




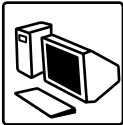







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Chapter 1

***Executive
Summary***

Executive Summary

Goal

The main goal of this report is to identify the future standardisation needs for ICT in order to create a society that is accessible to all citizens, i.e. avoid a digital divide between those that can use ICT and those that cannot.

The frame of reference for this project is built upon two complementary approaches: “Design for All” and “Assistive Technology”.

Design for All is the intervention on environments, products and services with the aim that everybody, included future generations, independently of the age, sex, capacities or cultural baggage can enjoy participating in the building of society.

For the purpose of this report, Assistive technology is defined as:

Any product, instrument, equipment or technical system used by a disabled person, especially produced or generally available, preventing, compensating, relieving or neutralizing the impairment, disability or handicap. (ISO 9999:1998).

Background for the report

This report, and a standalone, Executive Summary Report, have been commissioned by CEN /ISSS in response to Commission Mandate M 273, Design for All and Assistive technology – ICT standards. The work has been carried out by an independent project team comprising experts from industry, user organisations, research and consultancies.

Deliverables

There are two main deliverables as a result of this project:

1. A standalone Executive Summary Report
2. This reference document

The Executive Summary Report provides a work programme for ICT standardisation in order to create a society that is accessible to all citizens. The work programme lists work items proposed for standardisation and /or other measures, proposes who should carry out the work, provides a timeframe and suggests a prioritisation of the work items.

This report has several functions:

- It documents the work of the project team in developing the work programme.
- It collates, for the first time, requirements for ICT standardisation in relation to Design for All in one document.
- It provides the details behind the proposed work items and will be a useful starting point for those organisations that will be completing work items.
- It is a state of the art document for the IST Vth framework programme.
- It provides ideas/ requirements for new ICT products, services and systems.

Apart from the main deliverables, this report has raised considerable awareness of the need for and importance of “Design for All” both within the standardisation world, public authorities and industry. The projects “Open Meeting” attracted 70 vociferous participants, some from the USA. After the Open Meeting a number of inputs have been from various parties. Invitations to present the report have been received from various for a including the EU Ministerial Meeting in Lisbon.

Executive Summary

High level conclusions

Knowledge/ requirements for Design for All in relation to different ICT domains exist and these could be revised and applied generically across different ICT domains.

The subject matter of this report, ICT, is both enormous has no clear boundaries.

In addition, no pan –ICT standards currently exist with regard to the Design for All approach. As a result of this point and the one above, a considerable amount of work will be needed to rectify the situation, as witnessed by the number of recommendations in the Executive Summary report.

This project and the deliverables are the first step in rectifying this situation; - a follow up plan will be needed to ensure a successful implementation.

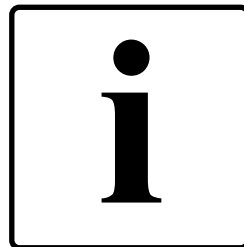
The speed at which ICT is developing and the convergence between technologies will require organisations to work more effectively across traditional organisational boundaries if the recommendations are to be implemented, and a digital divide avoided.

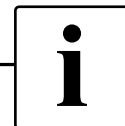
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Chapter 2

Guide to the Document





This chapter provides a brief description of the overall document and chapter structure. It gives an indication of the different chapter contents. It includes a list of definitions and abbreviations used in the report.

How to read this report

The document is NOT designed to be read from start to end, but should be used as a reference tool.

This report provides:

1. An introduction to Design for All and Assistive technology (Chapter 3)
2. A reference to standards, projects, guidelines and literature in relation to Design for All and Assistive technology (Chapter 4)
3. An overview of standards and guidelines within different ICT domains. (Each ICT domain related chapter, 6 -15).
4. An overview of future standardisation needs within different ICT domains and a rationale. (Each ICT domain related chapter, 6-15).

Document structure

There are two major parts to this document:

- Introductory/ Background chapters (three –five) which explain underlying concepts
- Chapters on different ICT domains–(six–sixteen) and requirements for ICT standardisation.

Chapter Structure for Chapters 6-15

Each chapter has the following structure:

Introduction

The introduction to the ICT domain is presented and a resume of challenges for different users is presented.

Standards

An overview of standards that ensure user requirements is presented.

Output from projects

An overview of important projects that provide user requirements is noted.

User Requirements Analysis

A high level checklist is presented of users interactions with the ICT domain in relation to different environments. This is presented in tables. It is the sum of interactions that provides requirements (user characteristics x task x environment).

Conclusions

Conclusions for standardisation are based on a synthesis of the above information.

Definitions

Assistive technology	Any product, instrument, equipment or technical system used by a disabled person, especially produced or generally available, preventing, compensating, relieving or neutralizing the impairment, disability or handicap.
Design for All	The design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialised design.

List Of Abbreviations

ANEC	European Association for the coordination of consumer participation in standardisation	ISDN	Integrated Service Digital Network
CEN	Comité Européen de Normalisation	ISO	International Standardisation Organisation
CENELEC	Comité Européen de Normalisation Électronique	ISSS	Information Society Standardisation System (CEN)
COPOLCO	COConsumer POLicy COuncil (sits on ISO)	IST	Information Society Technologies
CWA	CEN Workshop Agreement	ITU	International Telecommunications Union
EIDD	European Institute for Design and Disability	MMI	Man Machine Interface
EMC	Electro-Magnetic Compatibility	NSB	National Standards Body
ETR	ETSI Technical Report	RTD	Research & Technology Development
ETSI	European Telecommunications Standardisation Institute	SATURN	Smart cArD and Terminal Usability RequireMeNts (TIDE project)
ETSI TS	ETSI Technical Standard	SET	Secure Electronic Transactions
EU	European Union	TC	Technical Committee (in CEN)
FTP	File Transfer Protocol	TIDE	Telematics for Integrating Disabled and Elderly
GSM	Group Special Mobile	UMTS	Universal Mobile Telecommunications System
HF	Human Factors	WG	Working Group (in CEN)
ICT	Information and Communications Technologies	W3C	World-Wide Web Consortium
IEC	International Electrotechnical Committee	WWW	World-Wide Web

Chapter 3

Introduction

Background for the Project

The use of ICT (Information and Communication Technology) is rapidly becoming an essential part of the economic, educational and social life of the European citizen. This heightened reliance on ICT technology to convey/distribute content and services has raised concern as to whether these new services are fully accessible for all people, especially disabled and elderly people. Access by elderly and disabled people to mainstream technology and technology based services is a major issue in enabling and facilitating their integration in society. The growing proportion of elderly and disabled in the European population signifies that the urgency of this issue will not decrease in the years to come.

In the Member States of the European Union, the number of people who are elderly or disabled is estimated at between 60 and 80 million. There is a large overlap between these two groups since disability is strongly related to age,

with 70% of people with disabilities being aged 60 or over. By the year 2020 it is estimated that 25% of the population will be aged over 60, and the largest increase is expected in the oldest age groups (75+) where disability is most prevalent. This rise in the elderly population signifies that in the near future the European Governments must create a large number of assistance services or they must ensure that the elderly are capable of living independently over a longer time period. This would imply that transport facilities, shops, public buildings and services, consumer goods, accommodation, communications etc. should be adapted to encompass these "new" user groups.

It is a major challenge for the European Union to maintain and improve the quality of life, integration and independence of these citizens, including providing technology based solutions aimed at integrating them and helping them to lead full and independent lives. Today, the

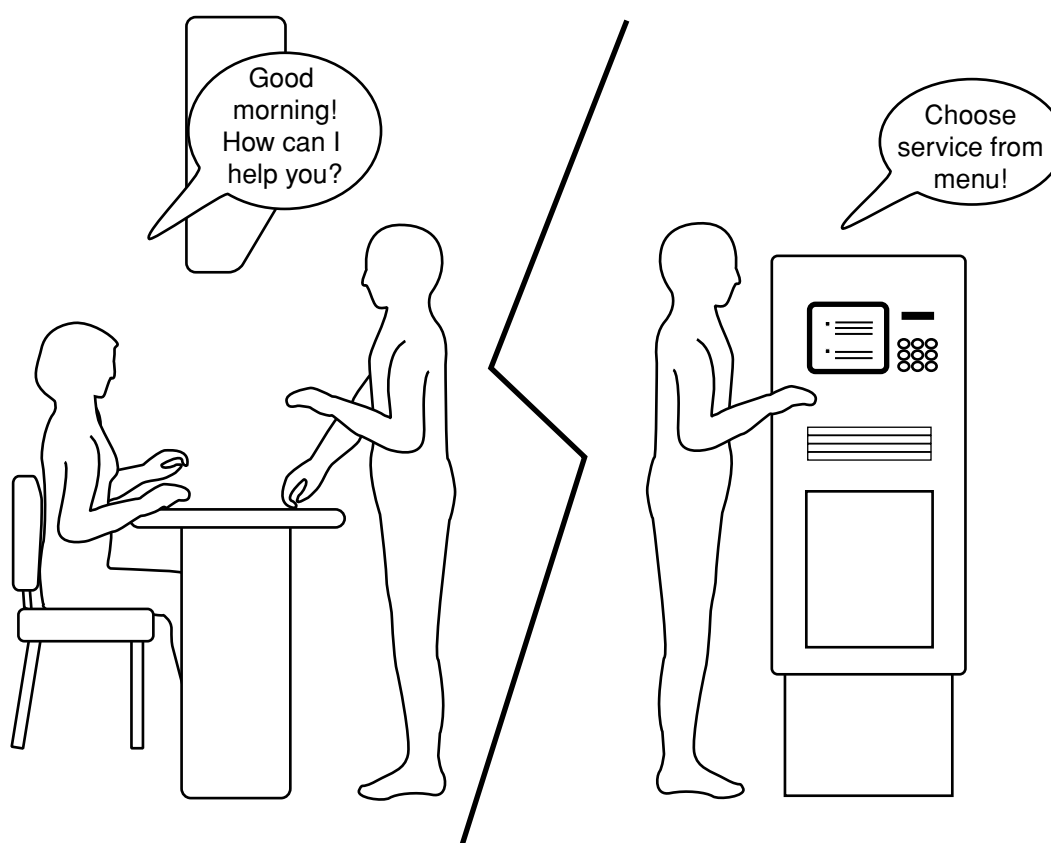


Figure 3-1: "The service society is being replaced by a self service society."

Introduction

European Union strives towards this goal through concerted efforts in different areas, e.g. development of new legislation, support to technological research and development, and the development of new standards. Central for all these efforts is a focus on users requirements and Design for All.

This project focuses on the European Unions efforts to develop new ICT standards in order to provide European citizens with accessible ICT products and services. The market for accessible ICT products is growing, although

European industry, in contrast to some american industries, has not yet seen the market opportunities that is offered through “Design for All” solutions. In this respect, standards can play a significant role providing guidance and offering a clear framework for developers who wish to make their products and services accessible for all.

The main goal of this project is to identify the future standardisation needs for the ICT domain in order to create a society that is accessible to all citizens.

Goal

According to the Mandate M 273, CEN/CENELEC/ETSI are requested to determine requirements for standardisation to ensure accessibility for disabled and elderly people within the information society. In this process, close co-operation with organisations representing elderly and disabled organisations and relevant consumer organisations is required.

The main result of the project will be a preliminary programme that list work items to be standardised. Type of deliverable, lead responsibility, priority, and proposed timetable will also be described. When the work programme are accepted by representatives from industry, consumer groups and public authorities, the European standards bodies will start developing the new European standards.

The mandate states:

"The requirements shall be drawn up from the perspective of the European dimension in terms of markets and technologies, and shall be based on an examination of:

- World wide, European and national Member States situation with regard to standardisation and accessibility. Full account shall be given of existing national and international activities in this area. This shall include at least ISO, the World Wide Web Consortium (W3C), the international and European activities for the Web Accessibility Initiative (WAI), and the Nordic Initiative on Standards for Disabled and Elderly People (NORDICT). Liaison shall be established with the TIDE ACCESS project and COST 219 bis.
- The impact of this situation on the European market.
- The prospects outside Europe.

An analysis and assessment shall be made of requirements of European guidelines on ICT accessibility, taking into account other relevant activities including the MART "Telecoms for Older People in the Information Society" study, the US ATBCB accessibility guidelines and the standardisation activities of the ACCESS project. An analysis and assessment shall also be made of the pre-standardisation and standardisation requirements of EU-funded RTD programmes aimed at disabled and elderly people, including in particular the TIDE programme and the Telematics Applications Programme.

Constraints

Rationale for Subdivision of ICT

The domain of ICT-technology is extremely large, and growing. Development of new technology and convergence between already established technologies, both within and outside the ICT-domain, provides for fuzzy borders between technological domains. As a consequence it is very difficult to differentiate between ICT-domains.

Even within ICT-domains, convergence among different technologies also makes it difficult to identify fully independent sub-domains. There is today substantial overlap between sub-domains that previously were considered as distinct, e.g. telecommunications and personal computers.

This project has chosen to adopt the classification used in ANECs Consumer Requirement document (ANEC IT98-007). Slight modifications were made in order to adapt the different categories (sub-domains) with regard to the competence of the project group.

The categories employed are listed below:



Communication Devices



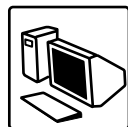
Digital Broadcasting



Wayfinding



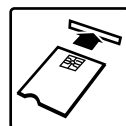
Personal Information Appliances



Personal Computers



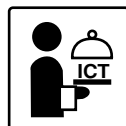
Public Access Terminals



Smart Cards



Internet and Electronic Commerce



Services



Smart Housing

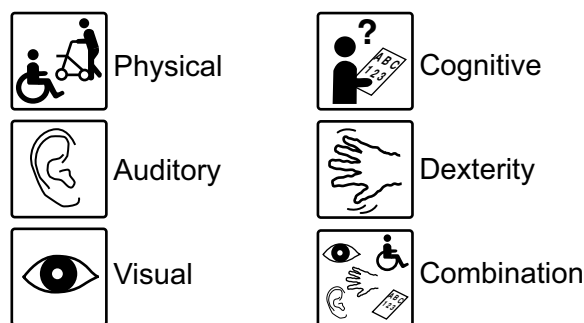
Rationale for Subdivisions of User Diversity

In order to understand and effectively use ICT technology, people are dependent upon being able to perceive the relevant information from the environment, understand and make decisions based on the perceived information, and be able to turn the decisions into appropriate behaviour.

At the same time, people cannot be thought of as a homogenous group with the same needs, skills and capacities. People vary in sex, physical and cognitive capacities, etc. In addition, peoples characteristics and activities gradually change throughout their lives. Children's size prevents them from reaching, or operating, a series of objects or facilities, and adults may experience situations in which their normal situational-proficiency is temporarily reduced due to a bandaged hand, a broken leg, a heavy load, a foreign language, etc. Some people also develop more specific and permanent disabilities in the course of their lives.

The experience of feeling disabled or not depends on the match between the environment, the persons individual characteristics, and the task to be carried out. Conceptualised in this way, disabilities can be said to be situation specific, and not a personality trait to be attributed to individuals. It is the "gap" between the demands from environment and work tasks, and the individual capacities and skills that determine whether or not a person is "disabled" in a specific situation. As such, disability can be said to be situation dependent. Coupled with the fact that there is a large variation between different people regarding their capacities and skills, care should be taken to include user requirements when designing products, services and environments. Few people represent the "average" person, with the consequence that if a product is designed for the "average" person, it might be uncomfortable or impossible for most people to use it.

All categorisation schemes, of which there are several, are simplifications of reality. It is neither possible, nor advantageous to consider all relevant variables. In the design process it is desirable to reduce the complexity by only considering the most relevant variables. In this project we have chosen to use a rather coarse categorisation based on the functioning of the main human senses and



limbs. In addition, cognition has been added as a separate category. The categories used are:

It should be emphasised that the categorisation scheme is very general and does not give justice to the large differentiation that exists within each category. E.g. visual impairments include blindness, tunnel vision, partial loss of peripheral sight, loss of central sight, etc.

The simplicity of the categories used should be kept in mind when conclusions are drawn regarding needs for standardisation. Based on the categories it is easy to think of the users as deaf, blind, etc., while many disabled users are elderly with slight to moderate degradation in one or more of their capacities and skills. E.g. for every profoundly deaf person, there are 80 who are hard of hearing, and for every citizen dependent on a wheelchair, there are 15 persons that have problems over long distances without aid or support (Coleman 1999, p. 164). Using the rather "black and white" categories (blind, deaf, etc.) without considering the large variation within each category, we run the risk of having a strong bias in the conclusions favouring the most extreme, and smallest user groups.

In most cases, it will be difficult to satisfy all requirements from all user groups in relation to a product. Some groups might need special adaptations (assistive technology). In order

to make solutions that are suitable for the largest possible number of users, demographic information should be used as input for design decisions.

Theoretical Perspectives

The frame of reference for this project, or the philosophy guiding the collection and analysis of information, is built upon two complementary approaches: “Design for All” and “Assistive Technology”.

Design for All

Design for All is the intervention on environments, products and services with the aim that everybody, included the future generations, independently of the age, sex, capacities or cultural baggage can enjoy participating in the building of our society.

It is a simple idea: **make products and services usable by everybody**. It serves two purposes at the same time: meeting the needs of consumers who have difficulty using some products, and meeting the needs of companies who want to expand their potential market.

Assistive Technology

Typically, “Assistive Technology” is concerned with the **development of the specific interfaces needed by disabled and elderly people to gain access to mainstream technology terminals and services**. New technology is exploited to construct new products and services specifically targeted at elderly and disabled people to permit certain functions or compensate for loss of function. A broader interpretation of the concept would encompass any device or interface developed to enable a specific individual to get access to mainstream technologies and services.

A complementary approach: Design for All AND Assistive Technology

Ideally all products and services should be accessible to 100% of the population (Design for All), but today this is not a realistic goal, both due to the large variation in user characteristics, inadequate understanding of the complexity in user characteristics, situational demands, available technology, etc. A complementary approach is therefore needed to address those cases where it is not practical, possible or cost-effective to meet all requirements. In these cases, an Assistive Technology approach will focus on the development of special interfaces and devices that can bridge the gap between demands from the products/- environment and the users abilities (see figure 3-1). Examples include the size of text on a screen (increasing the size for those that have vision problems could be annoying for the rest of the population) or the volume of a headphone. In these two cases, glasses will correct the problem of those who have deficiencies in the vision and a hearing aid will improve the inability to hear sounds at an ordinary volume and frequency.

It should be stressed that the Design for All approach for developing products and services is the preferable route due to both economic and usability considerations. All too often the development of assistive technology solutions are developed at great expense and effort when a more effective and cheaper solution would have been to build the appropriate features into mainstream products and services at a fraction of the cost.

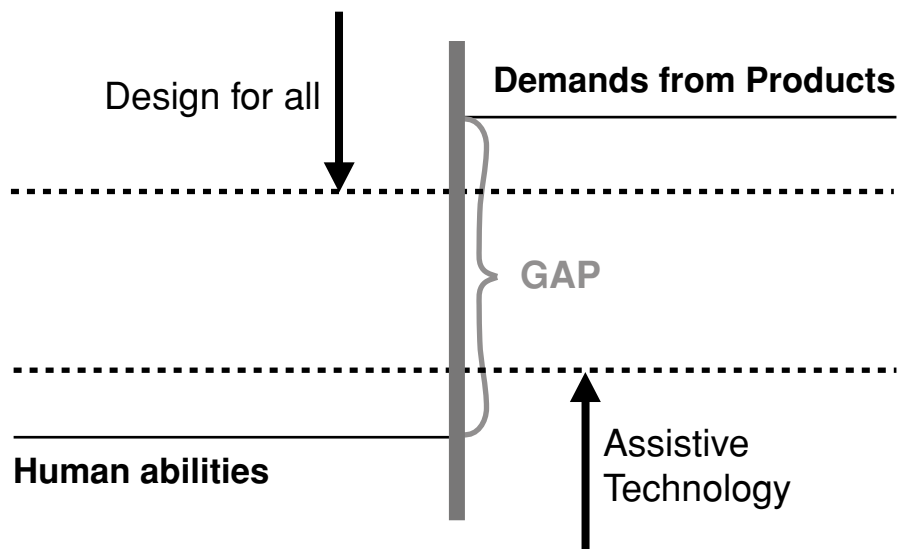


Figure 3-1: Society has two ways to reduce the gap: The Design for All approach and Assistive Technology.

There would of course be the possibility of creating special products for each of the areas of the affected population but apart from being discriminating, it would involve an enormous expense. On the other hand experience shows that many products have been developed for people with handicaps (taps operated by one hand, remote control, low-floor buses, etc.) and their usage has spread to the majority of the population. By this we do not wish to imply production and technical improvements like computer adapters should stop. But that usage should be limited to those situations in which

in spite of having done as much as possible to adjust the environment to the requirements of the greatest majority of the population, they do not cover a particular persons need.

Where to draw the line between when to use either of these two approaches is dependent on several factors including available technology, experience resources, etc. The line will be in constant fluctuation due to new developments in technology, new legislation, new services and customers, resources, tradition, etc.

Chapter 4

Design for All and Assistive Technology

Design for All and Assistive Technology

Public acknowledgement of people with disabilities and progress towards Design for All has developed in the last few decades along three parallel tracks of activities: legislation fuelled by the disability rights movement, the barrier-free design to design-for-all movement,

and advances in rehabilitation engineering and assistive technology. The last two, Design for All and Assistive Technology, are the basis for this project (see section 4.3.3) and are described below.

Design for All

“Design for All” is the term used in Europe for the principle of making technology – systems, products, services – accessible to all people, including persons with disabilities and elderly people.

The intent of Design for All is to simplify life for everyone by making products, communications, and the built environment more usable by as many people as possible at little or no extra cost. Design for All benefits people of all ages and abilities.

Design for All is the designing of products, services and systems so that they are:

- flexible enough to be directly used, without assistive devices or modifications, by people with the widest range of abilities and circumstances as is commercially practical given current materials, technologies and knowledge; and
- compatible with the assistive technology products that might be used by those who cannot efficiently access and use the products directly.

Design for All has its beginnings in demographic, legislative, economic, and social changes among older adults and people with disabilities throughout the 20th century.

Design for All Standards

There are no known standards addressing directly the issue of Design for All. However, the Consumer Policy Committee (COPOLCO) of the International Organization for Standardization (ISO) has prepared a policy statement on addressing the needs of the elderly and of people with disabilities in standardization work (see Annex 1).

The INCLUDE project (see below) has made a synthesis of a number of published European documents with recommendations regarding Design for All aspects of information technology standardisation (INCLUDE Deliverable 5.3). Some of them have already been addressed in the mandate and terms of reference for this project team.

Design for All Guidelines

At the political level, the importance of access to information and communication technologies has been identified in several international documents. In 1993, the United Nations adopted the **UN Standard Rules on the Equalization of Opportunities for Persons with Disabilities**. These rules have since been adopted and implemented by a large number of countries. In Rule 5, the following is stated:

"States should develop strategies to make information services and documentation accessible for different groups of persons with disabilities. Braille, tape services, large print and other appropriate technologies should be used to provide access to written information and documentation for persons with visual impairments. Similarly, appropriate technologies should be used to provide access to spoken information for persons with auditory impairments or comprehension difficulties.

Consideration should be given to the use of sign language in the education of deaf children, in their families and communities. Sign language interpretation services should also be provided to facilitate the communication between deaf persons and others.

Consideration should also be given to the needs of people with other communication disabilities.

States should encourage the media, especially television, radio and newspapers, to make their services accessible.

States should ensure that new computerized information and service systems offered to the general public are either made initially accessible or are adapted to be made accessible to persons with disabilities.

Organizations of persons with disabilities should be consulted when measures to make information services accessible are being developed. "

Practical guidelines for Design for All have been published by several international bodies, such as COST 219, INCLUDE and NORDICT(see below).

National initiatives have been taken in several European countries to develop and publish various guidelines on accessible design of information technology. Examples are:

Denmark:	Centre for Accessibility
Ireland:	Interdepartmental Group
Sweden:	The Swedish Handicap Institute
UK:	RNIB
Norway:	DELTA-senteret

In the **United States**, the **Access Board** is the federal agency which develops minimum guidelines and requirements for standards issued under the Americans with Disabilities Act (ADA) and the Architectural Barriers Act (ABA), develops accessibility guidelines for telecommunications equipment and customer premises equipment under the Telecommunications Act, develops accessibility standards for electronic and information technology under section 508 of the Rehabilitation Act, provides technical assistance on those guidelines and standards, and enforces the Architectural Barriers Act.

The **Center for IT Accommodation (CITA)** of the General Services Administration, a federal agency, is a nationally recognized model demonstration facility influencing accessible information environments, services, and management practices. To achieve this goal, CITA works with an expanding network of public and private sector partners.

The **Center for Universal Design at North Carolina State University** is a national research, information, and technical assistance center that evaluates, develops, and promotes universal design. It has developed seven principles as general guidelines for Design for All (see Annex 2). They may be applied to evaluate

Design for All and Assistive Technology

existing designs, guide the design process and educate both designers and consumers about the characteristics of more usable products and environments.

In **specific technology areas**, various guidelines have also been developed, as can be seen in the following chapters. Examples are the Web Accessibility Initiative (WAI) with

guidelines on Internet accessibility (see section 14.3) and the Nordic Guidelines for Computer Accessibility (see section 11.2).

However, recent research appears to indicate that traditional guidelines may not be the optimal way to influence designers. The WAI guidelines are not being used by Web designers as much as was originally expected.

Design for All Projects

COST 219 is a joint action between 14 European countries to increase the availability of telecommunication services and equipment so that they are accessible also to elderly people and people with disabilities. The aim is therefore to make sure that the Design for All concept in one form or another is taken into account when dealing with telecommunications and teleinformatics.

COST 219 also seeks to promote research in the field of telecommunications and teleinformatics with the aim of proposing solutions to the problems related to the needs of disabled and elderly people in providing access to new telecommunication and teleinformatic services.

The objectives of COST 219 have been specified in operational terms as follows:

- To identify the impact of technical, social and economic developments on elderly people and people with disabilities.
- To define the needs of the target groups and alleviate problems of the target groups.
- To produce guidelines to meet the needs of the target groups and influence the development of services and equipment.
- To provide a forum for the exchange and dissemination of results from research and specialist's experiences.
- To create a network of users and experts in this field.
- To initiate and perform feasibility studies, research preparation and technology evaluation.
- To disseminate information and create awareness among relevant actors.

