.4 Evolution of text telephony

Text telephony is currently the basic means of communication for many people with disabilities, such as deaf people. The technology supporting mobile telephony does not allow the extension of traditional text telephony. For this reason, many users substitute mobile text telephony by the use of SMS messages, but they do not allow full interactive communication, hence the need to develop novel mobile text telephony services.

Since the next generation of text telephony in Europe is under development, it is necessary to establish basic design guidelines that guarantee the quality of the service. "The recommendations of the Nordic countries regarding functionality for text telephony" section compiles criteria that include mobility, interoperability, continuity, accessibility from the internet, and availability of relay services.

Diverse experiences have been developed to provide mobile text telephony through the access to internet servers. The section entitled "Mobile & IP-based text telephony" shows the deployment of such a service in Sweden, while "Mobile text telephony based on GPRS communications" explains the results obtained by a Spanish project.

Section 2.5 User participation in technology

With the attraction of a growing market, there is a greater likelihood that more and more companies will be marketing devices in the near future that can be accessed by elderly people and/or people with disabilities. Since these concepts can be interpreted in diverse ways, consumers may find that devices advertised as fully accessible, straightforward and easy to use, do not really fulfil their needs. It is within this context that the availability of functional specifications of terminals becomes essential, so that products can be checked and certified in order to give to the customer a guarantee of the appropriateness of a given product or service

in relation to his or her needs. The section entitled "Functional specification for terminal procurement" presents an example of good practice from Sweden in what will become an important area for the future.

2.2 New technologies to help people with disabilities and elderly people

2.2.1 Safe navigation with wireless technology

Jan-Ingvar Lindström

Background

How can I be sure to find my way? Can I walk safely here? What happens if I get lost? Do I dare to try a new route? What if I suddenly fall ill and need help? The lack of good answers to these and similar questions have prevented a number of vulnerable people to move around in outdoor as well as indoor environments which they are not familiar with.

And who is not vulnerable? Basically, all of us sometimes are in need for help because we have lost our way or feel unsafe or have made a mistake in our way-finding effort. Among us, however, are people who feel more at risk than others, not least people with various kinds of disabilities. And among these, people with visual disabilities and those who suffer from cognitive impairments have expressed strong interest in finding solutions to overcome their problems.

Historically, blindness and partial sight have inspired engineers and psychologists to find solutions to way-finding problems for these groups, both in terms of personal navigation aids and landmarks in the environment. Early on, the long cane became a well known attribute to blind pedestrian's navigation, and later efforts have been made to improve the cane by adding remote sensors. Examples are laser emitting diodes end sensors, magnetic field probes and – most recently – RFID[1] detecting devices. Other ideas have been to simulate bat's navigation technique, i.e. the development of various kinds of ultra sonic devices to scan the environment and get some idea of what it looks like.

The common denominator for all these examples has been the individual characteristics of the solutions. Also, they only provide information about the very near environment.

Given these historical facts, over the last few decades, navigation problems of other groups have been acknowledged. An example is the large group of people with cognitive impairments, including e.g. those with dyslexia, mental disabilities, dementia and stroke, but also people with mobility problems, including wheel chair

[1] Radio Frequency Identification

users. The problems here are wide ranging from being able to read and understand a map or remember information to learning in advance about obstacles, on-going road works and similar matters. Even people who are deaf or hard-of-hearing have experienced great problems in moving from their home to e.g. a school or working site by public transport as so much information is given about changes in time tables and alternative means of transport, etc., has been given orally. Slow improvements have come about in society as much information has successively been given both as voice information and presented on visual displays. These solutions, however, have been generic, and not been of much help to people who suffer from dementia, mental disabilities and other cognitive disorders.

A break through came about with the installation of the American Global Positioning System – GPS, that has been used since the late 1980s for positioning purpose, mainly as a tool for finding the way for car drivers and boat and aircraft navigation. As it will be discussed later, the GPS system per se does of course not solve the problems displayed above, but it forms a basis for further development that can lead to powerful tools for all groups with significant navigation problems.

Positioning, orientation, navigation, communication and localization

Mobility outdoors

Knowing one's position is important, but not enough for safe moving around in an unknown environment. A system should also make it possible for users to orientate themselves, i.e. to know in which direction they are standing in relation to, for example, the points of the compass, to navigate independently, i.e. be able to move from one given position to another, and also if necessary, raise an alarm or communicate with an information or alarm centre for personal support and assistance. It should also be possible, for those who so wish, to be found without having to consciously trigger a localization function themselves.

Positioning

Satellite systems

The most widely used and available system – the GPS system – is based on the use of radio signals transmitted from satellites orbiting the Earth and with whose assistance it is possible, with the use of special receivers, to get a position on the

Earth's surface in the form of coordinates. This kind of reference can be transformed into, for example, an indication on an electronic map on a GPS receiver. This can be linked to a mobile telephone, handheld computer or the like.

At present there are two existing systems in use: the American GPS (Global Positioning System) and the Russian GLONASS (Global Navigation System). The latter does not have any marketing in Europe and is currently being extensively updated. For many years, a system has been planned in Europe known by the working name Galileo. This system is designed to be well-adapted for European environments in particular. However, it is still presently at the development phase and will not be fully accessible until 2008 at the earliest.

GPS is designed to provide the best possible coverage some hundred miles north and south of the equator. This means that the further north and south one goes, the worse coverage one gets with GPS owing to the satellites all appearing to lie rather close to the horizon.

In it simplest form, GPS provides a positioning accuracy of some tens of meters. However, there is an extensive system of terrestrial stations that can take care of and process signals before they are received in the individual GPS receiver. This is known as Differential GPS or DGPS. With such support, it is possible to get down to an accuracy of just a few meters. In principle, it is possible to achieve even greater accuracy in this way (to within centimetres) but, for various reasons, it is not practically feasible for the navigation application in question. One reason is that access is not available everywhere to the terrestrial stations required for processing the signal. Another reason is that it may take up an unacceptably long time to process the signal – sometimes several seconds, which is too long in a real orientation situation.

Another possibility is Assisted GPS – AGPS – which can be used in situations where the signals from the satellites are too weak. This may be appropriate indoors, but also outdoors under less favourable circumstances. Examples of such circumstances are when only a small number of satellites can be reached or when moving around on narrow streets surrounded by high buildings or other similar environments – the so called canyon-effect.

It should be pointed out in this context that GPS receivers with much greater sensitivity than before – iGPS – are now starting to come onto the market, which may allow navigation with sufficiently good precision even in environments that are currently problematic from a radio perspective[2].

[2] www.gpsworld.com and www.esa.int/esa websites can be consulted for more information about GPS, DGPS and AGPS.