- To influence standardisation, regulation and legislation to take into account present and future needs of elderly people and people with disabilities.

- To promote end user involvement.

- To promote involvement of industry, service providers, policy and decision makers in the process.

Among its activities, COST 219 puts out publications, organizes seminars and other events and maintains an extensive website.

INCLUDE is a project funded by the European Commission to advise projects on how to incorporate the requirements of disabled and elderly users in the design of telematics systems. INCLUDE provides direct advice to projects, as well as produces publications on good design. INCLUDE also disseminates information relating to standardisation and legislation in this area. The INCLUDE website has extensive information about various aspects on Design for All in the information and communication technologies. This is how INCLUDE describes the rationale for Design for All:

"People are different. We are short, tall, young, old, quick and slow. Our abilities to see, to hear, to react and to move vary in time and between people. Regardless of our physical, sensory or mental ability, all of us will sooner or later come across a product, service or system of information and communication technology (ICT) as an integrated part in school, at work or in everyday life."

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“Developers, designers, manufacturers and other actors in the ICT field must take a broad variety of human abilities into account in the design process. The design cannot be for the average person. It has to be for all. The goal is to design products and services that everyone, as much as possible, can use, expressed in the concept of Design for All.”

NORDICT is a joint project in the Nordic countries (Denmark, Finland, Iceland, Norway and Sweden) with the objective to work for the inclusion of disabled and older persons' needs in the European and international standardisation work within the ICT area.

According to the plans, this will be accomplished by:

- identifying the specifically important parts of the ICT-area, where the needs of disabled and older people must be included.

- identifying user demands.
- influencing planning and priorities of the European ICT-standardisation.
- identifying and participating in standardisation work, where the needs of disabled and older people must be included.

The areas to be covered are:

- Electronic commerce
- Information kiosks and self service terminals
- Smart Cards
- Digital services in the home
- World Wide Web
- Smart houses
- IT and traffic.

Assistive Technology

Several definitions have been developed for assistive technology. For the purpose of this report, the definition of “technical aid” in the international standard ISO 9999:1998 will be appropriate:

“Any product, instrument, equipment or technical system used by a disabled person, especially produced or generally available, preventing, compensating, relieving or neutralizing the impairment, disability or handicap.”

Assistive Technology Standards

Formal European standardisation of assistive technology involves several bodies.

Most of the work producing European standards for assistive technology products is carried out by the technical committee TC 293 “Technical aids for disabled persons” of the European Committee for Standardisation (CEN).

A technical aid has been defined in the standard EN 29999 as “any product, instrument, equipment or technical system used by a disabled person, especially produced or generally available, preventing, compensating, relieving or neutralising the impairment, disability or handicap”.

CEN/TC 293 and its “sister committee” TC 173 of the International Organization for Standardisation (ISO) cooperate closely and aim at identical standards wherever possible.

The actual technical work is carried out by “working groups”, consisting of experts nominated by concerned nations and other interested parties (e.g. organizations of consumers and manufacturers). The work of CEN/TC 293 involves almost 200 European experts. A large number of these experts are engaged in the corresponding ISO work as well.

In order to reduce the total number of standards, a “3-level model” has been designed. The basic principle is that common requirements for groups of products are gathered in single standard documents. Product specific requirements/test methods are found in the standards at the lowest level. Then references

are made to higher level documents.

The three-level model

There are three levels of European standards dealing with technical aids for persons with disabilities. These are as follows, with level 1 being the highest:

- Level 1: General requirements for technical aids.
- Level 2: Particular requirements for families of technical aids.
- Level 3: Specific requirements for types of technical aids.

Levels 2 and 3 may be combined. Where standards for particular aids or groups of aids exist (level 2 or 3), the requirements of lower level standards take precedence over higher level standards. Therefore, to address all requirements for a particular aid, it is necessary to start with standards of the lowest available standard.

Implementation of European standards – Medical Devices Directive

As of 14 June 1998, all medical devices, which includes technical aids (assistive devices) for persons with disabilities, must comply with the Medical Devices Directive (MDD). In the field of assistive technology, the MDD defines a medical device as:

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“any instrument, apparatus, appliance, material or other article, whether used alone or in combination, including the software necessary for its proper application intended by the manufacturer to be used for human beings for the purpose of

- diagnosis, monitoring, treatment, alleviation of or compensation for an injury or handicap

- investigation, replacement or modification of the anatomy or of a physiological process.”

It is important to note that it is the manufacturer who decides the intention and thus whether the product is a medical device.

Other Directives may also be applicable. For example, the EMC (electromagnetic compatibility) Directive is generally valid for all electrical equipment.

The MDD, as other product directives, contains a number of administrative rules and certain basic safety and functionality requirements, called Essential Requirements. These requirements must be fulfilled. Otherwise, the product may not be placed on the European market.

The Essential Requirements are very general in character. In order to make them technically applicable for manufacturers, they need to be specified. This is where European Standards come in. They constitute the technical specification of the Essential Requirements.

Standards connected to the Directives and their Essential Requirements are called Harmonized Standards. A Harmonized Standard satisfies the Essential Requirements of the Directive. Therefore, it is a very efficient tool when designing products with respect to the Directive(s).

Product categories

The work in CEN/TC 293 started in 1992 and focused first on “traditional” technical aids, in particular for persons with mobility impairments. These categories were seen to be the most suitable for the first round of standards. Important considerations were that the aids have a large market and that it was possible

to find experts and standards bodies willing to participate in the work.

European standards have now been completed for the following areas: walking aids, urine collection bags, ostomy collection bags, manual wheelchairs, electric wheelchairs, hoists, adjustable beds, prostheses/orthoses and classification.

Obviously, the ICT content in these areas is limited. There are, however, some important ICT-related issues involved, such as electromagnetic compatibility (EMC) with ICT equipment. One example is the potential influence of mobile telephones on electric wheelchairs, hoists and adjustable beds.

Communication aids

In 1996, CEN/TC 293 initiated a process with the intention to start new work in the area of communication aids. Communication aids is an important and growing part of the field of assistive devices for persons with disabilities. Yet, few standards exist. The main product category that has been subject to standardisation efforts, is hearing aids, which is the responsibility of IEC and CENELEC.

“Communication aids” can be seen as all products, systems, services and methods to facilitate and enable communication for persons with disabilities impairing what can be considered “normal” communication.

For practical standardisation purposes in CEN/TC 293, communication aids can be divided into two main areas:

a) Assistive technology devices or technical aids for disabled persons as defined and classified in EN 29999 Technical aids for disabled persons - Classification. The classes and subclasses considered are the following:

Classes	Sub Classes
21	Aids for communication, information and signalling
24 09	Operating controls and devices
24 12	Environmental control systems

Communication aids make up a significant part of the total market of aids for persons with disabilities. In Sweden, communication aids (EN 29999 class 21) represent close to 30% of the total cost of technical aids. Class 21 is dominated by products using information and communication technologies, such as electro-optical aids, computers, audio equipment, video equipment, telephones, face-to-face communication aids, hearing aids, signalling aids and alarm systems. Communication aids is a rapidly developing area, due to the general technical development and expanded knowledge about needs, requirements and preferences of users.

b) Other, related areas, primarily within the fields of telecommunications and information technology.

These include:

- components used in communication aids, such as synthetic speech modules
- regular consumer products used as communication aids, such as personal computers and telephones
- systems features, such as text communication.

In addition, accessibility for persons with disabilities is an important issue in the standardisation of many products and systems related to communication.

In CEN/TC 293, standardisation in area a) will be the main focus. However, it is obvious that activities in other related areas will also be important and have an impact on the standardisation of technical aids. Consideration will be given to the need for keeping links to the areas in b).

CEN/TC 293 has set up an ad-hoc group with the task of making a plan for the standardisation of communication aids. The group has identified possible areas for standardisation (see below).

Standardisation work on environmental controls (now called remote controls) has started in November 1998. Preparations are under way for colour codes and electronic maps. Interfaces for personal communication aids need more preparation work.

ISO TC 173 activities

In ISO TC 173 “Technical systems and aids for disabled or handicapped persons”, most of the work concerns mechanical properties of wheelchairs and aids for ostomy and incontinence.

There is, however, some work going on with relevance to the ICT area:

Classification of assistive technology: ISO/TC 173/SC 2/WG 9 is working on a third edition of the document ISO 9999 “Technical aids for disabled persons – Classification”.

Wheelchairs – serial interface: ISO/TC 173/SC 1/WG 7 is working on the document ISO/CD 7176-17 “Wheelchairs –Part 17: Serial interface for electric wheelchair controllers”. This work originated in the TIDE projects M3S and MOBIC.

The following three documents are being prepared by working groups under the secretariat of TC 173:

ISO/CD 11548 “Communication aids for blind persons – 8-dot Braille graphic characters – Identifiers, names and assignment to 8-bit code tables.”

ISO/DIS 11549 “Technical aids for vision and vision-and-hearing impaired persons –Acoustic and tactile signals for traffic lights.”

ISO/CD 11550 “Technical aids for blind and visually impaired persons – Tactile ground surface indicators.”

Assistive Technology Guidelines

Standardisation guidelines: When considering standardisation priorities, ensuring safety and removing trade barriers are cornerstones of the international standardisation in general and the European standardisation in particular.

Other generally important aspects concern the simplification of production, removal of obvious disadvantages due to lack of harmonised requirements and test methods, the size of the market (e.g. number of users), the need for standardisation as indicated by manufacturers and other actors, etc.

The CEN/TC 293 ad-hoc group on Communication Aids has identified priority areas for future standardisation. The group has paid special attention to a) products/systems for personal use; b) the possibilities to transform already far advanced studies/findings into International/European standards (e.g. studies within the TIDE programme); and c) the practical feasibility of potential projects.

The following areas were identified:

1 Areas for standardisation in the short-range perspective:

- environmental controls
- interfaces for personal communication devices
- electronic maps
- colour codes.

2 Areas for further investigation - high priority:

- modular communication and control systems (highest priority)
- alarm systems
- alerting/signalling system (vibrators etc)
- text telephones and accessories (e.g. amplifiers).

3 Areas for further investigation - lower priority:

- external electronic access
- general input device emulator interface
- infrared signal systems
- internet applications
- keyboards
- scanning logarithms
- short distance wireless communication
- symbol codes
- synthetic speech
- telefax applications.

Assistive Technology Projects

In the first phase of the TIDE (Technology for the Inclusion of Disabled and Elderly in Europe) initiative, the so called TIDE Pilot Phase (1991-95), the following assistive technology projects have been identified as having produced results related to standardisation:

Project	Topic	Results	Recommendations Standards needed
CORE	The rehabilitation technology market	Models and causal diagrams of the market process of standardization and product development	Need for standardised classification and data collection formats
MECCS	Environmental Control and Communication		Compatibility with future telematics products and services
M3S	Intelligent Interface for the Rehabilitation Environment	Full technical specification Two demonstrators	Interface for rehabilitation technology products
SYMBOL	Multilingual learning tool		Tool to measure level of cognitive development
FASDE	Alarm services and products	Prototype devices and system	Social alarm interfaces Conventions for raising civil alerts Graphic symbols Connections for PTT-provided telephone lines Short-distance radio signalling
ASHoRED	Smart Homes (including accelerating the development of technical standards)	Integration Architecture and Design Requirement Specifications Demonstrators	Consistency in user interface design Compatibility in systems and products
CAPS	Access to electronic documents	Evaluation of existing standards European Interchange Format (EIF) for electronic documents Prototype products	Full account of needs of people with reading impairments in standards specifying structure and organisation of electronic documents
HEART	Surveys, analyses and recommendations regarding the rehabilitation technology field, including standardization	Reports: A.2.1 "Existing Standards and Current Standardization Work" A.2.2 "Needs for New Standardization" A.2.3 "New and More Efficient Standardization for Users with Disabilities"	Recommendations in the following topic areas: -Accessibility -User Influence -Research and standardization -More efficiency in standardization work -Important areas that need standards (appr. 60 product groups)
AUDELTEL	Speech information about TV programmes for visually impaired viewers	Actual use of system with TV speech channel	Standard for using teletext and for digital TV

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From the TIDE Bridge Phase and the Telematics Applications for Disabled and Elderly (TIDE Main Phase), the following are some assistive technology projects which have been identified as having potential relevance to standardisation, in addition to projects already mentioned in this chapter:

MORE (DE3006)

Integrating the non-uniform group of disabled and elderly potential customers into the mobile phone users' society for interpersonal communication, covering: redesign of existing mobile phones and simplifying the user interface to make mobile phone services accessible for all.

Relevance: accessible user interface to mobile phone services.

HARMONY (DE1226)

Horizontal action for the harmonisation of accessible structured digital documents.

Relevance: ISO SGML standard, European Interchange format (EIF).

HOME BRAIN (DE3209)

Product concepts for low cost, mass consumer, plug&play, radio frequency controlled home automation appliances.

Relevance: generic methodology for Design for All interfaces.

SATURN (DE1040)

Smart card and terminal usability requirements and needs. Identification of problems presented by self-service terminals. Specification of solutions to problems.

Relevance: coding of user requirements/profiles on smart card, adaptability of terminals, etc.

VISTEL (DE3014)

Access to screen phones: user requirements for blind visually impaired, deaf-blind and elderly visually impaired users. Design and implementation of adaptations, verification and demonstration of solutions.

Relevance: audible and tactile messages at various levels, navigation and exploration tools

for the screen user interface, enhancement of service protocols for association of textual description of icons.

PLAY (DE3212)

Hardware and software for storage of music, conversion of braille syntax into sound, enabling blind musicians to write, read and print music in braille.

Relevance: a mutual musical braille syntax.

MOSAİK-HS (DE3007)

Modular system for application, integration and clustering in Home Systems.

Relevance: a common Application Protocol Interface for Home Systems.

ENABLE (DE3206)

Access to computer-based vocational tasks with language and speech. User interface controllable by speech, even dysarthric speech.

Relevance: user interface controllable by speech.

HOME (DE3003)

Home applications multimedia system for environmental control.

Relevance: multimodal dialogue design, iterative development cycle.

ACTION (DE3001)

Assisting carers using telematics interventions to meet elderly persons' needs.

Relevance: 'Technical standards and specifications' regarding carer information and communication systems.

ARIADNE (DE3201)

Access, information and navigation support in the labyrinth of large buildings.

Relevance: architectural and technological infrastructure to provide support appropriate to a person's needs.

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FOCUS (TP1092)

Continuation of M3S bus architecture (see above) for rehabilitation technology.

Relevance: Serial interface for electric wheelchair controllers (ISO/TC173/SC1/WG7).

ACCESS (TP1001)

Unified development platform for user interfaces for persons with disabilities.

Relevance: Generation of user interfaces for different target users (ISO/TC159/SC4/WG6).

MATHS (TP1033)

Software/hardware for mathematical expressions using auditory and braille techniques.

Relevance: standards for braille description of mathematical notation.

COMSPEC (TP1169)

A common modular software platform on industry standard hardware for the production of communication aids and access systems.

Relevance: common platform for assistive technology software.

Design for All and Assistive Technology

Conclusions

No specific standards exist on Design for All.

Several Design for All guidelines have been developed for different technology areas.

Guidelines may not be the best way to influence designers.

Standardisation of assistive technology is well established and active.

Standards connected to EU directives (Harmonised Standards) have a powerful, mandatory status.

There is a need for more standardisation activities in assistive information and communication technologies.

A number of European projects have produced results of potential interests for standardisation. Improved contact between the standardisation world and the research and development community is needed.

References / Contact Information

The Center for Universal Design at North Carolina State University: <http://www.design.ncsu.edu/cud>

Trace Research and Development Center: <http://www.trace.wisc.edu>

INCLUDE project: <http://www.stakes.fi/include>

COST 219: <http://www.stakes.fi/cost219>

NORDICT project: <http://www.centil.dk/cgi-bin/gentest.pl>

CEN/TC 293 secretariat: Folke Eliasson, The Swedish Handicap Institute, Box 510, SE-162 15 Vällingby, Sweden. E-mail: folke.eliasson@hi.se

ISO/TC 173 secretariat: Lars Lindén, The Swedish Handicap Institute, Box 510, SE-162 15 Vällingby, Sweden. E-mail: lars.linden@hi.se

The Access Board, US Government: <http://www.access-board.gov/>
Center for IT Accommodation (CITA), US Government: <http://www.itpolicy.gsa.gov/cita/>

Chapter 5

Method

The domain of ICT was arbitrarily subdivided into several sub-domains (smart cards, etc) as documented in Chapters 6 –16. Each sub domain was then analysed as described below.

User requirements in existing and ongoing standards

For each ICT domain, user requirements in existing and ongoing standards were identified and evaluated by the domain expert. The purpose of this exercise was to;

- establish a baseline of requirements that did not need to be promoted for standardisation again;
- identify standards that needed revising because they were missing something/ out of date/ were in conflict with other standards
- identify standards that were missing completely.

The experts went through a list of all standards bodies, defacto/ de jure to help them perform this activity systematically.

Input from completed TIDE projects and other ongoing projects

An important concern for this project has been to gather and evaluate user requirements identified in completed TIDE projects and other ongoing projects.

One project participant who has previously built up overviews of TIDE projects provided an overview of user requirements identified in projects for the different ICT domains, with a view to what should be standardised. In addition, the domain experts also provided their knowledge from projects they had participated in. The results of this activity are presented in Chapter 5 and referred to again in the different domain chapters.

User Requirements Analysis

For each ICT domain, the experts performed a User Requirements Analysis. User requirements are derived as the result of interactions between users characteristics, tasks they perform and in relation to their environments.

For each ICT domain the following process was carried out:

1. General requirements from use of ICT in different environments, home, mobile, public space were elicited.

2. A User task checklist was gone through. This lists the sequential nature of using ICT:

- Locating and accessing
- Physical handling
- User Interface
- Operation
- Adaptation to user profile
- Security of operation.

3. When going through the user task checklist, an ability checklist was gone through simultaneously so that for each task steps the requirements for different abilities was considered. The ability checklist consisted of the following abilities:



Physical



Cognitive



Auditory



Dexterity



Visual



Combination

User Group Workshop in Norway

In Oslo, a user group workshop was held in relation to the domain of smart card systems. Several user groups were present. This workshop went through scenarios using the ability checklist and task checklist. Scenarios examined included the use of smart cards at home, in public and in relation to driving. The user task checklist was slightly adapted to suit smart card operation as follows:

- Find terminal
- Get to terminal
- Access at terminal
- Use terminal
- Leave terminal
- Safety at the terminal.

Synthesis

Requirements identified from the above activities have been synthesised and are presented at the end of each chapter.

Development of Work Programme

Once the overview of standardisation requirements had been determined, a process of allocation of responsibility for proposed work items, prioritisation and timeframe has begun. Input from others such as the ICTSB, participants at the Projects Open Meeting, comments from others have been sought and included where appropriate. The Work programme forms the basis of the Executive Summary Report.

Internal Project Team Quality Assurance

Several draft versions of this document have been circulated amongst the project team for input and comment and cross checking by the individual expert and his/ her organisation.

External Validation

The following procedures have been adopted to facilitate external validation.

During development of this report, several draft versions have been submitted to the ICTSB for guidance, which has been incorporated into the further development of this report and the Executive Summary Report where appropriate.

The Second Draft report has been available on the web for comment from 14.02.2000. In addition a number of bodies, such as ANEC and EIDD have been directly contacted for comment.

The report has been presented for comment to an Open Meeting in Brussels on 21.02.2000. Comments have been incorporated where appropriate.

Sections of this report have been circulated for comment to relevant bodies such as the ETSI Technical Committee for Human Factors and CEN TC 224.

Chapter 6

Communication Devices





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Introduction

For the purpose of this report, the term 'communications devices' is defined as comprising telephones in both public and private locations with the latter including corded and cordless terminals for both fixed and mobile networks. The recommendations apply in most cases equally to analogue and digital (e.g. ISDN) fixed network phones. Videotelephony is addressed where appropriate.



Home environment

Cordless and corded telephones, analogue and digital (ISDN), voice-only (telephone), text only (text telephone), and voice, text and image (videophone) in private homes and at work.



Public environment

Public telephones, textphones, videophones and total conversation terminals.



Mobile environment

Mobile phones for voice, text and voice, text and image communications (GSM, UMTS, CDMA, AMPS...)

Voice over IP (internet telephony) is covered in the context of Total Conversation (see below).

For text telephony, different (national) standards exist; with the V.18 protocol, ITU-T defined an international standard for fixed networks, although one for mobile networks is not yet implemented. Many users need text as a medium in conversation, because of a disability in hearing or speech or of other reasons. By including text conversation facilities in communication device designs and telecom services, they can be designed for all, and satisfy both disabled users and others. Text conversation may be provided in new environments, like mobile networks and the Internet. Then, it is natural to establish interworking functions for communication with text telephones in the telephone network, in the same way as is done for voice telephony. Many of the recommendations listed below also apply for these forms of telecommunications.

Compared to some of the other technologies addressed in this report, telecommunications services and devices are mature and well established. For this reason, a large number of agreed-upon and empirically confirmed design guidelines and examples of good design practice exist. Following these is good for all users, with or without special needs, and ignoring them potentially jeopardises the usability of the products for impaired people.

While telephony is more than a century old, recent trends towards adding more and more features ('featurism') leads to a new level of



complexity of the user interfaces of telephones. While some of these features can simply be ignored by those who do not need them, others may become a necessity for some users (such as adding a new terminal to a DECT-station or using a missed-calls list and network-based answering machines). This leads to the requirement for user interfaces to manage the feature complexity in such a way as to make the most important features easily accessible by all.

The complexity of using telecommunications services and devices is further increased by the advent of a liberated telecommunications market offering a plethora of services from a large number of providers making service selection and the charging structures (e.g. call by call and preselect) very difficult to understand for the non-expert.

Another crucial issue with modern telecommunications is mobility, such as in the case of mobile phones and cordless fixed-network phones. Mobility affords a trend towards miniaturisation which in particular affects the input/output characteristics of a telephone: keyboards become so small that they are difficult to be used even by people without impairments; displays are small and often present low resolution characters. The very small devices have to indicate additional functionality such as battery status and signal strength.

While manufacturers feel forced to follow the trend towards miniaturisation for reasons of competitiveness, a design that supports Assistive Technology with defined technical interfaces for enhanced input/output has the potential of remedying this problem to a certain degree.

Finally, the issue is not just one of making sure people with special needs are not excluded from using telecommunications terminals and services, but also to ensure that telecommunications can have additional value for people with functional restrictions or other impairments by helping to organise social relationships at home or at work and by supporting care services thus empowering people with special needs to participate as active members of society.



Standards

Relevant ETSI recommendations

The Technical Committee Human Factors (TC HF) of the European Telecommunications Standards Institute (ETSI) was founded in 1989 with the mission of addressing Human Factors aspects of telecommunications technology benefiting from standardisation. In doing this, TC HF has consistently adopted a user-centred approach of Design for All.

Between 1989 and 1997, an entire Subtechnical Committee (STC HF 2) was dedicated to addressing the specific requirements of People with Special Needs. As of 1997, i.e. after the closure of the Subtechnical Committees of TC HF, all work items of TC HF including those on people with special needs are dealt with in the plenary committee.

Relevant work completed as of 02/2000

The following list provides an overview of deliverables item completed so far by ETSI TC HF:

Previous standards

ETR 068 "European standardisation situation of telecommunications facilities for people with special needs."

User requirements

ETR 334 "The implications of ageing for the design of telephone terminals."

General design guidelines

ETR 029 "Access to telecommunications for people with special needs; Recommendations for improving telecommunications terminals and services for people with impairments."

TR 101 767 "Symbols to identify telecommunications facilities for deaf and hard of hearing people; Development and evaluations."

ETR 333 ed.1 and ed.2 "Text Telephony; Basic user requirements and recommendations."

Hardware design issues

ETR 165 "Recommendations for a tactile identifier on machine readable cards for telecommunications terminals."

ETS 300 767 "Telephone prepayment cards; Tactile identifier."

ETR 345 "Characteristics of telephone keypads and keyboards; Requirements of elderly and disabled people."

ES 201 381 "Telecommunications keypads and keyboards; Tactile identifiers."

Design Evaluation

ETR 166 "Evaluation of telephones for people with special needs; An evaluation method."

Current relevant work items as of 02/2000

The following work items related to people with special needs are currently in preparation:

User requirements

DEG/HF-00003 "Guidelines for user-oriented addressing in future telecommunications systems".

DTR/HF-00005 "Symbols to identify telecommunications facilities for deaf and hard of hearing people".

DTR/HF-00014 "Guidelines for telecommunication relay services for text telephones."

DTR/HF-00018 "Requirements for Assistive Technology devices in ICT".



Hardware design issues

EN 301 462 “Symbols to identify telecommunications facilities for deaf and hard of hearing people”.

DTR/HF-02022 “Mobile videotelephony for use by people with special needs”.

DTR/HF-02021 “Sign language video communication; Quality evaluation method and requirement specification”.

Design Evaluation

DEG/HF-00006 “Usability evaluation for the design of telecommunication systems, services and terminals”.

Relevant ITU-T Recommendations

Work on human factors issues in general and on issues related to people with special needs in particular is addressed in ITU-T Study Group 2, Questions 16 and 17 (previously the word was carried out in Study Group 1). And in Study Group 16, Multimedia Systems and Services, where Question 9, titled “Accessibility to Multimedia for people with disabilities, work in co-operation with expert groups in the study group to define services and protocols of importance for accessibility.

ITU-T E.135 (10/93) – Human Factors aspects of public telecommunications terminals for people with disabilities.

ITU-T E.136 (05/97) – Specification of a tactile identifier for use with telecommunications cards.

ITU-T E.161 (05/95) – Arrangement of digits, letters and symbols on telephones and other devices that can be used for gaining access to a telephone network.

Relevant work completed as of 02/2000

General design guidelines

ITU-T E.121 (07/96) – Pictograms, symbols and icons to assist users of the telephone service.

ITU-T F.902 (02/95) – Interactive services design guidelines.

ITU-T F.910 (02/95) – Procedures for designing, evaluating and selecting symbols, pictograms and icons.

H Series Supplement 1: Application Profile Sign language and lip-reading real time conversation usage of low bit rate video communication (requirements).

Hardware design issues

ITU-T E.134 (03/93) – Human Factors aspects of public terminals: Generic operating procedures.

Design Evaluation

ITU-T F.901 (03/93) – Usability evaluation of telecommunications services.

Recommendations created in ITU for Total Conversation

(For further information see the informal web area of ITU-T Q9/16 :www.omnitor.se/english/standards.)

T.140 Text conversation protocol for multimedia application, With Amendment 1(character set, editing, display and transmission of text for real time text conversation).

H.323 Annex G Text Conversation and Text SET (text in IP multimedia and IP telephony).

T.134 Text Chat Application Entity (for the T.120 data conferencing environment).



V.18 Operational and interworking requirements for DCEs operating in the text telephone mode (Automatic interworking with all old textphones and allowing voice and text simultaneously).

Recommendations modified for Total Conversation:

H.224 A Real Time Control protocol for simplex applications using the H.221 LSD/HSD/MLP channels (with addition for text conversation in H.320 video telephones).

H.324 Multimedia terminal for circuit switched networks.

V.8 Procedures for starting sessions of data transmission over the public switched telephone network (for selection of text telephone call type in PSTN).

V.8 bis Procedures for the identification and selection of common modes of operation between data circuit-termination equipments (For selecting voice and text simultaneous).

H.245 Multimedia control protocol (for selecting the text channel in multimedia protocols).

V.250 and V.254 DCE control. (General modem commands with additions for text telephony).

Current relevant work items as of 02/2000

Hardware design issues

ITU-T E.138 – Human Factors aspects of public telecommunications terminals relevant to their use by older people.

Total Conversation

F.700 Framework for Multimedia Service description.

F.MCVS Multimedia Conversation Service description.

H.248 Gateway control protocol Annex F fax, text conversation and call discrimination packages.



Output from projects

The COST 219 programme is the most comprehensive study in the telecommunications sector of user requirements for people with different degrees of disabilities. The authors are, of course, aware of many more projects conducted within and outside the framework of European programmes, e.g. INCLUDE (see the Handbook on Inclusive Design of Telematics Applications). To review them all would go beyond the scope of this document. Fortunately, the findings of most of them are in line with those of COST 219 and its subsequent work (see below). The main findings are summarised in the table below providing an overview of difficulties in various aspects of the use of telecommunications terminals and services arising from different types of impairments.

Some of the issues raised by the COST 219 reports have been addressed since the work was conducted (e.g. international standards on telecommunications payment cards and tactile markers on telecommunications keyboards) while others remain to be solved.

It has been proposed (Forschungsinstitut Technologie-Behindertenhilfe der Evangelischen Stiftung Volmastein, Study conducted for Directorate-General XIII of the European Commission) to update the COST 219 Table above by including a set of columns describing the problems of access to services that have come into operation since the original COST 219 work:

- telecommunications market
- identify and choose provider
- Select and contract
- Initialise and install
- Set individual options
- Call by call
- Equipment maintenance

Concerning images, videophones and multimedia, three more columns are being proposed:

- Images
- Video
- Enforced multimedia

With respect of the demographic shift, two sets of combinations of functional restrictions are proposed as rows:

- Low level loss of multiple functions (LLLoMF) representing a huge part of the older population. For this category, 82% of the actions in the table lead to problems, with an average overall problem degree of the class 'difficult' (1).
- High level loss of multiple functions (HLLoMF), closely related to the age group 80+ who have extremely high prevalence of disability. For this group, 97% of the actions lead to problems, with an average problem degree of 2.6 which means almost impossible. This indicates, that this group is very close to being excluded from many telecommunications services.

An activity aimed at capturing the multimedia requirements not initially covered by COST 219 is the Total Conversation initiative by ITU and IETF. This issue is one of the main topics of ITU-T SG16 Q9 and refers to the concept for conversation in video, text and voice (see ITU-T F.MVCS). IP-based Total Conversation and the interworking between IP-based and switched Total Conversation is addressed by ITU, ETSI TIPHON and IETF (MEGACO). This activity should also be seen in the light of European Parliament Resolution B4-0985/98 requiring compatibility among text and video communications systems.

The following tables follow the framework of this extended approach of the COST 219 results by addressing novel telecommunications technologies wherever possible.



Area of Impairment	Use of telecommunication			Physical access							Directory			Establishing contact					Alerting signals				Communication									Storing			Correction	
	Private	Public	Payment	Handling	Reading	Switch on	Lift receiver	Hold receiver	Dialling tone	Read numbers	Dial number	Line signals	Acoustic	Visual	Tactile	Hearing	Speech	Lip reading	Lip movements	Receive sign language	Use sign language	Visual reading	Visual writing	Handling printed matter	Tactile reading	Tactile writing	Typing	Writing	Vocal	Visual						
Visual	Blind	1	2	3	4	1	1	1	1	3	1	1	3	13	14																3					
	Partially sighted	1	1	1	1	2	1			1			1					3		2		3	1							1	1					
	Reduced vision					1								1				1		1		1									1					
Hearing	Deaf - without speech																														3					
	Deaf - with speech																														3					
	Hard of hearing																														2					
	No speech																														2					
Speech	Reduced intelligibility																														2					
	Low volume																														2					
Reading	Dyslexia																														2					
Language comprehension	& intellectually impaired																														2					
	Not intell. impaired																														3					
Use of legs and feet	Wheelchair dependency	1	2	2	1																										2					
	Need help or aid	1	1	1	1																										1					
Use of arms and hands	Cannot use arms	1	2	3	3																										2					
	Can use one arm			1	1																										3					
Strength	Cannot move fingers		1	2	2																										2					
	Cannot lift or push		1	1	2																										2					
Coordination of movement	Reduced strength		1	1	1																										1					
	Lack of coordination	2	3	3	3																										2					
Body size	Reduced coordination	1	2	2	2																										1					
	Height	1	1	2																											1					

Figure 6-1

3 impossible

2 very difficult

1 difficult

usually no problem



User Requirement

Locating and Physical Access



Home Environment

- The terminal must not be required to be installed in such a way as to prevent some users from accessing it (e.g. it must be possible to attach an extension cord to a corded phone that is long enough so that the phone can be reached by a person in a wheelchair).
- Locating a terminal (e.g. a DECT handset) can be facilitated with a paging button on the station.



Public Environment

- The Public telecommunications terminal must be placed in an area that everybody can reach. The user may need additional space (for a wheelchair, for a companion, for valuables and possessions) for interacting with a public telecommunications terminal.
- The Public telecommunications terminal has to be easily recognised and located by everybody.



Mobile Environment

- Locating a mobile terminal can be facilitated by using a paging feature or by placing a call to the terminal.

Requirements

Standardisation



Physical

- Terminals (in particular public) should be accessible to all individuals (i.e. also to those with mobility impairments).
- Free and unimpeded access requires that the terminal be located and designed in such a way as to be operable by wheelchair, walker or cane user (e.g. level floor surface). There should be sufficient room around the terminal for wheelchair access, clear floor ground space of at least 760 mm deep by 1220 mm wide

In preparation:

- Draft Rec. ITU-T E.138.



Auditory

- It must be possible to present acoustic signals (in particular ringing signals) in a way for them to be noticeable against background noise also by mildly auditory impaired people.

In preparation:

- Draft Rec. ITU-T E.138.



Requirements

Standardisation



Visual

- Standardised signs with accompanied text (in national language) indicating the nature of the public terminal should be displayed in sufficient size and placed in close context with a terminal. The sign should be in high contrast (e.g. white or yellow characters on a dark background) and illuminated.
 - Lighting of at least 50 lux to be provided at floor level and at least 200 lux in the interactive area of the terminal.
- In preparation:
- Draft Rec. ITU-T E.138.
 - Required:
 - Standardised symbols for different kinds of telecommunications terminals and services.



Cognitive

- Unique information symbol language for location signs minimising confusability.
- Required:
- Standardised symbols for different kinds of telecommunications terminals and services.



Dexterity

- Same as physical.



Combination

- Specialist directory enquiry and service help facilities.
 - No phone should bar outgoing calls completely: Emergency call must always be possible.
- Required:
- Recommendation for specialist directory enquiry and service help facilities for people with special needs.
 - Standard for accessibility of emergency calls (as in GSM).



Physical Handling of Telecommunications device



Home Environment

- The device should not impose undue restrictions on the position of the user during extended use (e.g. use extendable receiver cords or portable videophone displays).



Public Environment

- All interaction elements (e.g. receiver, keypad, coin and card slots) should also be reachable from a wheelchair.
- Allow for protection from ambient noise.

Requirements

Standardisation



Physical

- Weight, size, and balance should be such as to allow for one-handed and single-handed (e.g. only left hand) operation and installation (e.g. insertion of SIM-card).
- When using fixed camera angles, tall pedestrian users and short wheelchair users must also be captured.

Existing standards:

- ETR 345 on telephone keypads and keyboards.

In preparation:

- Draft Rec. ITU-T E.138.

Required:

- Standardised interface to external input device (e.g. larger keyboard).
- Standard for camera characteristics in public videophones.



Auditory

- All audio events (signalling, receiver and loudspeaker) should be presented in scaleable volume.
- Induction coupling should be provided wherever possible.

In preparation:

- Draft Rec. ITU-T E.138 (for Variable amplification in all (public) phones and adjustable volume of ringer).

Required:

- Standardised interface to external amplification system.
- Induction coupling in (all) (public) (fixed network and cellular) phones.



Requirements

Standardisation



Visual

- Provide visually clear access to functionality (e.g. on / off).
- All the interaction elements (e.g. keys) should be easily detectable and recognisable.
- The interaction elements should be logically distributed in terms of the interaction process. Display resolution and illumination should be adequate.
- Tactile markers for orientation on the keypad should be used.

Existing standards:

- ETS 300 767 on tactile markers.
- In preparation:
- Draft Rec. ITU-T E.138.

Required:

- Standardised symbols e.g. for on-off.
- Standardised interface to external display system (e.g. TV, large display).



Cognitive

- People must easily recognise the type of terminal.
- All the interaction points (slots, buttons, screen buttons...) must be easily detected and recognised.
- Redundant coding should be used for different set-up elements (e.g. unique shape of connectors for mains and telephone network).

Existing standards:

- ITU-T E.161 on telephone keypad layout.

Required:

- Symbols for mains, receiver...



Dexterity

- Orientation and operation should be possible with tactile sensors only.
- One-handed and single-handed operation (e.g. connecting to power supply for battery charging, use of card readers).

Existing standards:

- ETS 300 767 on tactile markers.

Required:

- Recommendation on how to make equipment usable for one-handed and single-handed users.



Combination

- The interaction elements should offer the possibility of multimodal feedback (acoustic, tactile and visible).

Required:

- Standards on interaction elements (shape, colours, feedback, dimensions) for physical and screen controls and indications.



User Interface (UI)



Home Environment

- The user interface should be adjustable to individual needs (individualisation, user profiles).



Public Environment

- Special requirements for public manuals apply.



Mobile Environment

- The user interface should be adjustable to individual needs (individualisation, user profiles).
- The user interface must be consistent independently from environmental influences (e.g. type of mobile communications network).

Requirements

Standardisation



Physical

- Tall pedestrian users and short wheelchair users can have parallax problems in using softkeys and precision problems with tactile screen system.

Required:

- Standard for adjustable display angles (tilted displays).



Auditory

- Optional provision of redundant visual and acoustic feedback.
- Redundant visual and tactile alert for deaf users.
- Scaleable volume (for interlocutor voice and feedback indication) also during conversation phase.
- Network facilities to provide text information in parallel with voiced information.

Required:

- Recommendation on feedback typology: how to activate the different outputs (speech, visual...), message typologies, tactile feedback.
- Standards on hearing aid coupling (inductive loops, possibility to plug in hearing aids).
- Interface for ISDN User to user signalling.



Requirements

Standardisation



Visual

- The entire user interface must be “readable” by a visually impaired person.
- Use standard layouts for keypads, legible key labels (size and contrast).
- Display text: contrast, colour, typeface and size. Established guidelines for instructions for public phones [ETSI ETR 167] apply.
- Output of display in Braille or voice.

Existing standards:

- ETSI ETR 167 on user instructions for public phones.
- ETS 300 767 on tactile markers.
- ITU-T E.135 (10/93) – Human Factors aspects of public telecommunications terminals for people with disabilities.
- ITU-T x on standard key layout.

In preparation:

- Draft Rec. ITU-T E.138.

Required:

- Recommendation on “blind” activation and navigation.
- Recommendation on the user interface attending to typefaces, legibility, sizes, colours and graphical representations.
- Recommendation for converting display information into voice output.



Cognitive

- Use established graphical symbols for common functions.
- Use consistent and distinguishable user interface layouts for different applications. Internal consistency of the entire user interface.
- Provide continuous feedback during operation.

Required:

- Standards on user interface symbols.
- Standards on feedback typology (as auditory).



Dexterity

- For manual dexterity the dimensions of the operation buttons are a priority. In mobile phones, the requirement of sufficiently large keys may only be achieved by employing assistive technology.

Required:

- Standardised interface to external input device (e.g. larger keyboard).



Combination

- Internal consistency of the entire user interface.
- Provision of alternative input modes and interface for assistive technology devices (adaptation equipment).

Required:

- Standard on interface for adaptation equipment.



Operation (User Dialogue)

Requirements

Standardisation



Auditory

- Use redundant (auditory and visual) dialogue prompting.
- Multi-modal information about cost structure and billing.

Required:

- Recommendation for multi-modal dialogue prompting.
- Recommendation for multi-modal presentation of information on cost structure and billing.



Visual

- Use redundant (auditory and visual) dialogue prompting.
- Multi-modal information about cost structure and billing.

Required:

- Recommendation for multi-modal dialogue prompting.
- Recommendation for multi-modal presentation of information on cost structure and billing.



Cognitive

- Correspondence between logic of the user task and screen design / menu or button ordering.
- Consistent standard functionality (e.g. deleting an entry from a phone book and deleting and entry of a redial list).
- Many elderly or cognitively impaired people need more time to read and understand the different screens of the telephone. Therefore sufficiently long timeouts (critical for elderly users) for input (prompts) and output (e.g. feedback).
- Offer (preferably) multi-modal help.
- Offer optionally reduced dialogue complexity (separate steps).
- Prompts should be recognisable, clear and unambiguous.
- Offer easy-to-understand information on cost structure and billing.

Required:

- Standard for minimum timeout in dialogue input prompts.
- Recommendation for multi-modal help.



Requirements

Standardisation



Dexterity

- Adjustable time-dependent input events (e.g. double click).
- Sequencing of shift or function key input.

Required:

- Recommendation on the implementation of shift or function keys (in terms of offering alternatives for the one-handed user).



Combination

Physical

- None identified



Adaptation to User Profile



Home Environment

- Profiles of settings for different users (profile selection).



Public Environment

- Possibilities of adapting public terminal are limited, but e.g. to be able to short dial n numbers stored on the phone card.
- Adaptation in terms of these characteristics can be: language, size of the messages and labels, time between different displays, speaker volume, operation typology.



Mobile Environment

- Preferences for user (individualisation) and according to the environment.

Requirements

Standardisation



Physical

- Adaptation of the user interface or operation process to specific physical requirements of the user, e.g. voice input instead of keypad input.

Required:

- Recommendation on adaptability of phone user interfaces to people with different needs.



Auditory

- Use redundant (auditory and visual) dialogue elements and optional visual feedback of every interaction.
- Technical interface for audio amplification and hearing aid coupling.

Required:

- Recommendation for additional auditory signals in dialogues.
- Standard for assistive technology (see above).



Visual

- Use redundant (auditory and visual) dialogue elements and optional auditory feedback of every interaction (e.g. auditory signal of menu wrap).
- Profiling of character size on the display.
- Technical interface for external enlarged display.

Required:

- Standard for assistive technology (see above).



Requirements

Standardisation



Cognitive

- Novice, expert and extended help modes. Simplified user interface for the most important functions.

Required:

- Recommendation on characteristics of novice and expert menus and help systems.



Dexterity

- Interface for extended input device (e.g. larger keys).
- Require confirmation dialogues for potentially problematic actions.

Required:

- Recommendation for prompting in potentially damaging dialogues.
- Standards for assistive technology (see above).



Combination

- E.g. for deaf *and* blind people solely rely on e.g. Braille.

Required:

- Standards for assistive technology (see above).



Security of Operation



Public Environment

- The public terminal should minimise the risk of interception of private information.



Mobile Environment

- Risk of unauthorised use, eavesdropping.

Requirements

Standardisation



Auditory

- To reduce the danger of eavesdropping, headsets can be used instead of speakers.

Required:

- Standardised interface for earphones.



Visual

- Multimodal prompts also for set-up phase (e.g. prompt for PIN entry).
- Replace PIN by biometric identification (e.g. fingerprints).

Required:

- Standardised interface for biometric identification.



Cognitive Physical

- None identified



Dexterity

- Replace PIN by biometric identification (e.g. fingerprints).

Required:

- Standardised interface for biometric identification.



Combination

- Privacy, integrity of information, authenticity of information or originator, non-repudiation of sender and access control, maximum reliability of transmission and timely availability of services.

Required:

- Technical (non-human factors) standards on these aspects.



Conclusions

Input for standards currently being prepared

Draft Rec. ITU-T E.138 (various issues across the report).

Required standards (listed in order of priorities)

Standard on interfaces for adaptation equipment:

Recommendation on adaptability of phone user interfaces to people with different needs. (ETSI SMG 9/ ITU-T).

Standardised interface to external input device (e.g. larger keyboard). (ETSI AT / STQ).

Standardised interface to external display system (e.g. TV, large display). (ETSI AT / STQ).

Standardised interface to earphones and external sound amplification system. (ETSI AT / STQ).

Induction coupling in (all) (public) (fixed network and cellular) phones. (ETSI / ITU-T).

Standards on hearing aid coupling (inductive loops, possibility to plug in hearing aids). (ETSI AT / STQ).

Standards for the wireless connection of audio to hearing aids (e.g. ANSI C63.19). (ISO/IEC).

Recommendation for multi-modal user interfaces:

Recommendation for multi-modal dialogue prompting and feedback. (ETSI TC HF).

Recommendation for multi-modal presentation of information (e.g. on cost structure and billing). (ETSI TC HF).

Recommendation for multi-modal help. (ETSI TC HF).

Recommendation on “blind” activation and navigation. (ETSI TC HF).

Review user interface recommendation on the user interface attending to typefaces, legibility, sizes, colours and graphical representations. (ISO / ETSI TC HF).

Recommendation for converting display information into voice output. (ISO).

Recommendation for additional auditory signals in dialogues, building on ETSI ETR 101041. (ETSI TC HF / ITU-T).

Recommendation on feedback typology: how to activate the different outputs (speech, visual...), message typologies, tactile feedback. (ETSI TC HF / ITU-T).

Recommendation on how to make equipment usable for one-handed and single-handed users. (ISO).

Recommendation on the implementation of shift or function keys (in terms of offering alternatives for the one-handed user). (ETSI TC HF / ITU-T).

Recommendations on lowering cognitive demands:

Standard for minimum timeout in dialogue input prompts. (ETSI TC HF).

Recommendation on characteristics of novice and expert menus and help systems. (ISO).

Review previous standards (ETSI ETR 116) and develop standards on interaction elements (shape, colours, feedback, dimensions...) for physical and screen controls and indications. (ETSI TC HF).

**Safety and Security:**

Standard for accessibility of emergency calls (as in GSM). (ETSI / ITU-T).

Recommendation for prompting in potentially damaging dialogues. (ITU-T).

Standardised interface for biometric identification. (CEN TC 224 WG 6 / CEN ISSS WS E-SIGN / ETSI SEC).

Technical (non-human factors) standards on security aspects. (CEN TC 224 WG 6 / CEN ISSS E-SIGN).

Standards for text telephony:

European communication protocol for text telephones (European or global standard).

Complete standard for national text telephone relay service. (ETSI / ITU-T / National standardisation bodies).

Interface for ISDN User to user signalling.

Standardised symbols:

Symbols for different kinds of telecommunications terminals and services; symbols for user interface elements; symbols for on-off, mains, receiver, etc. (ISO/IEC 35 / ITU-T / ETSI TC HF to provide input).

Other Recommendations:

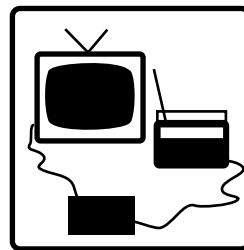
Review recommendation for specialist directory enquiry and service help facilities for people with special needs. ETSI TC HF / ITU-T.

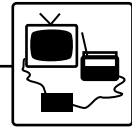
Standard for camera characteristics in public videophones. ETSI TC HF / ITU-T.

Standard for adjustable display angles (tilted displays). ETSI TC HF / ITU-T.

Chapter 7

Digital Broadcasting





Contents

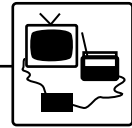
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Introduction

In the digital broadcast area there are two main areas for distribution of digital content to the public. There is the Digital Audio Broadcast (DAB) system, which will and is already replacing the analogue radio. The other main distribution will be through the Digital Video Broadcast (DVB) system, which will replace the analogue TV using cable, satellite and terrestrial networks.

Both these new technologies will have the possibility to introduce new multimedia services as an addition to audio and TV. If they are well received in the market these services will have great impact on all users.

The development of these technologies is pushed forward by the industry. There is an ongoing struggle to come to a common platform, especially in the DVB area. Preliminary local specifications have been developed to be able to start introducing the services before a common set of standards has been agreed upon. The DVB Steering Board however reached a unanimous agreement in November 1999 on the Multimedia Home Platform (MHP), which is essential for the end-user.



Standards

Digital Audio Broadcast (DAB)

The standardisation of the DAB is pushed forward by the WorldDAB Forum and the Eureka 147 Origination. The WorldDAB Forum has over 200 organisations. The Royal National Institute for the Blind (RNIB) is one of its members. The standards are mainly produced by Comite de Normalisation Electrotechnique (CENELEC) and the European Telecommunications Standards Institute (ETSI)

Some areas, which could have specific interest for a Design for All perspective, are the following:

Standards work	What
EN 50248 1997	Characteristics of DAB receivers
World DAB Module 5 Multimedia Radio	How will a multimedia radio be?
Eureka 147 TASK Force APPS (Applications)	How will a multimedia radio be?

Digital Video Broadcast (DVB)

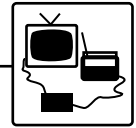
The standardisation in the DVB is pushed forward in Europe by the DVB project which is a consortium of public and private sector organisations the television industry. The consortium comprises over 200 organisations from more than 25 countries. The standards are mainly produced by the Joint Technical Committee (JTC) of the European Broadcasting Union (EBU), Comite de Normalisation Electrotechnique (CENELEC) and the European Telecommunications Standards Institute (ETSI), but there is also work done under ISO and ITU-R.

Some areas, which have specific interest for a Design for All perspective, are the following:

Standards work	What
DVB - TAM 232	The specification of a standard platform for the DVB receiver - Multimedia Home Platform (MHP)
MHP or TAM group in DVB project	Built in Navigator -The way to guide the viewer to a special event
MHP or TAM group in DVB project	Electronic Programme Guide (EPG) -The program guide gives the user details on the content of the programs
ETS 300 743	Subtitling system - Different ways of subtitling

Other work

In the USA there has been work going on the also make proposals for standard in a Design for All perspective. The final report from the Electronic and Information Technology Access Advisory Committee (<http://www.access-board.gov/pubs/eitaacprt.htm>) is of special interest since it also recommends standards work in this area, but also the work from National Committee on Information Technology Standards Information Technology Accommodation Study Group (<http://w3.gsa.gov/web/m/cita.nsf/Portals/NCITS>). There are some projects, which has work with the access and use of digital broadcasting technology.



Output from Projects

In the TIDE program, the project AUDETEL 2 worked on how to implement the audio description in an extra sound track.

The Royal National Institute for the Blind (RNIB) has worked to identify areas in both DAB and DVB which could cause problems for person with a visual impairment, and have made recommendations for improving access for visually impaired people. Input to the requirements is provided by the RNIB.

NORDICT is a co-operation project between the institutes for technical aids in the Nordic countries, i.e. Danish Centre for technical aids for rehabilitation and education, Research and Development Centre for Welfare and Health (Finland), National Insurance Administration (Norway), The Swedish Handicap Institute, The State Social Security Institute (Iceland) and Nordic co-operation on Disability, a co-operation body under the government of the Nordic countries. The purpose of NORDICT is to contribute to the inclusion of the needs of older people and disabled people in European and international ICT standardisation. NORDICT analyses the consequences for people with disabilities of the technology and market development in the same ICT fields as are covered by the ANEC ICT Working group.

In May 1999, NORDICT made the following conclusions in the area of Digital services (NORDICT definition: interactive and possibly customised services such as public information to the citizen, entertainment, communication etc., where the digital technology provides subjective sorting of information or customised presentation of information. The interface for digital services are primarily TV or PC.)

In principle, the key aspects for standardisation identified are:

- Electronic programme guides (EPGs).
- Interoperable, expandable and upgradable systems.
- Encryption/decryption systems.

- Standards for what information to bring when to the user.
- Standardised hardware and software facilities. It would be advantageous if products of the same type had the same HW and SW facilities (plug-in facilities, user interface, on-line help, programming processes etc.).
- Horizontal standards for components, enabling the user to build a system out of products from different vendors.

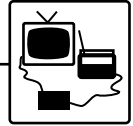
DTV Access Project at the National Center for Accessible Media (NCAM), Boston was established in 1998 as an inter-industry partnership to encourage implementation of Digital Television (DTV) services for people with sensory disabilities in USA.

The DTV Access Project endorses open technical standards and creates test materials to support the delivery of Closed Captioning and Video Description in professional and consumer digital television systems.

Trace is a research centre at the University of Wisconsin - Madison is another major actor which focuses on making off the technologies and more accessible for everyone through the process known as universal, or accessible design. TRACE is involved in Design for All in many areas, but for digital broadcast they have been working on guidelines for consumer products which is relevant for this area: (http://trace.wisc.edu/world/consumer_products). These guidelines have been used as input to the requirements.

Ongoing projects

In the Vth framework program there are at least three projects which are working in the field of new use of DVB technology: 11702 myTV, 11288 NEXTV and 12605 SAMBITS. These could be targeted to look into the needs of a broad set of user groups.



User Requirements

Locating and Physical Access



Home Environment

- The keypad is often difficult for users to locate.

Requirements

Standardisation



Physical

- None identified.



Auditory



Visual



Cognitive

- To find the keypad to the DVB, it should be a button on the DVB receiver which initiate a sound signal in the keypad.
- Not relevant as standard.

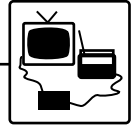


Dexterity

- None identified.



Combination



Physical Handling



Mobile Environment

- The DAB receiver should come in versions which are small and suit different needs.

Requirements

Standardisation



Physical



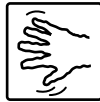
Auditory



Visual



Cognitive

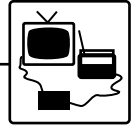


Dexterity



Combination

- None identified.



User Interface (UI)



Home Environment

- Standardisation of DVB MHP operating systems will make it viable to develop special software to improve the services for people with different special needs.



Mobile Environment

- The mobile DAB receiver must also come in versions which are accessible for persons with different types of disabilities.

Requirements

Standardisation



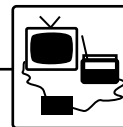
Physical

- None identified.



Auditory

- Both the DAB and the DVB terminal should providing a headphone jack to enable a person with impaired hearing to listen at high volume without disturbing others, to enable such a person to effectively isolate themselves from background noise, and to facilitate use of neck loops and special amplifiers.
 - Both the DAB and the DVB terminal should present auditory information continuously or periodically until the desired message is confirmed or acted upon.
 - Both the DAB and the DVB terminal should use accompanying visual cues and warnings by a sound, one component of which is of a mid-low frequency (500-3000 Hz).
 - Both the DAB and the DVB terminal should having auto-repeat or a means to repeat auditory messages.
 - The DVB service should be able to provide an audio description. The purpose is to provide extra commentary, in between the programme dialogue, to describe actions, facial expressions, scenery or anything that helps people to follow what is happening on screen.
- Required:
- The AUDETEL standard for audio description in DVB should be an European wide standard.



Requirements

Standardisation



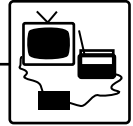
Visual

- Both the DAB and the DVB terminal should providing all important auditory information in visual form as well (or having it available). This includes any speech output as well as auditory cues and warnings.
 - Both the DAB and the DVB terminal should making letters and symbols on visual output as large as possible/practical.
 - Both the DAB and the DVB terminal should supplement colour coding with different shape or relative position coding.
 - Both the DAB and the DVB terminal should keep letters and symbols on visual output as simple as possible; using sans serif typefaces for non text lettering (e.g., labels, dials, displays).
- Required:
- There should be a standard for picture-in-picture signing in DVB.
 - There should be a subtitling standard on DVB.
 - There should be made a guideline on text fonts, colour contrasts and size of text for both DAB and DVB.



Cognitive

- Both the DAB and the DVB terminal should use simple concise language.
- Both the DAB and the DVB terminal should use common colour coding conventions in addition to textual or graphic labelling.
- Both the DAB and the DVB terminal should provide cueing on required sequences of action.
- Both the DAB and the DVB terminal should providing an easy exit that returns the user to the original starting point from any point in the program/sequence. (This exit should be prominent and clear.)
- Both the DAB and the DVB terminal should use visual/graphic indications for settings along with, or instead of, numbers or notches/dots.
- Both the DAB and the DVB terminal should providing a busy indicator or, preferably, a progress indicator when a product is busy and cannot take further input or when there is a delay before the requested action is taken.
- Both the DAB and the DVB terminal should use simple screen layouts, or providing the user with the option to look at one thing at a time.
- Both the DAB and the DVB terminal should hide (or layering) seldom used commands or information.
- Both the DAB and the DVB terminal should accompany words with pictures or icons.
- There should be a structure for the on-screen menu for both DAB and DVB terminals which make them logical and easy to use.



Requirements

Standardisation



Dexterity

- Interactive menus on the screen should use direct selection techniques where practical (selection techniques where the person need only make a single, simple, non-time-dependent movement to select).

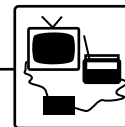


Combination

- Both the DAB and the DVB terminal should make information which is visually displayed, such as EPG, interactive menus for pay per view, for home shopping and home banking, e-mail etc, available electronically at an external connection point (standard or special port) to facilitate the use of special assistive devices (e.g., voice synthesisers, braille printers). The information should be available in an industry standard format.

Required:

- All the services offered on both the DAB and DVB terminal should be available electronically at an external connection point (standard or special port) to facilitate the use of special assistive devices (e.g., voice synthesisers, braille printers). The information should be available in an industry standard format.



Operation



Home Environment

- Standardisation of DVB MHP operating systems will make it viable to develop special technical aids to improve the access to these services for people with different special needs.

Requirements

Standardisation



Physical

- None identified.



Auditory

- Both the DAB and the DVB terminal should providing speech output to read or confirm the setting.



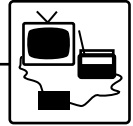
Visual

- Both the DAB and the DVB terminal should make lettering used for labels as large as possible/practical.
- Both the DAB and the DVB terminal should use voice output to "speak" the names of keys or buttons as they are pressed. (This capability would need to be turned on and off as needed.)
- Both the DAB and the DVB terminal should use high contrast between letters/graphics and background.



Cognitive

- Both the DAB and the DVB terminal should way the size of controls (also texture or shape) with the most important being larger to facilitate their location and identification.
- Both the DAB and the DVB terminal should providing controls whose shapes are associated with their functions.
- Both the DAB and the DVB terminal should limit the number of choices where practical.



Requirements

Standardisation

- Both the DAB and the DVB terminal should integrate group and otherwise arrange controls to indicate function or sequence of operation.
- Both the DAB and the DVB terminal should place the label on or, less preferably, immediately adjacent to, the control (this does not apply to scales, which should not be on the controls but on the background).
- Both the DAB and the DVB terminal should place a line around the button and label (or from button to label) to show association. The line should be kept away from any lettering especially if it is raised to avoid tactile confusion with the lettering.
- Both the DAB and the DVB terminal should use redundant labelling (e.g., colour code plus label).
- Both the DAB and the DVB terminal should avoid abbreviations in labelling (e.g., PrtScr, FF, C).
- Both the DAB and the DVB terminal should allow use of programmable function keys or using a "default" mode.
- Both the DAB and the DVB terminal should simplify required sequences, limiting the number of steps.

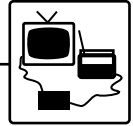


Dexterity

- Both the DAB and the DVB terminal should providing a standard connection point (connector or infra-red link) for special alternative input devices (e.g., eye gaze keyboards, communication aids).
- Both the DAB and the DVB terminal should make layout of controls logical and easy to understand, to facilitate tactile identification.
- Both the DAB and the DVB terminal should arrange controls in groupings which facilitate tactile identification (e.g., using small groups of keys that are separated from the other keys, placing frequently used keys near tactile landmarks such as along the edges of a keyboard and with texture coding).
- Both the DAB and the DVB terminal should use moving pointers with stationary scales.
- Both the DAB and the DVB terminal should use concave and/or non-slip buttons, which are easier to use with mouthsticks or headsticks. On flat membrane keypads, provide a ridge around buttons.

Required:

- The DVB and the DAB terminal should have a standard interface for keyboard and mouse.
- The numerical keypad should have the same layout as a telephone.



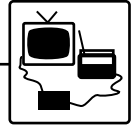
Requirements

Standardisation



Combination

- Both the DAB and the DVB terminal should provide sufficient space (at least 15mm) between controls for easy tactile location and identification as well as easier labelling (large print or braille).
 - Supplement colour coding with use of different button/key shape or letter/graphic labels.
 - Both the DAB and the DVB terminal should provide multi-sensory indication of the separate divisions, positions and levels of the controls (e.g. use of detents or clicks to indicate centre position or increments, raised lines,etc).
 - Both the DAB and the DVB terminal should provide multi-sensory indications of control status (e.g., in addition to a status light indicating "on," or providing an intermittent audible tone and/or tactilely discernible vibration).
- Standardise following user interface elements: shape/colour/icon/label for same function or action (within and across products and manufacturers.)



Adaptation to User Profile



Home Environment

- It should be possible to store different profiles if some of the family members have different needs.
 - The DAB and the DVB platform should support XHTML with the possibility to set up individual style sheets.
-



Mobile Environment

- It should be possible for the user to bring with him the profile to use on other DAB and DVB terminals.
-

Requirements

Standardisation



Physical

- None identified.
-



Auditory

- The DAB and the DVB terminal should have software to enable the listener to customise auditory output.
-



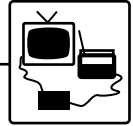
Visual

- The DAB and the DVB terminal should have software to enable the viewer to customise screen displays, for example to make the text bigger or to change the colour contrast.
-



Cognitive

- The DAB and the DVB terminal should have software to enable the user to customise screen menu and controls.
-



Requirements

Standardisation



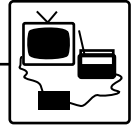
Dexterity

- The DAB and the DVB terminal should have software to enable the user to customise input devices.
-



Combination

- None identified.



Security of Operation



Home Environment

- All user of both DAB and DVB terminals should be able to access encrypted/secure information. The chapter on Smart Cards discusses this issue.

Requirements

Standardisation



Physical



Auditory



Visual



Cognitive

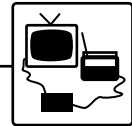


Dexterity



Combination

- None identified.



Conclusions

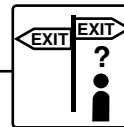
Standards required:

- The DVB MHP operating systems should be standardised.
- The AUDETEL standard for audio description in DVB should be a European wide standard.
- There should be a standard for picture-in-picture signing in DVB.
- All the services offered on both the DAB and DVB terminal should be available electronically at a standard external connection point - facilitate the use of special assistive devices (e.g., voice synthesisers, braille printers). The information should be available in an industry standard format (e.g. XHTML).
- The DVB and the DAB terminal should have a standard interface for keyboard and mouse.
- It should be possible to store different profiles if some of the family members have different needs.
- It should be possible for the user to bring his/her profile to use on other DAB and DVB terminals.
- There should be a structure for the on-screen menu for both DAB and DVB terminals which make them logical and easy to use.
- The numerical keypad should have the same layout as a telephone.
- Standardise following user interface elements: shape/colour/icon/label for same function or action (within and across products and manufacturers).

Chapter 8

Wayfinding





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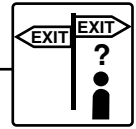
Introduction

The term “Wayfinding” is defined as services and products, which could be used as a tool for users to access information which is associated with geographically located information. These tools are used to navigate from one place to another, but could also be used to access other information services, which are location aware.

Wayfinding is the process the user does when moving from one location to another. E.g. from the hospital to visit a family member and need to find the correct department and room. For the user, this process can be divided in to several subtasks: Where am I going? How to get there? Where am I? Am I on the right track? Am I there?

To do these tasks the user need to get information both in the planning stage and from the environment when moving there. This could be a problem for many people - if they are not able to read, they have problems with the orientation, they have problems with handling new information, and they have problems with keeping track of the sequence.

Several projects have shown that properly designed supporting tools will be of great help to persons with these problems.



Standards

Standardisation work is today mainly located under two headings: – geographic information systems and Transport information and control systems. There are groups working under ISO and CEN within these areas, but today the main activities is under the ISO umbrella.

In the World Wide Web Consortium (W3C) there is also input to potential activities which could be of great benefit in a Design for All perspective.

Some areas, which could have specific interest for a Design for All perspective, are the following:

ISO /TC 204 Transport information and control systems.

Standardisation of information, communication and control systems in the field of urban and rural surface transportation, including intermodal and multimodal aspects thereof, traveller information, traffic management, public transport, commercial transport, emergency services and commercial services in the transport information and control systems (TICS) field.

ISO / TC 211 Geographic information/ Geomatics

Standardisation in the field of digital geographic information. This work aims to establish a structured set of standards for information concerning objects or phenomena that are directly or indirectly associated with a location relative to the Earth.

ISO / TC 213 Dimensional and geometrical product specifications and verification

Standardisation in the field of geometrical product specifications (GPS). The standardisation includes the basic layout and explanation of drawing indications (symbols).

Potential future work

CEN/TC 293 Ad-hoc Group on Communication Aids has identified electronic maps as an area for standardisation.

There are also currently under consideration to come up with a proposal for a standard for wayfinding technology under the ISO / TC 204 Transport information and control systems. This has its origin in “Talking Signs” technology.

Under the Mobile Access area in the User Interface Domain of the W3C there has been submitted several proposals for markup languages to enable location and related information to be available to web enabled devices.



Output from Projects

There have been several projects looking at how to support people navigate in the physical space. In TIDE there were three projects: Ariadne, Mobic and Open. Results from the first two projects are reported. In this chapter there is also some results from a national project in Norway. In addition there have been other projects like SEAL in Italy and Talking Signs in USA.

ARIADNE

ARIADNE - Access, Information and Navigation Support in the Labyrinth of Large Buildings (4th fw EU project). The main project goal has been to develop and evaluate a technology for navigating in buildings by means of user-adapted information supported by a building network of signs and speakers.

Spoken messages:

The use of verbal messages, whether natural or artificial voice, is a challenge for the user, as he can not investigate and absorb the information at his own pace.

Spoken messages should be presented in a compact language, and should not be too long. Messages should not contain more than 3-4 information elements (geographic references and/or directional cues), as users tend to forget or mix up elements if they are too many.

The user expects to receive information relevant to his navigational goal. Irrelevant information about the environment and localisation descriptions that include features in the environment will often distract or mislead the user.

Relative directional references (e.g. "turn right") as part of route information should be avoided, unless the user movement is controlled in a way so that his facial orientation is always predictable.

Different types of verbal information (e.g. route descriptions and environment information) should be presented by use of different voice

characteristics, e.g. male and female voice. The use of voice characteristics should be consistent throughout the system.

Verbal messages should have a user-controlled repeat option.

Messages should be offered by a "wearable speaker" or headphones as some messages are only for individual use.

Positioning and use of public speakers should consider the room acoustics and environment background noise.

Sound buoys:

Blind users depend upon the use of sound buoys as directional references when navigating in unfamiliar surroundings.

Sound buoys should be placed with sufficiently short distance between them, so that the next sound buoy can easily be detected from the present position.

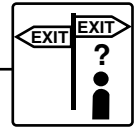
Blind users want to be able to control the performance of the sound buoy, in terms of onset, offset and duration. In unfamiliar surroundings the user will normally require a sound signal to guide them all the way to their (sub) goal.

Blind users will need an auditive confirmation that they have reached their (sub)goal.

When sound buoys are accompanied by a verbal message, the message should be played first, and end of message should trigger onset of the sound buoy. Users will have problems focusing on both sound messages at the same time.

Sound buoys should be positioned so that room acoustics does not make it difficult to localise. Open halls with concrete walls are particularly unsuitable.

Sound buoys should be positioned in relation to relevant reference points along the route.



Visual information:

Visual information includes directional and orientation signage, architecture and use of low-tech solutions (colour, tactile markings etc.). It is important to apply a complete way-finding strategy that includes all aspects contributing to better or worse orientation in a building. The use of dynamic information (information changing with the situation) requires thorough analysis of expected user activity.

Visual information must be positioned so that it is visible from all areas where the user might have a natural interest in the information conveyed. There should not be obstacles between the sign and the user, and it must be considered that users are of different a height (e.g. wheelchair users, children).

When using many signs in the same area denoting several possible destinations, it is important to emphasise/attract attention to the information relevant to the user in the situation. Illuminating or marking relevant information can do this.

The use of bright, flashing or coloured signs will normally attract the users attention. Irrelevant information of these types must be placed well away from essential way-finding information to avoid distractions.

When using flashing signs and illumination, it is important to consider the light conditions in the environment (light glares and reflections), choice of colours and contrast in the signs, and size of the text information.

The appearance of the information must be consistent throughout the system, i.e. the same sign behaviour (e.g. flashing) should convey the same information in all situations for the same type of signs. Dynamic information must appear in a predictable way to the user, and same type of information should be controlled/varied by the same principles.

Use of symbols on the signs should be consistent with corresponding use of symbols in other everyday situations (e.g. telephone, toilets, elevator signs).

When using multiple mode information (sound

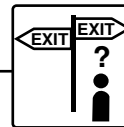
and illumination) the appearance of the information must be timed correctly. When a sound message address specific visual cues, the user will normally do a visual search for the information when it appears in the verbal message.

When using multiple mode information (sound and illumination) the visual information should last until after the message has finished. This because the user will normally face the direction of the sound source when it is played.

TIDE Mobic

The following was found to be essential in the TIDE Mobic project. The service needs to know:

- *The user's current location* including: direction currently facing/travelling.
- *Directions to destination* for example: number of streets/turns, distances (in feet, metres or approximate number of steps).
- *Layout of the environment* for example: grading of roads/junctions, changes in pavement surfaces/levels, steps/underpasses, ramps, one way streets.
- *Street information* including: numbers of buildings.
- *Roadworks*.
- *Street furniture* for example: trees, parking meters, stands, tables etc. outside shops, grading of street furniture/"clutter"1.
- *Pedestrian crossings* including: Is it meant to bleep? If it is out of order? Layout of complex crossings.
- *Useful items in street* for example: post boxes, public telephones, public toilets
- *Useful buildings and landmarks* for example: post offices, hospitals, medical centres, schools, banks (including those with cash machines), libraries, restaurants (including whether guide dogs are admitted), shops.



Speech navigation

The speech navigator is a project funded by the research council of Norway. A pre-project investigating technological and user-centered potential for development of a hand-held route planner and navigation unit for the blind, based on GPS, electronic maps and speech interface.

If the speech navigator should replace traditional mobility aids (dog or white cane), the available information must be more detailed, positioning must be more accurate, and the information supplied must be 100% trustable. Meaning that today's GPS technology must be radically improved.

Interface requirements for blind users

All information from the wearable unit (WU) should be available in speech, with an option of tactile output.

Input should be based on speech command and/or single button presses.

The command set should be limited and have a logical structure related to the navigational task when moving along a predefined route.

User interaction with the WU must be profiled for the specific user. This profile should be possible to tailor and set up for personal needs, and be possible to alter at a later stage when the user's needs and experience change.

Interaction with the WU must not interfere with the users normal way of navigating, meaning:

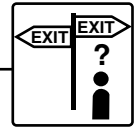
- 1) it must be possible to operate with one hand (as blind users use a cane or a dog) and
- 2) The information from the WU should be considered optional to their traditional navigation aid, and function as supporting the user with extra information.

Navigation

The WU must be able to give the user's position at any time with a simple command. The position information should be available both with reference to the destination and by description of local surroundings.

Route information must be available at any point along the route.

The system must give an unsolicited warning when the user moves away from the predefined route, and preferably offer information on how to get back on track.



User Requirements

Location and Accessing Terminals



Home Environment

- The system should enable the user to have access to planning information on the terminals in his/her home via TV and/or PC.



Public Environment

- The user should have access to his position both outdoors and indoors in an understandable format on his preferred terminal.
- The user should have access to basic information of his environment both indoors and outdoors in an understandable format on his preferred terminal.



Mobile Environment

- Basic wayfinding information should be available on standard mobile service technology.

Requirements

Standardisation



Physical

- The wayfinding service should be based on a standard format such that the user could use a terminal which meets his requirements
- The wayfinding service should be able to deliver services to terminals with different output media and input modalities.

Required:

- A terminal independent format for accessing multimodal navigational information.



Auditory

- None identified.



Visual



Requirements

Standardisation



Cognitive

- If a public area is supported with Wayfinding technology is should be clearly and understandable marked with a standard symbol.

Required but not urgent:

- Standard symbols for marking wayfinding technology present.



Dexterity

- The wayfinding service should be based on standard format such that the user could use a terminal, which meets his requirements
- The wayfinding service should be able to deliver services to terminals with different output media and input modalities.

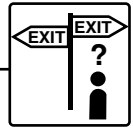
Required:

- A terminal independent format for accessing multimodal navigational information.



Combination

- None identified.



Physical Handling



Home Environment

- The system should enable the user to have access to planning information on the terminals in his/hers home e.g. TV and/or PC.
-



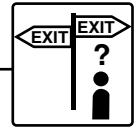
Public Environment

- The user should have access to his position both outdoors and indoors in an understandable format on his preferred terminal
 - The user should have access to basic information of his environment both indoors and outdoors in an understandable format on his preferred terminal.
-



Mobile Environment

- Basic wayfinding information should be available on standard mobile services technology.
- Specialised terminals should not require specialised formatted information.



User Interface

Requirements

Standardisation



Physical

- None identified.



Auditory

- The service should support both delivery of both spoken messages and use of synthetic speech.
- Messages should not contain more than 3-4 information elements.
- Different types of verbal information should be presented by use of different voice characteristics.

No need for standardisation.



Visual

- The service should support the delivery of the information in a visual format both with plain text and with graphics.
- The use of symbols should be consistent with corresponding use in other everyday situations.

Required:

- Maps should be accessible to different technology and to different user requirements.



Cognitive

- The appearance of the information should be consistent throughout the system.
- When using multiple mode information, the visual information should last until after the message has finished.

No need for standardisation.

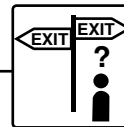


Dexterity

- None identified.



Combination



Operation



Home Environment

- These should be standardised location technology with high enough resolution in horizontal and vertical space for indoor and outdoor use. This technology should be able to store important information or decision points in the indoor and outdoor environment.
- The location technology should contain necessary multimodal information about the environment.
- The location technology should be readable with a user portable wayfinding technology.
- The wayfinding system should have access to relevant information for the user such as described in the Mobic project.



Mobile Environment

- The wayfinding system should give direction to destination.
- Interaction with the wayfinding service must not interfere with the users normal way of navigation e.g. with cane or dog.

Requirements

Standardisation



Physical

- The location technology should be easy to install and support.
- No need for standardisation.



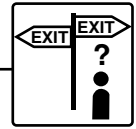
Auditory

- Messages should have a user-controlled repeat option.
- The wayfinding system should notify the user when he has reach a goal
- No need for standardisation.



Visual

- The wayfinding system should give visual feedback when a (sub)goal is reached.
- No need for standardisation.



Requirements

Standardisation



Cognitive

- The user should not receive other information than what is relevant for his navigational goal.
- The command set should be limited and have a logical structure related to the navigational task.
- Relative directional references should be avoided.

Required:

- A standard set of commands for navigation tasks.

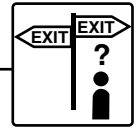


Dexterity

- None identified.



Combination



Adaptation to User Profile

Requirements

Standardisation

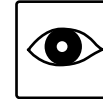


Physical

- None identified



Auditory



Visual



Cognitive

- It should be possible to tailor and set up the service based on personal needs.

Request:

- A standardised way of storing and using user profiles with navigational tasks.



Dexterity

- None identified.



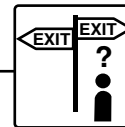
Combination

Security of Operation



Public Environment

- The technology should not put the user in dangerous situations.



Conclusions

A terminal independent format for accessing multimodal navigational information should be specified in W3C.

These should be standardised a location technology with high enough resolution in horizontal and vertical space for indoor and outdoor use in ISO/TC 204.

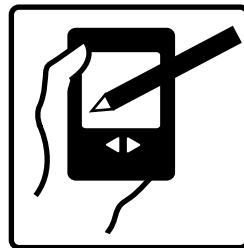
Electronic maps which are accessible to different technology and to different user requirements should be standardised in CEN/TC 293 or a CEN Workshop.

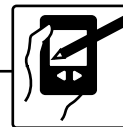
A standard set of commands for navigation tasks should be developed.

Standard symbols for marking wayfinding technology present should be developed.

Chapter 9

Personal Information Appliances





Contents

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Introduction

What are Information Appliances

The term "Personal Information Appliances" was coined to describe a family of devices which result from the convergence of communication technology with information processing technology. As the name suggests these devices are personal, often mobile and always with their users, and are dedicated appliances, not general purpose devices as the standard PC.

<p style="text-align: center;">Home Environment</p> <ul style="list-style-type: none">- Sub-Notebooks, PDAs, Smartphones, Remote Controls, Screenphones
<p style="text-align: center;">Public Environment</p> <ul style="list-style-type: none">- Information Kiosks, PC-based Payphones (covered in section 12)
<p style="text-align: center;">Mobile Environment</p> <ul style="list-style-type: none">- Communicators, Sub-Notebooks, PDAs, Smartphones

Figure 9-1

PIAs have been developed from two different starting points. The first starting point was the PC which became portable (Notebooks) and in consequence smaller and smaller (Sub-Notebooks). Since the power of the PC is not required by many people to be carried around, the first PDAs (Personal Digital Assistants) were developed, which had only limited functionality but a user interface which made them much easier to be used than the standard notebook. Adding communication features to these PDAs results in what we call PIAs.

The second starting point was the communication device, specifically the mobile phone. By simply adding information processing capabilities to a phone it is possible to create PIA which allow e.g. Internet access on the road or the use of an organizer system in the telephone.

The main problem in using PIAs currently is that of the user interface design. Coming from the PC the UI of many devices is far too complex for the average user, independently from any form of disability. For devices with a dedicated user interface the most important barrier for disabled people is the trend towards miniaturisation. Even a dedicated UI may become unusable with smaller and smaller keys or displays. Another potential problem area stems from the use of touchscreens in many PIAs. This is enforced by the requirement of portability of the devices in combination with the functionality required

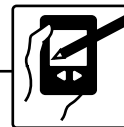


by their users. The use of touchscreens is more dominant in the area of PIAs than in the PC or Public Access area. Obviously, touchscreens impose a major obstacle on the use of these devices for people with visibility impairments or dexterity problems.

On the positive side, the communication and information capabilities of most PIAs allow the integration of assistive technology approaches with these devices. In addition, since many of the devices in question have general purpose processors, the possibilities of the PC environment to enhance the access for disabled users can be transferred to PIAs.

In the following tables we have focussed on PIAs in the mobile realm. Corded PIAs in the home have the same usage requirements as the well-known PC and we refer to the section on Personal Computer Access. Cordless PIAs on the other hand have requirements fairly similar to those of mobile communication devices. Their main advantage seems to be the fact that the user interface hardware is more developed than on most mobile telephones. Obviously many requirements for mobile phones will be found for PIAs at least to some extent.

Since PIAs are personal devices public, access PIAs are not considered of major importance. Public access PIAs (information kiosk etc.) are covered in section 11 of this report.



Standards

In the area of PIAs only very little work on standards can be found at the moment. The main reason for this is the fact, that the entire family of products as described in the previous section is still being defined. The products themselves are therefore not ripe for standardisation issues.

There are a number of standards in other areas which are relevant for the family of PIAs as well. In particular, standards from the communication device area are at least helpful for the designers of PIAs.

We consider the following standards, summarized in chapter 6 of this report as relevant for the products in questions:

Relevant ETSI recommendations

- ETR 068
- ETR 334
- ETR 029
- ETR 165
- ETR 345
- ETR 166
- DTR/HF-00005
- DTR/HF-02021
- DEG/HF-00006

Relevant ITU-T Recommendations

ITU-T F.910 (02/95) – Procedures for designing, evaluating and selecting symbols, pictograms and icons.

ITU.T E.136 (05/97) – Specification of a tactile identifier for use with telecommunications cards.

ITU.T E.161 (05/95) – Arrangement of digits, letters and symbols on telephones and other devices that can be used for gaining access to a telephone network.

ITU-T F.901 (03/93) – Usability evaluation of telecommunications services.

Standards and Recommendations from the PC-area

In addition to the standards for telecommunication devices a number of standards for computer systems may be applicable for the design of PIAs. A comprehensive list of relevant standards from the PC area can be found in chapter 10 of this report.



User Requirements

Locating and Physical Access



Home Environment

- Problem: locate after misplacing your device. For portable PIAs connected to e.g. a DECT base station the possibility of misplacing the device is rather high. To locate the device a "paging"-possibility should be foreseen on the base station. The device itself should react to a paging request with different audible and/or visible signals.



Mobile Environment

- No appropriate solution envisaged.

Requirements

Standardisation



Physical

- Stable positioning on table-top.
- No need for standardisation.



Auditory



Visual



Cognitive

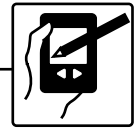


Dexterity



Combination

- None identified.



Physical Handling



Home Environment

- Light protection, card slot accessible without moving device. Not a requirement fit for standardisation.



Mobile Environment

- Usable in a mobile environment, light protection.

Requirements

Standardisation



Physical

- Weight, Size, One hand operation.
- One-handed operation of card readers, e.g. for pay cards or installation purposes,
- This is a design issue. Not a standardisation topic.



Auditory

- Scalability of audio output (data and feedback).
- Standardise external connector and protocol for external audio amplifier.



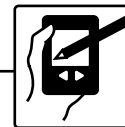
Visual

- Standardized access to functionality Easy detection recognition of interaction elements (Button size, colour).
- Display resolution and illumination.
- Standardized interface for external display system (TV-Monitor, larger display).



Cognitive

- All the interaction points (slots, buttons, screen buttons...) must be easily detected and recognised.
- Unique shape of connectors if several exist.
- Standardized symbols to main operations (e.g. Power on/off).
- Not a standardisation issue, but recommend to suppliers.



Requirements

Standardisation



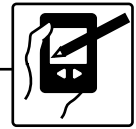
Dexterity

- One-hand operation of card readers, power supply for battery charging.
 - Usage of keyboard; replacement of touchscreen by keyboard input or voice input.
- Not a standardisation issue.
 - Standardised interface (protocols) for external input system (e.g. keyboard).



Combination

- Input and output devices should offer information redundantly (tactile feedback, keyclick, etc.).
- Not a standardisation issue, recommendation to suppliers.



User Interface (UI)



Home Environment

- The user interface must be consistent when using different applications on one device.



Mobile Environment

- The user interface must be consistent independently from environmental influences (e.g. type of mobile communication network).

Requirements

Standardisation



Physical

- Parallax problem and touchscreens.
- Display angles on non-mobile devices must be adjustable.



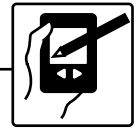
Auditory

- Optional provision of redundant (acoustic and visual) feedback.
- Create recommendation on feedback typology: how to activate the different outputs (speech, visual...), message typologies, tactile feedback.
- Possibility to increase the acoustic signal.
- Create standards on support for hearing impaired: possibility to plug in ear phones or hearing aids...). Create standard for connecting external amplifier system.



Visual

- The entire user interface must be "readable" by a visual impaired person.
- Create standardisation on "blind" navigation and its activation.
- Display text (contrast, colour, size) must be readable by visually impaired person.
- Create recommendations on the user interface attending to typefaces, legibility, sizes, colours and graphical representations.



Requirements

- Utilisation of standard layouts for keypads.
- Legible key labels (size, contrast).

Standardisation

- Use the standardised telephone layout on the PIAs, require QWERTY (AZERTY, QWERTZ) layout for PIAs. Require external connection to separate keyboard (via IRDA, cable, BlueTooth, etc.).
- Recommend good design for keyboard layout and inscription.



Cognitive

- Use established graphical symbols for common functions.
- Use consistent and distinguishable user interface layouts for different applications.
- Provide continuous feedback during operation.
- Internal consistency of the entire UI.
- Create standards on UI symbols.
- Create standards on consistent graphical representations. Use industrial style guides (e.g. Windows CE).
- Create standards on feedback typology (auditory, tactile, visual).
- Use industrial style guides.



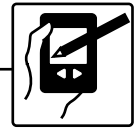
Dexterity

- For manual dexterity the dimensions of the operation buttons are priority. For mobile devices this requirement can only be fulfilled by assistive technology.
- Same as physical.
- Standardise assistive technology interface.



Combination

- Internal consistency of the entire UI.
- Create guidelines, use industrial style guides.



Operation (User Dialogue)



Home



Mobile Environment

- Common Concept of Dialogue.

Requirements

Standardisation



Physical

- None identified.



Auditory

- Redundant dialogue prompting.



Visual

- Not a technical standardisation issue; recommend good practice by consensus.



Cognitive

- Time-outs.
- Correlation between logic of the user task and screen design/button or menu ordering.
- Consistent standard functionality.
- Simple access to context-sensitive multi-modal help.
- Keep dialogues simple.
- Prompts must be recognisable, understandable and unambiguous.

- These requirements are not specific to disabled users. They are considered "Good User Interface Design" rules. Ignoring these good practice hints may be disastrous for impaired people. This is not a standardisation issue.



Dexterity

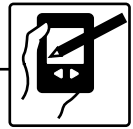
- Time-dependant input events must be scalable, adjustable.
- Sequencing of shift-key input.

- Recommendations, not a technical standardisation issue.
- Standardise the requirement for sequencing as on a Macintosh and/or PC.



Combination

- None identified.



Adaptation to User Profile



Home Environment

- Full individualization of the device should be possible for different users of the home-based device (profile selection).



Mobile Environment

- Full adaptation of the device for the personal requirements of an individual and/or the environment.

Requirements

Standardisation



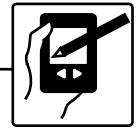
Physical

- | | |
|--|---|
| <ul style="list-style-type: none">- Adaptation of the user interface or operation process to specific physical requirements of the user.- Use of replacement technology: voice input instead of keypad input. | <ul style="list-style-type: none">- Standardise technology interfaces and protocols: Infrared, Bluetooth etc., Standardise protocol for information exchange between peripherals and PIA. (same as for PC?).- Standardise protocol for information exchange between peripherals and PIA. |
|--|---|



Auditory

- | | |
|---|--|
| <ul style="list-style-type: none">- Adaptation of the user interface or operation process to specific auditory requirements of the user: replace auditory output with visual output.- Enhance volume of auditory output. | <ul style="list-style-type: none">- Same as physical.- Recommendations for replacement rules auditory signals vs. Visual signals.- Standardise acoustic interface for external speakers/earphones.- Hearing aid coupling. |
|---|--|



Requirements

Standardisation



Visual

- | | |
|--|---|
| <ul style="list-style-type: none">- Adaptation of the user interface or operation process to specific visual requirements of the user:- Enhance visual output with auditory output.- Enlarge visual output.
- Profiling of character size on the display. | <ul style="list-style-type: none">- Same as physical.
- Recommendations as above.
- Technical interface for enlarged output.- Not a technical standardisation issue; recommend good practice by consensus. |
|--|---|



Cognitive

- | | |
|--|---|
| <ul style="list-style-type: none">- Adaptation of the user interface or operation process to specific cognitive requirements of the user.- Novice/expert profiling.
- Extended help mode.- Supply simplified user interface for the most important functions. | <ul style="list-style-type: none">- Same as physical.
- Not a technical standardisation issue; recommend good practice by consensus- Recommend good practice. |
|--|---|



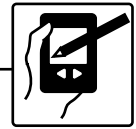
Dexterity

- | | |
|---|---|
| <ul style="list-style-type: none">- Adaptation of the user interface or operation process to specific dexterity requirements of the user.- Require confirmation dialogues for potentially problematic actions. | <ul style="list-style-type: none">- Same as physical.- Supply standardised interface to external input devices; assistive technology interface standard. |
|---|---|



Combination

- | | |
|--|--|
| <ul style="list-style-type: none">- Replacement of several input channels. | <ul style="list-style-type: none">- Standardise assistive technology interfaces. |
|--|--|



Security of Operation



Home Environment

- No need of special characteristics to assure the security of operation.



Mobile Environment

- Unauthorised use, unauthorised data access.
- Unintended use.
- Infringement.

Requirements

Standardisation



Physical

- None identified.



Auditory

- Some hear impaired people should need a higher volume of the acoustic feedback, which can be heard by people nearby.
- Standardise earphone connector.



Visual

- Some visually impaired people should need larger type, which can be read by people nearby.
- Multimodal prompts to prevent inadvertent actions.
- Replace PINs by biometric identification (e.g. fingerprints, iris recognition, voice authentication).
- No possibility foreseen.
- Recommend good UI practice.
- Standardise interface for identification modules.



Requirements

Standardisation



Cognitive

- Replace PINs by biometric identification (e.g. fingerprints, iris recognition, voice authentication).
- Standardise interface for identification modules.



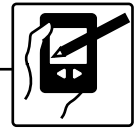
Dexterity

- Replace PINs by biometric identification (e.g. fingerprints, iris recognition, voice authentication).
- Standardise interface for identification modules (ref. to biometric work within EESSI).



Combination

- None identified.



Conclusion

Summary of Standardisation Issues

Standardise external connector and protocol for external audio amplifier.

Standardised interface for external display system (TV-Monitor, larger display).

Standardised symbols for main operations (e.g. Power on/off).

Standardised interface (protocols) for external input system (e.g. keyboard).

Display angles on non-mobile devices must be adjustable.

Create standards on support for hearing impaired: possibility to plug in ear phones or hearing aids.

Create standardisation on “blind” navigation and its activation.

Create recommendations on the user interface attending to typefaces, legibility, sizes, colours and graphical representations.

Use the standardised telephone layout on the PIAs, require QWERTY (AZERTY, QWERTZ) layout for PIAs.

Require external connection to separate keyboard (via IRDA, cable, BlueTooth, etc.)

Create standards on UI symbols.

Create standards on feedback typology (auditory, tactile, visual).

Standardise assistive technology interface.

Standardise the requirement for sequencing chord input as on a Macintosh and/or PC.

Standardise technology interfaces and protocols: Infrared, Bluetooth etc.

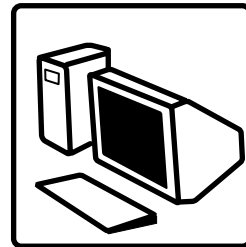
Standardise protocol for information exchange between peripherals and PIA. (same as for PC?).

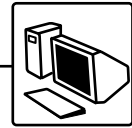
Standardise earphone connector.

Standardise interface for identification modules.

Chapter 10

Personal Computers





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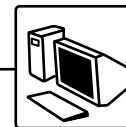
Introduction

The term "personal computer" is normally used for single-user desktop and portable workstations based on single-user operating systems, and used for office and home applications. There are other single-user workstations based on multi-user operating systems, mostly of the UNIX-type. Such workstations are commonly known as high-performance workstations and are used for technical computations, CAD/CAM, software development and other applications requiring high computational power. This section is limited to the personal computer in its first mentioned, normally used sense. It should however be recognised, that the boundary between low-end workstations and high-end personal computers is blurred.

Personal computers for professional and private use are dominated by one technical platform, the Microsoft Windows family of operating systems. (Sometimes the term "PC" is used for personal computers in general, sometimes it is used for what was formerly known as "IBM-compatible PCs". PC is originally a brand name for the first personal computer marketed by IBM). It is estimated that this platform comprise approximately 90% of the installed base. The main competing platform is the operating system of Apple. Another platform, currently increasing its market share, is Linux. However, none of the members of ICT Standards Board is involved in

making specifications, relevant for consumers, for any of the platforms Windows, Apple or Linux.

What will be the future of the current desktop PC? Will it be replaced by mobile telephones and other, not yet developed small handheld communication devices? A reasonable prediction is that the typical desktop PC will survive for many years. Another reasonable prediction is that the market segment of laptops and notebooks will merge with the segment of mobile telephones. A continuum of products will emerge, from the portable variant of the office PC, over the handheld communication terminal with web browser, e-mail, fax and telephony, to the single-functional mobile telephone.



Standards

Standards of the basic personal computer

The PC is standardised by market dominance of Intel and Microsoft, not by standardisation work of formal standards bodies or industry fora. Intel and Microsoft jointly produces annual specifications, which serve as references for PC hardware, firmware and device manufacturers. The current specification is PC 99 System Design Guide, A Technical Reference for Designing PCs and Peripherals for Microsoft Windows Family of Operating Systems. PC 99 make references to existing industry standards or specify performance goals or benchmarks rather than prescribing fixed hardware implementations. Examples of standards and specifications referred to are:

- ECMA standards for DVD disc drives,
- IEEE 1394 Bus standards,
- Control IR Specifications by the Infrared Data Association (IrDA),
- ISO/IEC 7816 Identification Cards,
- PCMCIA PC Card specifications,
- SCSI specification,
- USB (Universal Serial Bus),
- ITU Recommendation V.18,
- Display Data Channel specified by the Video Electronics Standards Association (VESA).

Furthermore, The PC Design Guide refers to some ergonomic and environment specifications, such as

- IEC and ANSI safety considerations for computers, networks and consumer electronic devices,
- The Storage Device Class Power Management Reference Specification, Version 1.0 or later.

Appendix C of PC99 is a guide with recommended accessibility features supported by the Windows family of operating systems. These guidelines were developed in consultation with the Trace Research and Development Center at the University of Wisconsin, USA, and were based on research funded by the National Institute for Disability and Rehabilitation Research (NIDRR). The

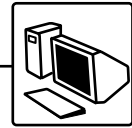
guidelines are recommendations and will not be made mandatory.

A similar guide is Nordic Guidelines for Computer Accessibility (1998), Second Edition, produced and published by Nordic Cooperation on Disability. The intended users are ICT strategists, purchasers, standardisers, developers and manufacturers. It presents a set of functional requirements which meet the need for accessibility of personal computer systems operated by the end-user. It is intended to be platform and vendor independent.

The Spanish standards body AENOR has adopted a national standard "Health informatics. Computer Applications for people with disabilities. Accessibility requirements for computer platforms". The standard has two parts, one (UNE 139801 EX) for hardware, one (UNE 139802 EX) for software.

The accessibility of an ICT system is to a great extent determined by the accessibility features of the user interface, the man-machine interaction. The major standard on man-machine interaction is ISO 9241: Ergonomic requirements for office work with visual display terminals. This standard is a multi-part standard for ergonomic requirements for hardware and software of computer-based office systems. The standard covers requirements on visual display units, keyboards, pointing devices, workstation layout, dialogue principles, presentation of information, design and evaluation of user guidance attributes, menu and command language dialogues, form filling etc. Although made for office applications and skilled workers, the standard may be applicable also for systems aimed for occasional, non-skilled users.

At present (March 2000), ISO 9241 does not address accessibility. However ISO TC159 (Ergonomics) is preparing a technical specification on software accessibility, ISO TS 16071, intended to be supplementary to ISO 9241. The purpose of the specification is to provide guidance on how to design software



which allows it to be used by as wide an audience as possible, minimising the use of assistive software and hardware, although supporting the use of these when necessary.

For standards related to web pages, please see chapter 13.

Connection of assistive devices

Assistive devices can be connected by

- plug-in to the serial port,
- plug-in to the parallel port,
- expansion slot,
- infrared technology,
- radio transmission.

The PC 99 Design Guide specifies six bus technologies: USB (Universal Serial Bus), IEEE 1394, PCI, ATA and ATAPI, SCSI and PC Card.

USB provides an expandable Plug and Play serial interface that intends to ensure a standard, low-cost socket for adding external peripheral devices ranging from interactive devices such as joysticks and pointing devices to isochronous devices such as telephony, audio, and imaging devices. The current ISA bus with ISA expansion slots are expected to be eliminated in the PC99 time frame and replaced by the USB. USB is required on all PC 99 systems, and migration of I/O devices from legacy ports, such as ISA, to USB is recommended by the PC 99 Design Guide.

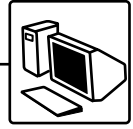
In particular, the joystick, pointing device, and keyboard devices that ship with PC systems should be USB. It should be noted that USB and MS-DOS do not support each other. MS-DOS is still used by many blind persons because of the easy access to the textual interface.

For infrared technology, PC99 encourages designers to use the IrDA Data and Control protocols, arguing that the IrDA Control protocol has some significant advantages over the legacy remote control protocols that give it the potential to become a world-wide standard.

Standards groups for radio frequency communications are emerging. Two major specifications are HomeRF and Bluetooth, both supported by most major telecom and computer manufacturers. Microsoft supports only HomeRF and the PC99 recommends it for use. On the other hand, Intel joined the Bluetooth consortium from its start.

Speech synthesizers and speech recognition are frequently used as assistive technologies. They are expected to become standard features of personal computers, provided however that the technology is available for different languages. Proprietary specifications are available:

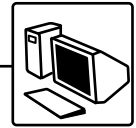
- SSIL (Speech Synthesizer Interface Library) V1.0 by Arkenstone,
- SAPI (Microsoft Speech API),
- JSAPI (JAVA Speech API).



Output from Projects

TIDE Bridge Phase Project 1001, ACCESS
ACCESS resulted in a technical platform for development of user interfaces and software tools for construction of interfaces adapted to particular user abilities, needs and preferences. ACCESS was completed in 1996. The ACCESS consortium proposed a New Work Item in ISO TC 159 SC4 on accessibility. This became the current work on software accessibility, based on previous work in ANSI. The ACCESS consortium is currently preparing proposals for work items based on ACCESS results.

Telematics Application Project TE 2010 RESPECT
RESPECT has produced a report "Requirements and evaluation for people with special needs". It focuses on human characteristics (vision, hearing, cognitive abilities, mobility and dexterity, old age and young age) and gives, inter alia, requirements on ICT applications related to the different characteristics and within the concept of Universal Design. In addition, the report provides advice on commonly used methods for evaluating prototype systems to ensure that the user requirements have been met.



User Requirements

The Technical Platform



Home



Professional



Mobile Environment

- The term "technical platform" is here meant to be a combination of components such as processor, operating system, network services, programming languages, database management etc., which are standardised or market leading.
- To maximise system accessibility, the platform should comply with the principles of open systems and allow that interoperable, compatible and portable standard application programs, company-specific application programs, and assistive software to be installed and executed. The platform should include as many features as possible which promote accessibility, thus providing the programmer with building blocks with intrinsic accessibility features. A special advantage is that this will facilitate development of assistive software with common user interface and behaviour, which promotes portability and compatibility. Assistive devices could easily be exchanged or upgraded when necessary.

Requirements

Standardisation



Physical

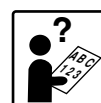
- The user interface should be customisable.
 - Users should have keyboard access to all commands and options.
 - Users should be enabled to select the output mode of the information according to their abilities and preferences.
- Major operating systems have a set of built-in accessibility features. For example, the features for modifying the keyboard behaviour ("Sticky keys", "Bounce keys" etc) are implemented in MS-DOS, Windows, OS/2, X-Windows, MacOS and some UNIX-implementations.
 - There is a limited need for increased unification of the major operating systems as regards the built-in accessibility. Windows dominates heavily, and people seldom move between different platforms. It is better to promote increased provision of flexibility and personalisation, however with easy-to-use parameter setting.



Auditory



Visual



Cognitive

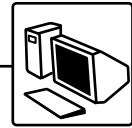


Dexterity



Combination

- Same as physical



The System Unit and other Hardware Components



Home



Professional



Mobile Environment

- The user must be able to connect the peripherals, assistive devices and assistive software needed to compensate for the specific disability. Interoperability, compatibility and portability between system parts must be ensured by means of open standards.

Requirements

Standardisation



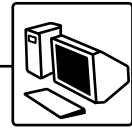
Physical

- Serial and parallel interface connectors, data buses, keyboard connectors and other data transfer mechanisms such as infrared technology or radio, should follow existing standards or widely recognised technical specifications.
 - In the authorisation process, allowing the user access to programs and data, different technical solutions for identification and identity verification should be allowed. The technical solution of the security system must not require modification of the standard input/output devices of the workstation.
 - There is a need for open and modular solutions, where a security system can be introduced or replaced without the need for changing an assistive device, and vice versa.
 - Card systems should be easy to use for people with reduced visual or mobility abilities. Swipe readers should be avoided. Preferably, contactless systems should be used.
- For the Windows operating systems, Intel and Microsoft jointly produces annual design guides for PC manufacturers. They include requirements on data buses and other connectors, and are market leading specifications.
 - This is an issue of standardisation of interfaces between the host system, the security system and the assistive device/software.
 - For standardisation of card system, see chapter 12.



Auditory

- Same as physical.
- The electromagnetic characteristics of the equipment should not generate interference for a user with a hearing aid where the induction pick-up coil is activated.
- A global standard on acceptable levels and measurement methods is required.



Requirements

- The noise from the fan, the harddisc, or the printer should be minimised, since it may be annoying for a hearing impaired person, since it interferes with the conversation in the room.

Standardisation

- This is a general consumer concern. A global standard on acceptable levels and measurement methods would substantially facilitate purchaser and consumer choices.
- IEC TC74 has attempted to produce requirements for acoustic safety applicable to ICT equipment. However, no agreement was made, and neither IEC TC74 nor CENELEC TC74 are currently active in this field. ETSI is currently discussing whether it should produce such a standard specific for telecommunication equipment or leave the matter to CENELEC as a general issue.



Visual



Cognitive

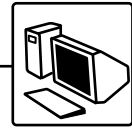


Dexterity



Combination

- Same as physical.



Controls - Finding, Reaching, Identifying, Using



Home



Professional



Mobile Environment

- People who have limited range, reduced strength and reduced precision in their movements may have a reduced ability to operate controls such as turn knobs and twist mechanisms. These people, and most other people, prefer front-placed push buttons and sliding mechanisms. Visually impaired persons may have difficulties in finding and identifying certain controls, as well as perceiving how a control is adjusted. Consequently, controls such as push buttons, switches, latches, control knobs etc., should be easy to reach, find, identify and use. In all cases, adjustment states should be easily perceivable.

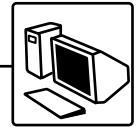
Requirements

Standardisation



Physical

- The surface of the controls should not contain chromium, nickel or other material which may cause allergy.
 - Controls should be placed so they could easily be reached by, for example, a short person or a person sitting in a wheelchair.
 - Controls should be placed separate from each other, to be easy to grasp and to avoid confusion.
 - Controls should be placed so that they are not activated by mistake.
 - Controls should be marked so that the control setting can be easily identified by touch.
 - The adjustment settings should be easily perceived.
 - The size, shape and surface of controls should be designed so that they are easily grasped when they are used as intended.
 - No operation of a control should require more power than 2 Newton.
 - Mechanisms for opening up and shutting by latches (for example laptop computers) should not require simultaneous use of two hands.
- There are two aspects on standardisation of controls: design and location. As regards design, this is an issue for any device, not only computers. There are guidelines on design of consumer products, e.g. by Trace Center, which covers manipulation of knobs, thumbwheels etc. As regards location, there seems to be no standard on where to locate various controls on a system unit, display unit, printer etc. Frequently used solutions, e.g. the touch controls for controlling the screen shape of a CRT display unit, seem to be the result of the market forces.



Requirements

Standardisation

- Mechanisms for inserting and removal of diskettes, CD discs and similar storage media should require a minimum of muscular strength, range of motion, reach and movement precision. Twist lock mechanisms should be avoided.
- Diskette units should pop out the diskette so that it can be easily grasped. It is desirable that this can be controlled by the software.



Auditory

- None identified



Visual

- Controls should be placed separate from each other, to be easy to grasp and to avoid confusion.
 - Controls should be placed so that they are not activated by mistake.
 - Controls should be marked so that the control setting can be easily identified by touch.
 - The adjustment settings should be easily perceived.
- Same as for physical.



Cognitive

- None identified.



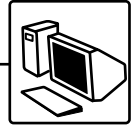
Dexterity

- Same as physical.



Combination

- Same as for physical.



The Perception of Alarms, Warnings, Status Signals, Error Messages



Home



Professional

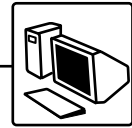


Mobile Environment

- Signal lamps are often used to show if a function is switched on or off, for example the Caps Lock key. Visually impaired persons require such information presented in other ways, either by touch or audibly. Visually impaired persons are also not able to perceive error messages appearing on displays.
- Many programs make use of a sound to notify the user of a warning or that an error has occurred. A person with a hearing impairment needs to be informed visually. Visually presented alarms should appear for a sufficiently long time to maximise the possibilities of the user noticing the signal.

Standardisation

- These issues are discussed in the ongoing work in ISO TC159 on ISO TS 16071, Accessibility of software.



The Use of Keyboards

Requirements

Standardisation



Physical

- The user should be allowed to customise the keyboard with respect to features such as repeat rate, key activation delay, delay between acceptance of two consecutive key presses, minimum time for pressing a key before the key repeat begins, and serial instead of multiple simultaneous keystrokes etc.
 - If sufficient space is available, shift keys (upper and lower case, ctrl, alt etc.) should be duplicated, one on each side of the keyboard, and be placed symmetrically.
 - The keyboard should be designed to provide sufficient space to allow the user to mount a keyguard.
 - The system should allow the connection of two keyboards, which could be used simultaneously, for instruction purposes.
 - The power needed to press a key should be between 0.3 and 0.6 Newton. Preferably, the required power should be adjustable.
- Keyboard design and keyboard layout is standardised in ISO 9241-4 and ISO 9995.
 - The issue of customising keyboard features is discussed in the ongoing work in ISO TC159 on ISO TS 16071, Accessibility of software.



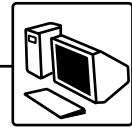
Auditory

- None identified.



Visual

- Groups of keys (alphanumeric, numeric, function keys) should be separated by distinct spaces, with a distance of at least half a key. (This requirement is not applicable on laptops.)
- Groups of keys should be distinguished by different colours on the key tops, but in a way that colour-blind persons may discern the colours.



Requirements

Standardisation

- The F and J keys on the alphanumeric keyboard, and the 5 key on the numeric keyboard, should be marked with a tactile identification, preferably in the form of a ridge on the keytop edge nearest to the user.
- Frequently used keys, such as ENTER, SHIFT, ESCAPE, CTRL, BACKSPACE etc., should be placed and have a shape that differ from other keys so that they are easy to find.
- The contrast between the colours of the characters and the background of the keytop should be the best possible.
- The height of the characters of the alphanumeric and numeric keys should not be less than 4 mm.
- The height of the characters of the other keys should not be less than 4 mm, if there is available space.
- The text on the keys should be printed in sans-serif characters, which is considered to be more easy to read than other typefaces.
- No text should be printed in red or green colour.



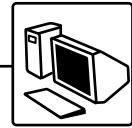
Cognitive

- None identified.



Dexterity

- The user should be allowed to customise the keyboard with respect to features such as repeat rate, key activation delay, delay between acceptance of two consecutive key presses, minimum time for pressing a key before the key repeat begins, and serial instead of multiple simultaneous keystrokes etc.



Requirements

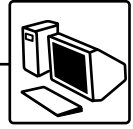
Standardisation

- If sufficient space is available, shift keys (upper and lower case, ctrl, alt etc.) should be duplicated, one on each side of the keyboard, and be placed symmetrically.
- The keyboard should be designed to provide sufficient space to allow the user to mount a keyguard.
- The system should allow the connection of two keyboards, which could be used simultaneously, for instruction purposes.
- The power needed to press a key should be between 0.3 and 0.6 Newton. Preferably, the required power should be adjustable.



Combination

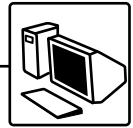
- Groups of keys (alphanumeric, numeric, function keys) should be separated by distinct spaces, with a distance of at least half a key. (This requirement is not applicable on laptops.)
- Groups of keys should be distinguished by different colours on the key tops, but in a way that colour-blind persons may discern the colours.
- The F and J keys on the alphanumeric keyboard, and the 5 key on the numeric keyboard, should be marked with a tactile identification, preferably in the form of a ridge on the keytop edge nearest to the user.
- Frequently used keys, such as ENTER, SHIFT, ESCAPE, CTRL, BACKSPACE etc., should be placed and have a shape that differ from other keys so that they are easy to find.
- The contrast between the colours of the characters and the background of the keytop should be the best possible.
- The height of the characters of the alphanumeric and numeric keys should not be less than 4 mm.



Requirements

Standardisation

- The height of the characters of the other keys should not be less than 4 mm, if there is available space.
- The text on the keys should be printed in sans-serif characters, which is considered to be more easy to read than other typefaces.
- No text should be printed in red or green colour.
- The user should be allowed to customise the keyboard with respect to features such as repeat rate, key activation delay, delay between acceptance of two consecutive key presses, minimum time for pressing a key before the key repeat begins, and serial instead of multiple simultaneous keystrokes etc.
- If sufficient space is available, shift keys (upper and lower case, ctrl, alt etc.) should be duplicated, one on each side of the keyboard, and be placed symmetrically.
- The keyboard should be designed to provide sufficient space to allow the user to mount a keyguard.
- The system should allow the connection of two keyboards, which could be used simultaneously, for instruction purposes.
- The power needed to press a key should be between 0.3 and 0.6 Newton. Preferably, the required power should be adjustable.



The Use of a Pointer Device



Home



Professional



Mobile Environment

- Some persons with reduced hand functions, such as reduced strength, small movements, or shaky hands etc., may encounter difficulties in handling pointing devices, such as mice, joysticks, track balls, touch pads, touch screens etc.

Requirements

Standardisation



Physical

- The user must be enabled to customise pointing device features such as double-click interval, pointer speed etc.
 - The user should be allowed to execute pointing functions from the keyboard.
 - The operation of a pointing device should not require two simultaneous hand movements.
 - The power needed to operate the pointing device should be between 0.3 and 0.6 Newton. Preferably, the required power should be adjustable.
 - Touchscreens should be operable by use of a fingertip as well as a tool.
- Customisation and adjustment of features of pointing devices are discussed in the ongoing work in ISO TC159 on ISO TS 16071, Accessibility of software.
 - There is a large number of different kinds of pointing devices available on the market. This includes mice of various design, including mice for left-handed people. There is no obvious need for standards for design of pointing devices.



Auditory

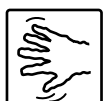
- None identified.



Visual



Cognitive

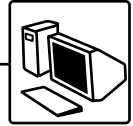


Dexterity

- Same as physical.



Combination



Requirements Related to the Needs of Professionals

Requirements related to the needs of designers and developers



Professional Environment

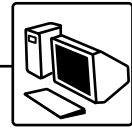
- In Europe there are many small local PC-assemblers who would benefit from having one single easy-to-use guideline to comply with, one that they could identify as agreed by suppliers and consumers, providing minimum requirements and additional recommendations, the latter allowing accessibility to become a domain of competition. Otherwise, since the guidelines are overlapping and sometimes addressing the same specific issue with slightly different wordings, the intended users are faced with the problem of knowing if one guide is better than another in the specific context. Furthermore, a standard guideline would facilitate inclusion of accessibility features in the many new products we will encounter in the near future, the "post-PC era".

Requirements

- There is a need for transforming one design guideline, or compiling the existing guidelines, into a standardisation document, targeted to designers and developers.

Standardisation

- It is clear that there is a sufficient basis of knowledge of user requirements to produce an agreed set of accessibility criteria for personal computers. This knowledge is documented in design guidelines and supplementary informative documents, issued by individual organisations or by co-operation bodies. A broad consensus is likely to be achievable.



Requirements Related to the Needs of Procurers



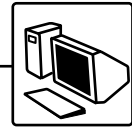
Professional Environment

- The procurement process is different from the design process. Design is increasingly regarded as an iterative process, and the message of the design guidelines is: do as much as you can! Public procurements are strictly regulated, and are definitely not iterative. The procurer is not allowed to add, reformulate or delete requirements and recommendations after the tenders are received. Moreover this is included in the code of good practices for any procurement. If a mandatory requirement is for some reason disregarded in the evaluation of tenders, the suppliers may have submitted their tenders — or refrained from submitting a tender — on false presumptions. Furthermore, since a call-for-tender is based on a decision to purchase, the requirements must be satisfiable by reasonably many products existing in the market. Consequently, the requirements and recommendations to be included in a call-for-tender have to be considered very carefully. Once they are formulated and sent to the suppliers, they must not be changed. This is contrary to the design process, which need to cater for a certain degree of freedom for the designer.
- This implies that a generic guideline intended for designers is not necessarily appropriate for direct use as a requirement specification in a procurement.
- As identified by the SPRITE-S2 project ACCENT, the lack of international and European standards dealing with accessibility of ICT products and services is a limiting factor for the inclusion of accessibility in ICT procurements. Accessibility is ignored partly because there are no widely recognised objective criteria to refer to when procuring products.

Requirements

Standardisation

- | Requirements | Standardisation |
|--|--|
| <ul style="list-style-type: none">- There is a need for a set of mandatory and desirable accessibility requirements to be included or referred to in procurements, especially public procurements. | <ul style="list-style-type: none">- It is clear that there is a sufficient basis of knowledge of user requirements to produce an agreed set of accessibility criteria for personal computers. This knowledge is documented in design guidelines and supplementary informative documents, issued by individual organisations or by co-operation bodies. A broad consensus is likely to be achievable.- The problem is creating a balance. If the requirements are too weak, the standard will be of limited use for the procurers; if the requirements are too strong, the standard will not be accepted by the suppliers. This is however not unique for accessibility. |



Requirements for the Technical Platforms



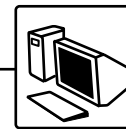
Professional Environment

- By a technical platform is here meant a combination of components such as processor, operating system, network services, programming languages, database management etc., which are standardised or market leading.
- To maximise system accessibility, the platform should comply with the principles of open systems and allow that interoperable, compatible and portable standard application programs, company-specific application programs, and assistive software can be installed and executed. The platform should include as many features as possible which promote accessibility, thus providing the programmer with building blocks with intrinsic accessibility features. A special advantage is that this will facilitate development of assistive software with common user interface and behaviour, which promotes portability and compatibility. Assistive devices could easily be exchanged or upgraded when necessary.

Requirements

Standardisation

- | | |
|---|---|
| <ul style="list-style-type: none">- Enabling flexibility for the user:<ul style="list-style-type: none">- The platform should allow application developers to enable the user to have keyboard access to all commands and options.- The platform should allow application developers to provide the user with the capability to select the output mode of the information according to his/her abilities and preferences.- Interaction with assistive devices:<ul style="list-style-type: none">- The tools and conventions of the platform should support the application developer in producing accessible software.- The platform should enable assistive devices to operate concurrently with all other system functions, yet be transparent to those functions.- The tools and conventions of the platform should support developers of assistive devices. | <ul style="list-style-type: none">- This is not a standardisation issue. Rather, it is a matter of awareness raising and training of developers as regards the needs of disabled and elderly people.- The use of assistive devices in a multi-platform environment is a complex issue. An open, vendor-independent API would be a possible solution. One suggestion would be that CEN/ISSS, as a first step, arranges a one-day workshop or a round table where leading mainstream ICT manufacturers and manufacturers of assistive devices are invited to exchange views, identify problems and explore possible solutions. |
|---|---|



Conclusions

The personal computer, its desktop as well as its notebook version, in the configuration it is sold off-the-shelf, is a well standardised product. This is not the result of formal standardisation, rather a result of proprietary specifications made publicly available and competing in the marketplace. It is not likely that new specifications for the personal computer market segment and gaining market success, will be produced in formal standards bodies.

In general, where the disability community wants to influence the future technical specifications in this market segment, this will need to be made by approaching individual market leading companies or industry consortia such as the group of companies behind the Bluetooth specification.

There are some general principles as regards standards that should be taken into account:

- It is of utmost importance that the future technical specifications in the field of personal computers are open and publicly available. This is necessary for those who need assistive devices. It is necessary that specifications are open and available to manufacturers of assistive devices in order that an individual who needs a specific assistive device should be enabled to use the device with any host computer, thus guaranteeing connectability and interoperability.
- Several guidelines exist on accessibility of computer hardware and software. There is a need for creating one world-wide well recognised standard. This is the purpose of ISO TC159, who currently elaborates ISO TS 16071 on software accessibility, based on a set of previously produced guidelines. The TS is intended for use by interface designers, software developers and purchasers. A similar standard on hardware accessibility would be of great value, especially for purchasers. Since in particular public procurement is a process different from the design process, the recommendations in a procurement guideline

must be strictly formulated, in order that both the supplier and the purchaser can easily verify that the requirements are satisfied. This could be a subsequent issue for ISO TC159 or CEN TC 122.

In addition, there are a few more specific standardisation issues of importance for people with disabilities, which not likely will be addressed by the market forces on their own initiative.

- There is a need for open and modular solutions which ensure that a system for identification and authentication of a user can be introduced or replaced without interfering with the use of assistive devices. The security system and the assistive device or software should be transparent to each other and to the host computer.

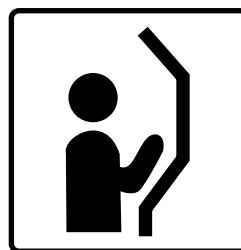
- A standard on acceptable levels and measurement methods is required for ensuring that the electromagnetic characteristics of the hardware does not interfere with a hearing aid where the induction pick-up coil is activated. This is an issue for IEC and/or CENELEC.

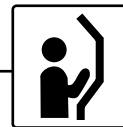
- Noise emitted from a computer can be more annoying for a hearing impaired person than for other users. A global standard on acceptable levels and measurement methods taking account of the needs of hearing impaired people would substantially facilitate purchaser and consumer choices. This is an issue for IEC and/or CENELEC.

- The use of assistive devices in a multi-platform environment is a complex issue. An open, vendor-independent Application Programming Interface (API) might be a possible solution. One suggestion would be that CEN/ISSS, as a first step, arranges a one-day workshop or a round table where leading mainstream ICT manufacturers and manufacturers of assistive devices are invited to exchange views, identify problems and explore possible solutions.

Chapter 11

Public Access Terminals





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Introduction

What are Public Access terminals?

We could define a Public Access Terminal (PAT) as an interactive system based on a computer acting as a sale or information point of products and services. The system is designed to be used without the need of personal assistance and it is placed in public areas, indoors or outdoors.

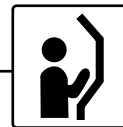
Currently, people are used to see Public Access Terminals in the environment. Autobanks, automatic ticket selling machines in transport or shows are products already implemented and used by a variety of people.

At the same time, we must keep in mind that its introduction will not end with these products. In the future, key societal services, such as getting hold of information and buying any kind of products and services will be available on Public Access Terminals.

The main reasons for the current and future penetration of PAT's in our society is the low maintenance cost, no need for personal assistance and the ease of registering of information on the actions carried out at the terminals.

The rapid and wide ranging introduction of these products in key societal functions, will require that people will have to interact with them in the near future in order to enjoy participating in the building of society.

For this reason, we must design future Public Access Terminals bearing in mind human diversity and different capabilities. Only by acting in this way, we will be able to ensure that everybody, independently of age, sex, capacities or cultural baggage could make use of them.



Standards

The main standards related to Public Access Terminals of different standardisation bodies are detailed. Most of them are not only related with the PAT domain but also with other domains (for example smart cards, communication devices, etc).

But it is important to have them described at this point because it is impossible to think of a PAT without interaction with the other ICT domains, as a separated telecommunication device.

The list consists of different existing standards (number and title) grouped by the standardisation body responsible for them.

Relevant ISO Standards.

ISO 7000 (1989)	Graphical symbols for use on equipment.
ISO 7001 (1991)	Public information symbols.
ISO 7239 (1990)	Development of principles for application of public information symbols.
ISO 9186	Procedures for the development and testing of public information symbols.
ISO 9241	Ergonomic requirements for office work with visual display terminals.
ISO/IEC 9995	Information technology: keyboard layout for text and office systems.
ISO 7816	Identification cards – Integrated circuit cards with contacts.
ISO/IEC 10536	Identification cards – contactless integrated circuit cards.

Relevant IEC Standards.

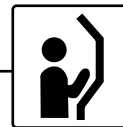
IEC 73	Colour of pushbuttons and their meanings.
IEC 118-4	Hearing aids: magnetic field strength in audio frequency induction loops or hearing aid purposes.

Relevant ITU Standards.

ITU-T E.134	Human factors aspects of public terminals – general operating procedures.
ITU-T E.135	Human factors aspects of public telecommunications terminals for people with disabilities.
ITU-T E.118	Automatic international telephone credit cards.
ITU-T E.133	Operating procedures for telephone credit cards.
ITU-T E.161	Arrangement of figures, letters and symbols on telephones.
ITU-T P.370	Magnetic field strength around the earcap of telephone handsets which provide for coupling to hearing aids.

Relevant CEN Standards.

EN 1332	Machine readable cards, related device interfaces and operations.
Part 1	Design principles and symbols for the use interface;
Part 2	Dimension and location of tactile identifier for ID1 cards;
Part 3	Keypads;



Part 4	Coding of user requirements for people with special needs.	ETR 160	Human factors aspects of multimedia telecommunications.
EN 29241	Part 4 Keyboard requirements; Part 11 Usability statement.	ETR 167	User instruction for public telecommunications services: Design guidelines.
EN 726	Requirements for IC cards and terminals for telecommunications use.	ETR 136	Tactile marker on prepaid telephone cards.

Relevant ETSI Standards.

ETR 029	Access to telecommunications for people with special needs: Recommendations for improving and adapting telecommunication terminals and services for people with impairments.	ETS 300 488	Telephony for hearing impaired people; Characteristics of telephone sets that provide additional receiving amplification for the benefit of hearing impaired.
ETR 039	Human factors standards for telecommunications applications.	ETS 300 679	Telephony for hearing impaired people; Electrical coupling of telephone sets to hearing aids.
ETR 068	European standardisation situation of telecommunication facilities for people with special needs.	ETR 165	Recommendations for a tactile identifier on machine readable cards for telecommunication terminals.



Output from projects

ISO-COPOLCO

Standards are written by experts from those industries producing a product or service, who use the standards process as a platform to form a common opinion, a standard. It is therefore important, in this process, to involve all those who will be affected by the standard. This includes in particular the private user or consumer. Within ISO the Consumer Policy Committee (COPOLCO), is the group that takes into account the needs of all consumers related with standardisation.

The main policy recommendations of this group are:

a) Promotion of Design for All.

Standard bodies should:

Promote standardisation work to ensure that products, services and environments are available, accessible, usable and safe for all consumers, including the elderly and people with disabilities, and adapt the general concepts of Design for All when developing and revising standards.

- Raise awareness and provide information for standards developers on the issue of accessible design.

- Co-ordinate between the standards committees dealing with mainstream products and those with responsibility for technical aids and accessibility standards for elderly and people with disabilities.

- Promote the standardisation of specific features or adaptations, where they exist, to make products/services more accessible and usable.

b) Consumer representation of the elderly and people with disabilities in standardisation work.

- It is important for standards bodies:

To ensure the direct participation of the elderly and people with disabilities, as consumers, in the standardisation process.

c) Links between research programmes and standardisation.

Standard bodies should promote:

- Co-operation and information exchange with research programmes on accessibility issues.

- The use in standards work of the result of existing research in technical research programmes in ergonomics and related to product/service accessibility.

CEN

Within CEN there are three technical committees that currently are working in standardisation related to Public Access Terminals.

- CEN TC 122: Ergonomics. A TC that tackles general requirements, not only related with Public Access Terminals, but can be of great importance.

- CEN TC 293: Technical aids for disabled persons. Is another TC that takes care of general issues but can define some aspects directly related with Public Access Terminals and its interaction with the user.

- CEN TC 224: Identification card system. Centred on smart cards but also relevant for Public Access Terminals. WG 6 is working with the Man- Machine Interface, which is producing the EN 1332 series. This includes subject areas such as keypads, tactile marking on cards, dialogue design principles, icons, symbols and pictograms, coding of user profiles on smart cards, and physical access to card operating devices (including self service terminals).



COST 219

Currently the project is known as COST 219bis as a continuation of the old COST 219 that finished in 1996. The project is not working directly on Public Access Terminals, but in relation to telecommunication services.

The aims and objectives of the study group related to standardisation are to:

Study the telecom-legislation/liberalisation issues.

Study how to pursue the uptake of the COST 219 report. The report had as urgent needs to develop standardisation on: inductive coupling of hearing aids to telephones, interference caused by TDMA to hearing aids, text telephony and videotelephony (all these issues are relevant to a PAT).

NORDICT

The conclusions of this Nordic project is that, at the current time, no standardisation body has addressed the Public Access Terminal as such in general sense. But, as has been explained, standardisation work is in progress for many possible components of the PAT, such as smart cards, keyboards, video systems and sound output.

INCLUDE

Within INCLUDE project, we can find two projects that are mainly related to Public Access Terminals and Design for All:

INFOPOLIS. Guidelines and recommendations on design of future user-oriented information systems (on-street terminals).

ATTACH. Style guide for the implementation of public self-service kiosk according to best ergonomic practices.

Nordic Council:

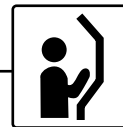
Consumer requirements for Self Service Systems

A project commissioned by the Nordic Council in 1993-1995 has detailed a series of consumer requirements for card based self service systems. Another report details a strategy for getting consumer requirements into the standardisation process. Whilst the reports are somewhat dated, the principles may still be relevant.

Norwegian project:

Self Service for All?

This publicly funded project, currently only available in Norwegian, provides "Design for ALL" guidelines to those purchasing and installing self service systems and advice on adapting user interfaces.



User Requirements

Locating and Physical Access



Public

- The Public Access terminal must be placed in an area that everybody can reach. We must have in mind that to interact with a Public Access Terminal the user can need additional space (for a companion, for valuables and possessions).
- The Public Access Terminal (PAT) has to be easily recognised and located by everybody.

Requirements

Standardisation



Physical

- The surroundings of the PAT should be on level, without steps and with a maximum slope of 6%. Just in front of the PAT there should be a clear area to allow wheelchair users to manoeuvre.
- It is covered by the European Concept of Accessibility and the architectural laws of each European member.
- NB. Ongoing standardisation work in CEN TC 224 WG 6 on an ENV for Physical Accessibility to Card Operating Devices should cover many of the issues related to accessibility.



Auditory

- Ease detection of the PAT without the need of acoustic signals.
- Develop guidelines on the locating signs of PATs.



Visual

- Street furniture or other objects should not obstruct the surroundings of the PAT.
- Ease detection of the PAT.
- Same as physical.
- Need of standardisation of a system of detection for blind people (usable in traffic lights, PAT detection, orientation...)



Cognitive

- All the signs to locate PATs should have a consistent and easy-detectable look.
- Same as auditory.



Requirements

Standardisation



Dexterity

- The user has to be able to approach to the PAT from any flank.
- Same as physical.



Combination

- None identified.



Physical Handling



Public

- Everybody must reach all the interaction buttons, slots, and operation points and obtain all the feedback from the PAT.
- The PAT must allow a correct approach of everybody to it from any flank.

Requirements

Standardisation



Physical

- To situate all the operation points accessible for a wheelchair user.
 - The screen must be readable by a wheelchair user or a tall pedestrian user.
- Create standards on accessibility to PATs (compilation of existing recommendations).



Auditory

- To duplicate all the acoustic detection output with visual outputs.
- Create standards on detection and recognition of a PAT.



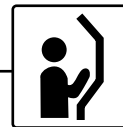
Visual

- Easy detection and recognition of all the operating points of the PAT.
 - Logical distribution of the operation points attending to the interaction process.
- Create standards for the different operation points (tactile recognition).
 - Create guidelines on distribution of the different operation points.



Cognitive

- People must recognise easily what type of machine it is and what it will do.
 - All the interaction points (slots, buttons, screen buttons) must be easily detected and recognised.
 - Different PATs with the same function must be similar.
- Create standards on PAT recognising (labels, legibility).
 - Create standards for the different operation points (card or coin slots, printer output) in detection and communication with other devices or PATs.



Requirements

Standardisation



Dexterity

- To allow the interaction with the different operation points.

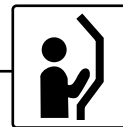
- Same as physical.
- Create standards for the different operation points (mainly with anti-slide properties of materials).



Combination

- The operation points must have feedback (acoustic, tactile and visible).

- Create standards on operation points (shape, colours, feedback, dimensions) either if they are physical buttons, buttons in a tactile screen.



User Interface (UI)



Public

- Common functions, either within different PATs or within different services in the same PAT, must have the same user interface.
- The user interface must have a consistent graphical representation.

Requirements

Standardisation



Physical

- Tall pedestrian users and short wheelchair users can have parallax problems in the display-side button system and precision problems in the tactile screen system.
- Create standards on the user interface with regard to typefaces, legibility, sizes, colours and graphical representations.
- (NB EN 1332-1, Annex A, to be developed, will provide graphic representations).



Auditory

- All the acoustic feedback must be visual at the same time.
- Possibility to adjust the acoustic signal feedback and volume.
- Create standards on feedback typology: how to activate the different outputs (speech, visual...), message typologies, tactile feedback...
- Create standards on hearing aid users (inductive loops, possibility to plug in hearing aids).



Visual

- The entire user interface must be "readable" by a visual impaired person.
- Utilisation of standard layouts for keypads.
- Create standards on "blind" navigation and its activation.
- Use the standardised keypad layout (EN 1332-3) on Public Access Terminals.



Requirements

Standardisation



Cognitive

- Reproduce graphical representations of common functions.
 - Ensure that the same functions are made under the same user interface.
 - Have a continuous feedback from the PAT while it is processing the information.
- Create standardisation on consistent graphical representations. (NB EN 1332-1, Annex A, to be developed, will provide graphic representations).
 - Create standardisation on feedback typology (as auditory).



Dexterity

- For manual dexterity the dimensions of the operation buttons are priority.
- Same as physical.



Combination

- The location of the different buttons in the screens must be repetitive and logical. Feedback requirements: simple expressions and short sentences.
- Create guidelines on standard layouts for tactile screens.
 - Create standards on "language" feedback (both acoustic and visual).



Operation



Public

- Currently, young people used to work with computers are the main users of the Public Access Terminals. In order to avoid training with the different PATs it is necessary to develop standards on the operating sequence.
- Different PATs with different functions must have a similar logical operation.

Requirements

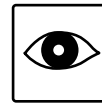
Standardisation



Physical



Auditory



Visual

- None identified.



Cognitive

- The location of the different operation points in the PAT must coincide with the logical sequence of operation and the utilisation of each operation point.
- Many elderly or cognitive impaired people need more time to read and understand the different screens of the PAT.
- Create standardisation on the sequence of interaction with a PAT and the feedback to the user (detection of the active operation point).
- Create guidelines on the location of the different buttons and operation points in the PAT.
- Specify minimum times for time outs.



Dexterity

- In those operations requiring money transaction the operation process must be secure against making mistakes with the operation buttons.
- Create standards on the sequence of interaction with a PAT (same as cognitive).



Combination

- The user should know what the PAT is asking him (if it is waiting a card, coins, an answer to a question).
- Create standards on the sequence of interaction with a PAT (same as cognitive).



Adaptation to User Profile



Public

- Although we are trying to design Public Access Terminals accessible to everybody, some characteristics of the user interface and the operation process can be tailored to special needs of the user.
- Some of these characteristics can be: language, size of the messages and labels, time between different displays, speaker volume, operation typology. Many of these are specified in EN 1332-4, although not widely implemented on PATS.

Requirements

Standardisation



Physical

- Adaptation of the user interface or operation process to specific physical requirements of the user.
- Implement EN1332-4 on different user devices.



Auditory

- Adaptation of the user interface or operation process to specific auditory requirements of the user.
- Same as physical.



Visual

- Adaptation of the user interface or operation process to specific visual requirements of the user.
- Same as physical.



Cognitive

- Adaptation of the user interface or operation process to specific cognitive requirements of the user.
- Same as physical.



Requirements

Standardisation



Dexterity

- Adaptation of the user interface or operation process to specific dexterity requirements of the user.

- Same as physical.



Combination

- None identified.



Security of Operation



Home

- No need for special characteristics to assure the security of operation.



Public

- If we have in mind that Public Access Terminals allow people to carry out transactions related with their identity, the privacy of the operation must be assured.
- The PAT, the site where it is located and the communication with other devices must minimise the risk of interception of private information.
- At the same time, outdoors environments can be very corrosive. So, the PAT must be robust and resistant.

Requirements

Standardisation



Physical

- None identified.



Cognitive



Dexterity



Auditory

- Some hearing impaired people could need a higher volume of the acoustic feedback, which can be heard by people near the PAT.
- Create standardisation on how acoustic feedback can be secure for the user.



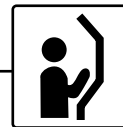
Visual

- Some visually impaired people may need larger type, which can be read by people near the PAT.
- Create guidelines on how to improve the safety of the terminal.



Combination

- The lack of security in the PAT is one of the main reasons for not using the terminals.
- The privacy of PIN codes, bank accounts and electronic cards codes must be assured.
- Same as visual.
- Improve secure transaction using telecommunications (SSL.).



Conclusions

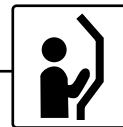
Firstly, this ICT domain needs to be treated as a whole, not just as an assembly of different components of other ICT services/products, such as smart cards, PC devices (screens, keyboards).

Secondly, the different standardisation bodies should take into account that, in the near future, the interaction with Public Access Terminals will

be very frequent. In order not to exclude people from the self service, we must ensure that the diversity of the population is taken into account in standardisation.

More detailed standardisation needs and suggestions on which standardisation body could carry out recommendations are shown in the following table.

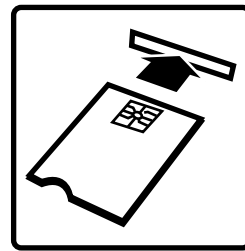
STANDARD	CEN	CEN-ELEC	ETSI	ISO
Develop standards on the detection, location and recognition of telecommunication devices and Public Access Terminals in concrete. (ENV 1332)	X		X	X
Develop standards on accessing to the Public Access Terminals operation points. (ENV 1332)	X			X
Develops standards on detection, location and recognition of the different operation points of the Public Access Terminal. (ENV 1332)	X			X
Develop standards on the sequence of interaction with a Public Access Terminal and the feedback to the user (detection of the active operation point).	X		X	X
Develop standards on the interaction between the Public Access Terminal and different user assistive technology devices.	X		X	X
Develop standards on the interaction between the Public Access Terminal and different system assistive technology devices.	X		X	X
Develop standards on interaction between Public Access Terminals and hearing aid users (inductive loops, possibility to plug in hearing aids, connector and protocol for external audio amplifier).			X	
Develop standards on the use of communication devices (telephone layout, keyboards) (EN 1332-3)	X		X	X
Develop standards on speech recognition.	X		X	X
Develop standards on synthetic speech.	X		X	X
Develop standards to adapt the Public Access Terminal to the user needs (interaction with smart cards, infrared controls).(EN 1332-4)			X	X
Develop standards on consistency of user interface (to ensure similar interaction in common services). (EN 1332-1)	X			X
Develop standards to provide the same service on many terminal types.	X			X

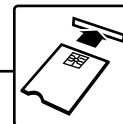


STANDARD	CEN	CEN-ELEC	ETSI	ISO
Develop standards on each public access service (tourist information, note and coin operating machine, self-vending machines) to unify their behaviour.	X			X
Develop standards on the user interface with regard to typefaces, legibility, sizes, colours and consistent graphical representations.	X			X
Create standards on user interface symbols and pictograms. (EN 1332-1, Annex A)	X			X
Create standards on "blind" navigation and its activation.	X		X	X
Develop standards on feedback to the consumer, attending to the output (auditory, tactile, visual), message typologies, feedback sequence.	X		X	X
Adapt existing standards and guidelines for tests of usability to include Public Access Terminals.	X			X
Develop standards on secure design of the Public Access Terminals and its location site.	X			X
Develop standards on secure feedback for the user ("large" acoustic and visual feedback).	X			X
Develop standards on the improvement of safety operation of the Public Access Terminal and error protection.	X			X
Develop standards on secure transaction using telecommunications (SSL).			X	

Chapter 12

Smart Cards





Contents

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Introduction

Card based systems have permeated key areas of the information society: they are the key to bank services (at ATMs or via telephone), are the key to communications (phone cards, GSM), transport (tickets, toll booths) and identity cards, (electronic passports/machine readable visas), health (patient cards/ health care professional cards) TV cards, electronic purses, access control for buildings, social security cards, etc. They are regarded as the “key” (currently the

missing key) to business to consumer Electronic Commerce.

Given that smart cards are the key to the information society, and given that there is a desire to avoid a two tier society (those that are members of the information society and those that are not) it is essential that no barriers to use (economic or technical) of smart card systems exist. They are the key to replacing the “service” society with a self-service society.

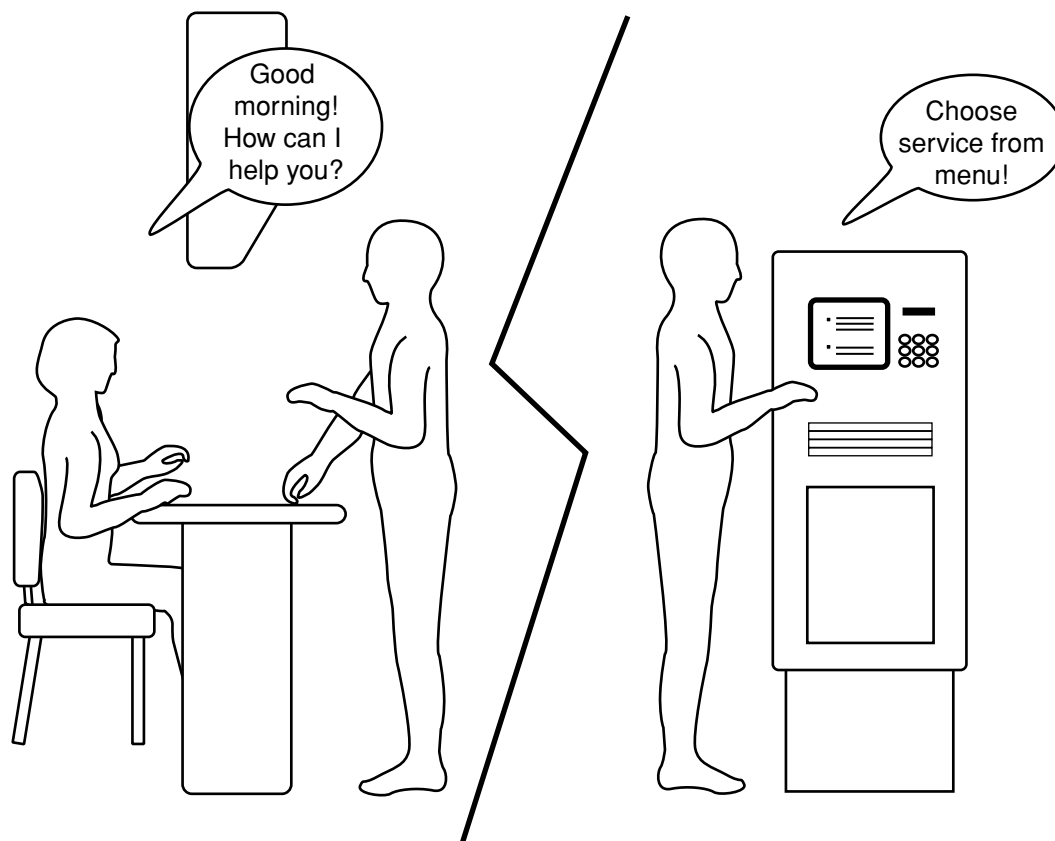
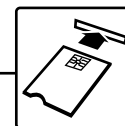


Figure 12-1: "The service society is being replaced by a self service society."



As figure 12-2 shows, the success of using a smart card system is similar to completing a puzzle. Completion of a task – or puzzle - is dependant upon the correct interoperation of all the different pieces. If one piece is missing, or sub-standard, the puzzle cannot be completed successfully. (This is very important when considering standards, which are the basis for smart card interoperability).

The development of smart card systems has also led to a potentially increasingly complex user interface as figure 12-3 shows:

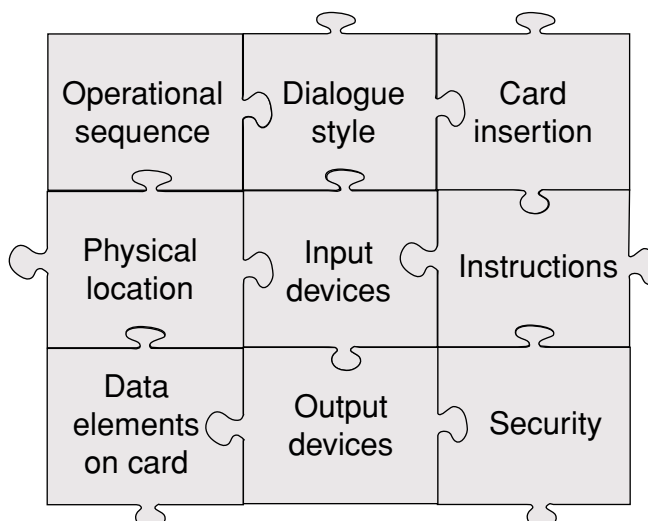


Figure 12-2: "The chain is only as strong as the weakest link."

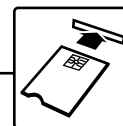
Today's user interface	Tomorrow's user interface
Monochrome	Unlimited number of colours
Limited numerical keying	Unlimited alphanumeric input
One channel of input	Several channels of input
Limited use of sound	Voice recognition/ synthetic speech
Limited responsibility with loss of card	Unlimited liability
Constant service offered	Different services – different times
One simple task to complete	Several subtasks to complete complex prime task
Mainly bank related	All societal functions
Voluntary use	Enforced use
Requires use of 1 card	Two or more cards
1 card – 1 PIN to remember	Many cards, many codes to remember

Figure12-3: An overview of today's and tomorrow's user interface

Not only is the user interface becoming more complex and demanding for its users, the consequences of not successfully using the system become more severe; - in the worst case social exclusion or an unlimited economic liability. The case for "Design for All" should be clear both from an individual and societal perspectives.

About smart cards

The term "smart card" refers to any plastic card with an embedded integrated circuit. As far as the public is concerned these cards will have physical dimensions according to ISO 7810. There are smart cards of other dimensions (e.g. SIM cards in mobile phones). Smart cards can perform two main functions: store data and perform calculations. Data storage allows the card to act as a data repository specific to the card holder; the calculation function allows the card to control access to that data.



Standards

The review below reflects that smart cards are used in many different domains and applications – providing a clear cut standards overview has therefore not proved to be easy. There is no one standards organisation that covers all user aspects of smart card systems.

ISO

ISO JTC 1 SC 17 Identification Card Systems

There are nine working groups in this ISO Sub-technical. None of them work specifically with ensuring that end users interests are systematically taken account of. Several of the working groups have work items that touch upon aspects that will affect the end user, for example WG 1, Physical characteristics and test methods for identification cards and WG 9, Optical Cards. Both working groups have work related to having a tactile identifier to assist visually impaired people orient a card (EN 1332-2) on the card.

Note:

WG 9 states that there will be a lamination problem with the dimensions specified in EN 1332-2 if there is a tactile identifier on the card. This has not been resolved.

ISO/IEC JTC 1 SC 17 WG 8 Contactless integrated circuit cards Task Force Two is producing a four part standard for proximity cards/ contactless cards.

ISO/IEC 14443-1

Identification cards – Contactless integrated circuit cards Proximity cards – Part 1: Physical characteristics

ISO/IEC 14443-2

Identification cards – Contactless integrated circuit cards Proximity cards – Part 2: Radio frequency power and signal interface

ISO/IEC 14443-3

Identification cards – Contactless integrated circuit cards Proximity cards – Part 3: Initialisation and anticollision

ISO/IEC 14443-4

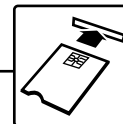
Identification cards – Contactless integrated circuit cards Proximity cards – Part 4: Transmission protocols

This four part standard is of relevance not only for accessing terminals without actually having to insert a card (of benefit to people with dexterity/ manipulation problems), but also for being able to gain access to buildings, and to use wayfinding systems in a complex builtup environment (see also Chapter 8, on Wayfinding).

Comment

Since cardholders may transmit confidential information to the system, measures must be taken to establish security of transmission between transponders and readers.

Protocols for communication between smart card, transponder and reader should be standardised so that the users can use their own personal equipment as an interface when communicating with the system. As such there should be interoperability between the wayfinding system and other smart card reading devices / personal devices. This also implies that there should be a certain compatibility between private smart house systems and public wayfinding systems.



Electronic commerce and smart cards

Within the domain of smart cards and business to consumer electronic commerce at the ISO level, there are at least two major initiatives that need referring to:

The ISO JTC 1 Business Team on Electronic Commerce and the ISO TC 68 /CEN TC 224 SC 6 Project Team on Electronic Commerce.

The ISO/IEC JTC 1 Business Team for Electronic Commerce, made several smart card related recommendations for standardisation as listed below (source ISO JTC 1 BT EC N071). (Note: These recommendations are also relevant for the chapter on the Internet and Electronic Commerce).

A.1	Review existing and emerging standards regarding user interfaces, formal and de facto, to establish the status of work in this area and their interworking. Establish their relevance from a consumer/user interface perspective in a home environment, using also delivery mechanisms other than a PC.
A.2	Develop a set of metaphors that are relevant for different domains within Electronic Commerce (e.g. shopping, travelling, ordering, searching, etc.). Existing desktop metaphors (office environment) may not be relevant for the consumer (home) environment, nor for other delivery mechanisms (smartphone, WebTV)
A.3	Develop a list of functions to be represented by each of the three (3) categories of icons; namely: (1) facilitating interaction; (2) representing certifications; and, (3) facilitating navigational aspects. Provide a functional description of these icons and provide design examples, both for visually represented icons and auditory ones (earcons). Define the grammatical rules for how these icons can be opened, closed, moved, emptied, etc. Icons to be developed in accordance with existing relevant standards. Relevant standards include not only office system standards, but also standards related to the design of information for the public.
A.4	Review existing dialogue design principles for office systems (ISO 9241-10) and self-service card-based systems (prEN 1332-1). Adapt these and others to consumers in a home environment. Determine which navigational aids are needed and standardise their representation (e.g. icons) and functionality.
A.5	Develop an approach to defining customer class profiles and individual customer profiles
A.6	Develop a starter set of customer class profiles using the approach defined in work item A.2.

Figure 12-4: Recommendations from ISO JTC/BT-EC.

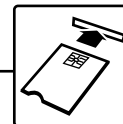
The ISO TC 68/CEN TC 224 Project Team on Financial transactions in Electronic Commerce is of direct relevance for smart card systems (and of course the internet and electronic commerce chapter of this report). The three deliverables provide an excellent analysis of electronic commerce with regard to ordering, delivery interfaces, payment, security and interoperability (including payment interoperability and communications protocols); a comprehensive overview of relevant existing standards and specifications and Requirements for Standardisation.

Note: CEN /ISSS has formed a co-ordination group of interested technical groups in order to monitor the follow up of these issue.

The key standardisation recommendations of relevance for this report are the recommendation for a Quality Standard and Transaction Profiles.

The proposed scope for a Quality Standard is as follows:

Guidelines for the behaviour of parties during the various stages of the transaction should be defined and agreed in order to establish a quality approach.



ISO 8402 states that “Requirements for quality” are an “Expression of the needs or their translation into a set of quantitatively or qualitatively stated requirements for the characteristics of an entity [e.g. a software solution for Electronic Commerce] to enable its realization and examination.”. Such requirements shall “fully reflect the stated and implied needs of the Customer.” And they cover “market-based and contractual, as well as an organization’s internal, requirements.”.

The requirements referred to below should be considered as such “requirements for quality”, and as such should be used to establish “quality standards” for Electronic Commerce. They may be supported by ergonomics related standards.

The proposed scope of Electronic Transaction Profiles is:

The purpose of this standard is to provide web site developers with a standardized method of describing to the Customer the sequence of the Electronic Commerce transaction.

The Merchant’s presentation of the sequences of stages and activities, in which Electronic Commerce transactions could be carried out, should be defined and agreed to ensure a good understanding of those sequences by the Customer. This presentation may include pictograms and flow charts.

The various transaction stages and their activities shall be defined, according to deliverable in section 4.1 for the ordering stage, section 5.1 for the delivery stage and section 6.1 for the payment stage). Some typical sequences, called profiles, might be included in the standard: their description may reflect codes of conduct.

Especially for order scenarios (see section 4.1.2 of deliverable 1), transaction profiles should be defined for the scenarios which comply with the quality criteria defined above.

Comment

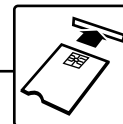
The recommendations from both of these project teams provide the opportunity to ensure a Design for All philosophy when specifying user interface elements and dialogue design for electronic commerce.

Accessing smart card systems

With regard to accessing smart card systems (see also chapter on Public Access Terminals) there is an ISO Technical Report ISO TR 9527 “Building Construction – Needs for disabled people in buildings – Design Guidelines and two national standards– one Canadian - CAN7CSA – B651.M99 (1999) Barrier free Design for Automated Banking Machines, and one Australian - AS 3769 (1999) Automatic Teller Machines: User Access.

User Interface Design

There are no ISO standards on the design and evaluation of user interfaces for smart card systems. There are standards that have been developed for other domains (signs for public information (ISO TR 9186, ISO 3461, user interfaces for offices systems (ISO 9241 – parts 10 –19) that could be applied to smart card systems in a Design for All perspective.



ITU

ITU - the International Telephone Union has several standards related to smart card systems as outlined below. These are more fully described in the Chapters on Communication Devices and Services.

ITU-T E.135 (10/93) Human Factors aspects of public telecommunications terminals for people with disabilities

ITU-T E.136 (05/97) Specification of a tactile identifier for use with telecommunications cards.

ITU-T E.121 (07/96) Pictograms, symbols and icons to assist users of the telephone service.

ITU-T F920 (02/95) Procedures for designing, evaluating and selecting symbols, pictograms and icons.

ITU-T E.161 (05/95) Arrangement of digits, letters and symbols on telephones and other devices that can be used for gaining access to a telephone network

ITU-T F.902 (02/95) Interactive services design guidelines.

ITU-T E.134 (03/93) Human Factors aspects of public terminals: Generic operating procedures.

CEN

Within CEN/ISSS there are three technical committees that currently perform standardisation work that is smart card related:

CEN TC 224 Identification Card Systems

CEN TC 251 Medical Informatics

CEN TC 278 Road Transport Informatics

The work of CEN TC 251 Medical Informatics, (www.centc251.org/) has currently only a remote link to smart cards used by the public (or in 251s case "patients"). This link, is in relation to being able to use cards that contain patient data in an inter-sector environment.

Comment

EN 1332-4 describes the data and coding format for data that should be entered on a card. It does not take a stand as to who should enter that data. Perhaps medical practitioners should enter the data, since it is very confidential.

Within TC 278, WG 3 has started work in relation to the user interface of ticket machines.

CEN TC 224, established in 1990 is charged to ensure cross border, inter sector interoperability within smart card systems. It has twelve working groups, of which only four are currently

operative. Working Group Six, Man Machine Interface, is specifically mandated to produce standards in relation to user requirements. It has produced a four part standard (EN 1332 parts 1 to 4) as described below.

Scope of EN 1332

The scope is stated as follows:

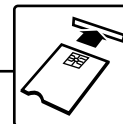
"Machine readable cards facilitate the provision of a growing variety of services cross Europe. The purpose of this standard is to increase the accessibility of these services for the benefit of consumers. This will be achieved by facilitating the inter-sector and cross border interoperability of machine readable cards and to do so with the maximum possible degree of user friendliness. EN 1332 addresses the needs of all users, including people with special needs, not overlooking first time users, minors, those not conversant with the local language."

Part One: User Interface dialogue design specifications

Part Two: Tactile identifier

Part Three: Keypads

Part Four: Coding of Special User Requirements



New Work Items to be completed by CEN TC 224WG 6

The following items are currently being worked on by WG 6.

- Physical access to card reading devices.
- Differentiating Plastic Cards by Touch.
- Supplement EN 1332-1 with an Annex of Icons, symbols and pictograms.

Comment

The standards have been written for typical ATM /Ticket Machine technology and for use in the public domain. Hand held devices, PDA's and use at home were not considered during development. Domains such as electronic commerce, transport, wayfinding, car useage, access control to buildings were not considered. Therefore the existing standards may be limited in their application.

EN 1332-2, "Tactile Identifier" has four options. Empirical research has shown that only one of the options actually meets the scope of the document. It is the option specified by ETSI. However this option is opposed by ISO/IEC JTC 1 SC 17 WG 9. A solution needs to be found.

CEN ISSS Workshops

Three workshops of direct relevance to smart cards are the CEN ISSS Distinct Workshop, CEN ISSS WS FINREAD and CEN ISSS WS E-SIGN.

The newly formed DISTINCT workshop intends to produce a CWA on coding of user requirements on cards (based on EN 1332-4) and to provide a mechanism for payment between those parties providing services to the cardholder. It will also provide a register of requirements that are coded in order to ensure interoperability. It has also provided coded user requirements in addition to those already specified in EN 1332-4.

Comment

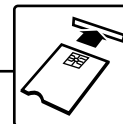
The concept behind this workshop has the potential to improve access to smart card systems for all users and is of considerable importance.

The CEN/ISSS FINREAD Workshop aims to provide a CWA specifying IC readers for use in the home in order to facillitate electronic commerce and other pay services such as Pay TV. It could also be used for authentication – e.g. electronic voting.

Comment

This CWA could have an considerable impact on daily living for all people. It is therefore important that the CWA embodies Design for All principles.

In response to the Electronic Signatures Directive, a CEN ISSS WS E-SIGN has been started. It is supported by a project team which is , inter alia, identifying requirements on "User interface and operating environment for electronic signature creation". This particular activity will be taking on board a "design for all perspective".



ETSI

For a more complete overview of work done by ETSI, the reader is referred to the chapters on Communication Devices and Services.

Work on smart card systems and its component parts is split up between different Technical committees in ETSI, such as SMG, Terminal Equipment, Human Factors, and The ETSI User group.

The ETSI Board is currently reviewing the Institutes card work, with a view to restructuring it. Particularly relevant are card requirements for UMTS (third generation mobile, with the global GPP Project).

The following produced mainly from the Technical Committee on Human Factors is of particular relevance to smart card systems and Design for All:

- ES 201 381 Keypads and keyboards for telecommunications equipment
- ETS 300 767 Tactile marker for use on prepaid telephone cards
- ETR 333 Text Telephony; Basic user requirements and recommendations
- ETR 165 Recommendations for a tactile identifier on machine readable cards for telecommunications terminals.
- ETR 029 Access to telecommunications for people with special needs; Recommendations for improving telecommunications terminals and services for people with impairments.

- ETR 116 1994 ISDN Terminal Design
- ETR 334 The implications of ageing for the design of telephone terminals.
- ETR 345 Characteristics of telephone keypads and keyboards; Requirements of elderly and disabled people.
- E.138 1998 Public terminals for the elderly

The ETSI User Group, 1996, produced a document: "Users requirements; Mobility; interworking and Interoperability between Networks". This lists a series of important requirements that will help to achieve Design for All.

Comment

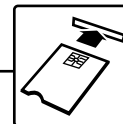
There is no one body in ETSI responsible for producing a set of standards related to the user interface of smart card systems with regard to Design for All issues. Much of the work that is relevant is produced as Technical Reports (i.e. recommendations), not standards. It is not clear if this work is used.

De Facto

There are a series of initiatives/ organisations/ industry associations that produce defacto standards/ agreements in relation to smart card systems which include EMV (Europay, Mastercard and Visa), Global Chipcard Alliance, ECBS (European Committee for banking Standards), Multos. There are several annual trade fairs; -ESCAT, ScandiCards, Smart Card Conference.

Comment

There is no apparent systematic focus on user interface and Design for All issues in any of the above mentioned defacto fora. It is worth noting that this defacto fora is the one that sets the standards that are in fact used.



Conclusions in Relation to Standards

Given the wide variety of uses for smart card systems and the potentially many different organisations (de facto and de jure) that perform standardisation of various components of smart card systems, it is hardly surprising that there is no overall holistic and consistent approach to the standardisation of smart card systems in relation to "Design for All". In addition, it must be recognised that the user interface is seen as an area of competition amongst service providers and therefore often stated as not one for standardisation.

The relevant standards that do exist have been driven mainly by the financial services and telecommunications industries. Other domains, such as transport, wayfinding, building access, have not been so proactive in the standardisation of user aspects.

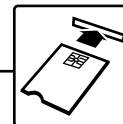
The one group charged with cross border inter sector interoperability is CEN TC 224 WG 6. Standards developed by this group have been based on achieving consensus (as indeed most standards are) as opposed to being based on empirical data, i.e. they do not necessarily meet users requirements. Output from ETSI TC Human Factors, which is often based on empirical data is produced as Technical Reports as opposed to ETSI Standards. Technical reports are not binding.

The starting point for CEN TC 24 WG 6 standards has been ATMs/ Ticket machines/ Telephone kiosks. Technology such as hand held devices, smart card readers in the home, set top boxes, wayfinding, access control, inter-sector purse, home banking, have come after publication of the existing four part standard.

In the defacto standardisation world there is little/ no evidence of standardisation and related activities that take account of Design for All.

There is however a potential prospect of adapting smart card systems to suit "all" users, and that is by getting the terminal and service to adapt to the individuals requirements (EN 1332-4, subject of the CEN/ISSS DISTINCT Workshop). This concept could be applied across many other areas of ICT.

There is a proposal under discussion for a European Payments observatory. This is an ISIS project. CEN / ISSS is interfacing by providing the standards link. It will take high level requirements, including on cards, so could provide a future focal point at that level.



Output from Projects

One of the most relevant EU projects for smart cards and disability was TIDE Project 1040 SATURN, 1994-1996. Its participants included smart card manufacturers, terminal equipment suppliers, telecommunications providers, a consumer council, disability and human factors experts.

The project has provided the basis for standards on coding of user requirements on cards (EN 1332-4), provided a holistic user requirements specification for smart card systems, and increased awareness of the need to “Design for All” amongst the terminal equipment suppliers (the largest in the world), card manufacturers and service providers. A series of brochures/guidance documents have been spawned on making smart card systems accessible to all users. Useful documents from the project include:

- An overview of legislation, standards, literature and other research on the useability of smart cards and related self service systems” Balfour, Klein and Petrie, Deliverable One, SATURN project 1994.
- User Requirements for Smart Card Systems, Balfour A, 1995, Deliverable 3, SATURN project.
- Cost 219 “Proceedings of the Cost 219 seminar on Smart cards and disability”, 1994
- Access Prohibited ? Information to Designers of Public Access Terminals, RNIB.

Another highly relevant EU project is DISTINCT. It has further developed the concept of coding user requirements on smart cards (started in SATURN), especially in relation to public transport (not covered in SATURN). It has added additional suggestions for coding to functions not currently specified in 1332-4, and since been taken forward as a CEN /ISSS Workshop.

The TIDE Project DE 3201 ARiADNE, a project demonstrating the use of smart cards and transponders to help disabled people navigate in complex buildings (see Chapter on wayfinding) has developed a set of standardisation

recommendations (December 1999) in relation to access and navigation in buildings, accessibility, standardisation requirements between smart card, transponders and terminals, user interfaces for transponders and terminals and user profiles.

In the Scandinavian countries, various consumer councils and disability organisations have attempted to put a focus on making self service systems more accessible for all users. A number of reports have been published and seminars held:

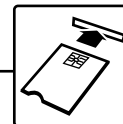
- Consumer Requirements for Specification for Smart Card Systems, TemaNord 1995
- Ensuring Consumer Interests in card based Self Service Systems, TemaNord 1995
- Automatic service machines – Service for Everybody ? Swedish Handicap Institute
- Self service for everyone ? – Guidelines for the procurement and installation of self service systems to meet a Design for All Approach. DELTA-senteret, Norway, 2000.

In anticipation of the UK Disability Discrimination Act, the financial services industry in the UK has developed a Code of Practice on Accessibility to ATMs.

Access to ATMs: UK Design Guidelines, Centre for Accessible Environments.

Comment

There is a range of output (holistic frameworks, research results, guidelines, etc) from a variety of projects (european and national) that could be applied in standardisation so that smart card systems could be “Designed for All”.



User Requirements

Locating and Accessing Terminals



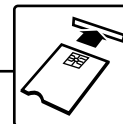
Home Environment

- Interoperability between smart card readers and different types of terminals (e.g. television, telephone and PC) is required.
- Card readers should read all smart cards in order to avoid the home user having several different card readers.
- Card reading equipment in the home should be usable for different functions such as payment on the internet and for pay-TV (i.e.. access control). This is in order to avoid the consumer having several card readers.
- Users should not be required to purchase any special equipment in order to get access to the services.



Public Environment

- There must always be a manual alternative to electronically provided services. Manual services should not be more expensive for the users.
- If possible the terminal should be located in the vicinity of an information desk.
- The terminals should be placed according to standard guidelines (aiming at conformity in placement of terminals).
- Some form of manual help, e.g. from personnel at an information desk, must be available.
- Terminals of the same type should have a unitary visual/auditory/tactual profile, be placed according to standard guidelines, and clearly identifiable from both long and short distances. The identification should tell the reader what kind of terminal this is (e.g. teller or ticket machine).
- No obstacles (street furniture etc) should be located in a predefined area around the terminal or on the route to the terminal. The area around the terminal should be large enough to turn a standard size pram or a wheelchair.
- Terminals should be on the same level as main pathways/walkways.
- Terminals should be installed according to existing and ongoing standards.
- Exit from indoor terminals should be clearly marked (alternative manual exit should also be marked).
- Tactile markings should be provided in the floor.
- Appropriate lighting around and on the route to the terminal is required.
- Pavements on access routes and in front of the terminal should be smooth with slip-resistance surface.
- Drainage gratings should be outside the route if possible.
- Where queuing is expected there should be room for people standing in a line.



Requirements

Standardisation



Physical

- Operation of the terminal should not require the user to move back and forth between different component parts of the equipment.
- The user should be able to operate the terminal from the position normally used when operating the equipment where the terminal is installed (e.g. from the sofa when using the TV).
- Provide means for storing cane, briefcase, etc. while using the terminal.
- Automatic doors preferred.
- Automatic doors should not create walking hazards (sliding doors are preferred).
- Terminal should be adaptable to the users size and position (e.g. mounted on flexible arm). Preferably the terminal should adjust automatically based on information stored in the user profile.
- The terminal must be mounted so that all users can reach the functional areas.
- Access routes should be flat, without steps, stairs or unevenness and not present barriers or hazards to people with impaired mobility or vision (UK Design Guidelines).

In progress:

- CEN TC224 WG6 – Provisions for physical accessibility to card reading terminals

Other relevant standards:

- ISO 7176-5 Wheelchairs – Part 5: Determination of overall dimensions, mass and turning space.

Existing guidelines (not standard):

- Access to ATMs – UK Design Guidelines.
- ISO TR 9527 Building construction – Needs of disabled people in buildings – Design guidelines
- Access Prohibited? Information for designers of Public Access Terminals
- ENV by CEN TC 224 WG6 should cover these issues.



Auditory

- The area surrounding the terminal should be protected against excessive background noise.
- Audible signals, used by visually impaired persons to find the terminal, must be heard at a distance of a few meters.

- ENV by CEN TC 224 WG6 should cover these issues.

- Standards required

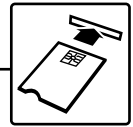


Visual

- Clear and visible markings of the terminal.
- Signs showing the location of the terminal must have letters that are at least 100 mm high, an easily recognisable font and high contrast between text and background.
- Terminals should be easily identifiable at night and on overcast days.
- Colour and contrast should be used to enable visually impaired persons to locate the terminal.

Existing:

- AS 3769 – ATM – User access
- ENV by CEN TC 224 WG6 should cover these issues.



Requirements

Standardisation

- Colour markings should be at least 40 cm wide on the walls and floor surrounding the terminal.
- Glare should be avoided from the terminal and its components.
- Light fixtures should not be placed so that the users of the terminal are dazzled or cast shadow on the screen.
- Lighting should be according to recognised guidelines (UK Design Guidelines) or standards.
- Terminal controls and function areas must be within the users comfortable viewing angle.



Cognitive

- Signs and symbols telling the user the type and location of the terminal should be easy to interpret.

Ongoing:

- EN 1332-1, N.W.I. on icons, symbols and pictograms.



Dexterity

- Hands free operation would be preferred. Other alternatives are: Intelligence in card remembering the most frequently used function presented as a default (user only needs to confirm the operation). Alternatively a preprogrammed sequence of commands could be transferred to the terminal from the users own digital assistant (requiring only one key press).
- Automatic doors are preferred
- Contactless means for identification to get access should be provided.

Required:

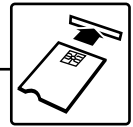
- A media independent, uniform protocol for secure digital data transfer explicitly directed from the contact-less smart card (device) to the terminal is needed.
- Further development of EN 1332-4.
- To be investigated in CEN ISSS WS E-SIGN.



Combination

- Tactile markings on the floor leading the user towards the terminal.

- Guidelines exist, standards required.



Physical Handling of Smart Cards and Controls



Home Environment

- It should be possible to operate the terminal from where the communication equipment (TV, Phone, PC etc.) usually is operated (e.g. from the sofa for the TV)



Public Environment

- The terminal should never be allowed to confiscate a card due to terminal malfunction (or alternative means for identification etc. should be provided immediately)



Mobile Environment

- None identified

Requirements

Standardisation

General

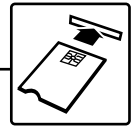
- There must be compatibility across card readers.
- Layout of functional areas on the terminal should be standardised.
- Connection between terminal and users personal user interfaces/equipment (e.g. headphones) should be standardised. Both communication protocol and technological interface should be standard.
- Differences between the different function areas should be emphasised in the design.
- Standardise card insertion slots.
- When touch screens are used, all screen functions should also be available from a tactile keypad,

Existing standards:

- EN 1332 Part 3: Keypads
- ISO/DIS 9355 Ergonomic requirements for the design of displays and control actuators:
Part 1: Human interactions with displays and actuators.
Part 2: Displays.

Other relevant standards:

- ISO 9995 Information technology - Keyboard layouts for text and office systems
- ISO 9214 Ergonomic requirement for office work with visual display terminals:
Part 11 Guidance on usability



Requirements

Standardisation



Physical

- Differences between the different function areas should be emphasised in the design.
- Tactile marking of numerical keypad (e.g. number 5 is elevated).
- Screens and controls must be located so that all functional areas are within comfortable reach of intended users without excessive effort (e.g. wheelchair users).
- The installation of the terminal must allow intended users to both provide input and receive necessary output without use of excessive effort.
- Terminals designed for use by car drivers (e.g. parking, etc.) should not require the driver to step out in order to be operated. (Terminals should be flexible enough to be operated from the driver seat, not requiring excessive physical effort from the driver).
- The driver should not be required to leave the car to get e.g. a parking ticket.
- The angle of control and output devices should be in such a way that it can be seen and operated by all users independent of height.
- Knee-holes for wheelchair users should be provided when possible.
- When the machine is a hole-in-the-wall solution the top collar of the machine should not be an obstruction.

Ongoing work:

- TC 224 WG 6 N.W.I. Physical accessibility should cover issues identified here.



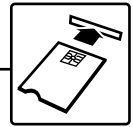
Auditory

- Voice messages should describe the transaction sequence and give audio confirmation of the keys selected.
- Standard required.



Visual

- If contact-less technology is used – the blind user must be provided with means to help him/her point at the spot where the sensor is located.
- Parallax should be avoided.



Requirements

Standardisation



Cognitive

- Consistent location and orientation of card insertion unit. Symbols for same.

Ongoing:

- Symbols should be developed in annex A of EN 1332 part 1



Dexterity

- The card must be designed so that it is easy to grip and handle for people with dexterity problems. Comment: Is card a good solution? For some user groups it would be better to avoid cards altogether.
- Contact-less technology should be used.
- International standards for keyboards should be followed (good contrast, large keys etc.).
- Buttons should be reliable and with a standard weight (pressure).
- If touch screens are used – an alternative solution with manual buttons should be provided.
- Means for correct orientation of card should be provided (e.g. tactile marking of card).
- It should be easy for the users to distinguish between different types of cards (e.g. tactile marking).
- It should be possible to orient the card in at least two ways, not just one.

Existing standards:

- EN 1332-2 – Card orientation
- EN 1332-3 – Keypads
- AS 3769 ATM – User Access

- EN 1332-3 may need revising.

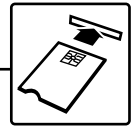
Proposed new work item:

- CEN TC224 WG6 – Tactual differentiation of cards
- Standard required.



Combination

- None identified



User Interface (UI)



Home



Mobile Environment

- User interface should be adaptable to individual abilities and needs.



Public Environment

- The design of new services must be standardised across service providers, and should where possible be designed in accordance with the already established user practice for carrying out the service (according to users expectations).

Requirements

Standardisation

General

- The user interface must be flexible enough to be adapted to individual users special needs.
- Users should receive feedback adapted to their special needs.
- The user interface should be developed according to recognised standards for usability

Existing:

- EN 1332-1 – General Design Principles

Required.

- Standards for information needs related to different user groups/abilities must developed.

Other relevant standards:

- ISO 9241 – Ergonomic requirements for office work with visual display terminals:
Part 9: Non-keyboard input devices.
Part 11: Guidance on usability



Physical

- Non identified

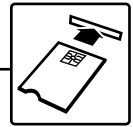


Auditory

- Optional connection to an inductive loops or headsets should be provided.
- Voice input is desirable.

Other relevant standards:

- ISO/DIS 11548 Communication aids for blind persons:
Part 1: General guidelines for Braille identifiers and shift marks.
Part 2: Latin alphabet based character sets.



Requirements

Standardisation



Visual

- Contrast and brightness should be designed in accordance with existing standards.
- Contrast and brightness controls should be designed and dimensioned to enable visually impaired users to adjust the screen according to their individual needs (Ref. RNIB Font type Tiriases).
- Letters should be designed according to standards for legible interfaces.
- Printed output should be in a clear and strong inked font.

Existing standards:

- AS 3769-1990 Automatic teller machines – User access.
- ISO/CD 13406 – Ergonomic requirements for flat panel displays:
 - Part 1: Introduction
 - Part 2: Ergonomic requirements for flat panel displays.

Other relevant standards:

- SO9241 – Ergonomic requirements for office work with visual display terminals:
 - Part 3: Visual display requirements.
 - Part 8: Requirements for displayed colours



Cognitive

- Graphics should be used for the main operating features (e.g. card insertion, money outlet)
- Standard symbols that are established in the surrounding culture should be used.
- Symbols should be easy to understand.
- Interface to be developed according to principles for User Centred Design and satisfy established standards for usability.

Existing standards:

- ISO 9241-11

In progress:

- CEN TC 304 is ongoing
- Annex A of EN 1332 part 1 is under development.

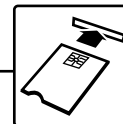
Other relevant standards:

- ISO 9241 – Ergonomic requirements for office work with visual display terminals:
 - Part 11: Guidance on usability



Dexterity

- None identified.



Operation



Home



Mobile Environment

- There must be a standardised procedure across different types of terminals. Users might need a training program to learn to operate the terminal.



Public Environment

- There must be a standardised procedure, but flexible (accepting different user strategies) across different types of terminals. The procedure should be communicated through visual, auditory and tactile information channels (flexible user interface).

Requirements

Standardisation

General

- The dialogue between the user and the terminal should be standardised and based on established standards for dialogue design.
- Help function adapted to the user's abilities should be provided (e.g. get in contact with certified personnel).
- There should be an "undo" button for all steps in the sequence. It should be possible to undo only the last step, or the whole transaction.
- The procedure must be designed to give the user full control of the transaction/process. Means for confirmation of transaction and identification of user must be provided.
- The user must be able to retrieve the card from the terminal at any stage during the process.
- Receipts should not be provided automatically, only on users specific request.
- The same type of procedures should be used for the same functions, irrespective of the type of terminal used (e.g. telephone and teller machine).

Existing standards:

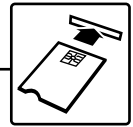
- EN 1332-1 General design principles

Required:

- A standard procedure for terminal use must be specified and standardised.
- Standards for help functions are needed.

Other relevant standards:

- ISO9241- Ergonomic requirements for office work with visual display terminals:
 - Part 10: Dialogue principles.
 - Part 13: User guidance
 - Part 14: Menu dialogues
- ISO 11429 Ergonomics – System of auditory and visual danger and information signals



Requirements

Standardisation



Physical

- The position of the instructions should relate to where the operation should take place.



Auditory

- An optional voice feedback telling the users which operations that have been performed should be provided.
- Standard procedure for use of voice recognition/voice feedback should be developed.

Other relevant standards:

- AS 2822 provides guidance on how to achieve intelligibility of audio messages.



Visual

- The next step in an operating sequence and associated functional areas should be clearly indicated according to the user's needs.
- Bleeps used for feedback should always have a visual feedback in addition.



Cognitive

- Messages and dialogues must be easy to interpret and should be standardised.



Dexterity

- None identified

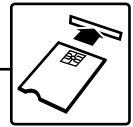


Combination

- Feedback, input and output should be adjusted to the users individual needs.

Existing standards:

- EN 1332-4 Coding of user requirements.



Adaptation to User Profile



Home



Mobile Environment

- Memory for personal adjustments (different profiles).



Public Environment

- Compatible with a standard profile.
- Easy to change profiles.
- User profile to be interoperable between devices.

Requirements

Standardisation

General

- It should be possible to adjust the timing to the needs of the user.

Existing:

- EN 1332-4 Coding of User Requirements
- Revise EN 1332-4 to include this requirement.



Physical



Visual



Cognitive

- None identified



Auditory

- Voice control and voice recognition should be provided.

- Revise EN 1332-4 to include this requirement.



Dexterity

- Hands free alternative should be provided.

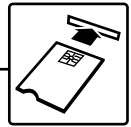
- Revise EN 1332-4 to include this requirement.



Combination

- Any combination of the above to suit the needs of individual users.
- Users should be able to choose identification method adapted to their abilities/user profile.

- Revise EN 1332-4 to include this requirement.



Security of Operation



Home Environment

- Safety measures should be built into the terminal-/system to protect the users from:
- Being robbed in their own home (e.g. held as hostages until the “pay up”).
- Unauthorised use (kids playing, etc.)



Public



Mobile Environment

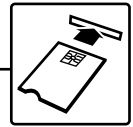
- Manual help from others should be available.
- The user must frequently receive feedback that the correct operations have been executed.
- The terminal should be designed to provide safety both with regards to surveillance and privacy regarding the use of the terminal.
- Privacy must be provided for the user during identification (e.g. screen blocking the sight of others when giving up the pin code).
- The terminals should be located in places that are experienced as safe by the users.

Requirements

Standardisation

General

- The transmission between the card and the card-reader must be encrypted (should be conformant with established standards).
 - The service provider should be responsible for designing an individual security profile for the different users. **Comment:** The service providers should be obliged to provide the service to all user groups. User groups that the service provider consider as a security risk due to their special needs should not be denied the service.
 - Special safety measures should be implemented in the different user profiles (e.g. maximum limit on withdrawals, maximum limit on giros that are not issued in the users name, and card should not be used on services that the user does not have access to)
 - The users should determine the user profile and the type and amount of information stored on the card. An optional security profile defining the services available to the user. The profile should be determined by the user him-/herself.
 - If the smart card is confiscated by the terminal the user should receive documentation for this.
- Standards required to be covered by CEN ISSS WS E-SIGN.



Requirements

Standardisation

- The contactless card must be protected against unintended use (e.g. tapping the users account while the users are passing by the terminal).
- Card should be resistant/protected against magnetic influence.



Physical

- Means to provide privacy and security for the users must be designed to take account for all users, irrespective of height and size.
- Standard required.



Auditory

- When auditory feedback is provided, care should be taken to keep this information/communication private. No sensitive information should be publicly announced.
- Standard required.



Visual

- None identified



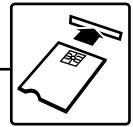
Cognitive

- Alternatives to pin codes should be provided for identification purposes.
- Means to reduce the number of pin codes should be investigated.
- CEN ISSS WS E-SIGN to cover this.



Dexterity

- It must be easy for the users to hold and grasp the smart cards.



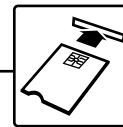
Requirements

Standardisation



Combination

- Security mechanisms should be adapted to the different users abilities (e.g. voice recognition for visually impaired users).
 - Alarms should appear if the user leaves the card, money, ticket etc. in the terminal. (At minimum a visual and an audible alarm should be provided)
- CEN ISSS WS E-SIGN to cover this.



Conclusions

Framework

Develop a framework of all user interface related smart card issues that should be standardised, taking into account the proposals for standardisation below. Develop a business plan for this work.

Revise the EN-1332 series to take on board hand held devices, IC card readers in the home, domains other than financial services and telecommunications, and environments other than public space. Output from relevant projects (SATURN, DISTINCT) and guidelines (national, scandinavian) should be incorporated.

Adapt usability standards (ISO 9241-11) to smart card systems and the Design for All philosophy. Determine usability goals for smart card systems.

Adapt design process related standards (ISO 13407, EN 614) to smart card systems and Design for All.

Access

Revise CEN TC 224 WG 6s Scope of Work on the ENV Physical access to terminals, to include visual (lighting, colour, size of text, reflections, glare - day and night) and cognitive accessibility. The ENV to take on board existing national standards, design guidelines, results of projects, other national standards. Car drivers requirements at drive in terminals to be covered (tollbooths, ticket dispensers, etc).

When revising the scope consider:

- “coding” the environment
- facilitating wayfinding information to severely visually impaired people
- defining the use of sound for navigational purposes
- defining the location of visual elements of a way finding system in relation to different user groups
- representing the built environment in a digital format

Auditory

Develop standards (taking account of relevant existing ETSI /ITU standards) for testing the intelligibility of speech/ voice output from systems in various environments, including public spaces.

Develop standards for the structure, form and presentation of verbal messages.

Card design

The CEN TC 224 Proposed New Work Item, Differentiating Plastic Cards by Touch, should proceed.

Revise 1332-2 to provide one tactile identifier that meets its Scope of Work and that is in line with other existing standards (ETSI).

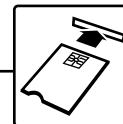
User interface

Key elements of visually presented user interfaces should be standardised. This standardisation should not compromise competition. Elements for standardisation could include, but not be limited to: metaphors, legibility, comprehensibility testing, text sizes, colours allocated to specific functions and icons, symbols and pictograms.

When, supplementing EN 1332-1 with an Annex of Icons, symbols and pictograms, follow the development process as specified in ISO 9186 and develop according to ISO 3461, ISO 7001.

The Annex should include icons, symbols and pictograms in relation to wayfinding, operational procedures, interaction elements / interaction design for physical and screen controls, how to activate the different forms of output (speech, visual), message typologies, tactile feedback, timely feedback during and after task completion, effective prompting during sequential actions and help functions.

There should be equivalent “earcons” /sounds specified in terms of frequency, amplification, number of.



Coding of user preferences

Code user requirements for service interfaces and for different application domains (e.g. electronic commerce, transport, wayfinding) based on EN 1332-4 and the output from the CEN ISSS WS DISTINCT. This will require a further analysis of which functions should be coded for different services and different people.

Coding is needed in relation to wayfinding information and its presentation in different modalities.

A “smart” function should be considered, i.e. the possibility of learning a card holders patterns (e.g. travel – if card is activated during evening rush hour, one automatically gets asked if you want a ticket home) or previous use of terminals (you have never used this system before - do you want a guided tour?).

Consider coding requirements in relation to different environments — home, mobile, public. This may require a terminal/ service coding.

The user should be able to customise which services the card can be used for and what limits are to be set for different services.

Security at the MMI

Standards for specifying and measuring security at the man machine interface, should be developed. It should take into account all sizes of the population, irrespective of height and size. The standard should take account of surveillance equipment and the possibility of observation from other people. When auditory feedback is provided, care should be taken to keep this information/ private. No sensitive information should be public.

Security mechanisms should be adapted to the different users capabilities (e.g. voice recognition for visually impaired users).

Alarms (visual and audible) should warn if the user leaves the card, money, ticket etc. in the terminal.

Interoperability

Standards to allow IC readers to be interoperable with a variety of home ICT delivery mechanisms (telephone, TV, set top boxes, smartphones, PCs) and accept all smart cards should be developed building on the proposed FIN-READ CWA.

This standard should allow smart card readers to be interoperable with assistive technology.

Terminal Equipment design

The orientation of card insertion slots should be standardised. A “funnel” should be placed over the slot to aid insertion.

The layout of functional areas on the terminal should be standardised. Differences between the different function areas should be emphasised in the design.

Connection between terminal and users personal user interfaces/equipment (e.g. headphones) should be standardised. Both communication protocol and technological interface should be standard.

When touch screens are used, all screen functions should be available from a tactile keypad or buttons.

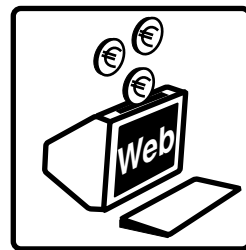
A standard for the location, design and dimensions of screen contrast and brightness controls should be developed with the intention of enabling visually impaired users to adjust the screen according to their individual needs.

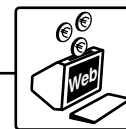
A standard for the connection of an inductive loop or headset to a card reading device should be developed.

A standard to ensure that the design of hand-held terminals allows visually impaired people to use them should be developed.

Chapter 13

Internet and Electronic Commerce





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Introduction

The emergence of the World Wide Web has made it possible for individuals with computer and telecommunications equipment to interact as never before. For elderly and disabled persons the Web holds great promises of transforming past barriers to information access. But as with any new technology, new barriers can arise in place of the old.

The percentage of people with disabilities in many populations is between 10% and 20%. The age group over 60 is the most rapidly growing and there is a large overlap between these two groups (elderly and disabled). This chapter focuses on disabled persons keeping in mind, that elderly persons, especially those with or developing impairments, have the same requirements and will benefit from the same solutions. For example, a clear structured Internet site will not only help blind persons, but will help everybody including those with cognitive impairments.

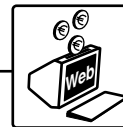
Not all disabilities affect access to information technologies such as the Web, but many do. Just as with other parts of the population, not all people with disabilities have access to the Web. But the number of people using the Web is steadily increasing, and for people with disabilities, access to this technology is sometimes even more critical than for the general population which may have an easier time accessing traditional sources of information such as print media.

As information and services including remote control are being transferred to the Internet, more than one in four persons will not have access to it, if the content on the Internet is not accessible for inexperienced or disabled users. This will create a digital divide. The "old-fashioned" personal services are being closed or drastically reduced to allow cost savings and the user has to pay additional fees for using them. For example, a banking account accessed via Internet is free or low-cost but the "ordinary" accounts costs the user more. A directory enquiry request about phone numbers via Internet is free but very expensive via the telephone service. Special low-cost telephone services for disabled persons have been closed in some countries.

New services will be started using the Internet only. The implementation of additional alternative services will not be undertaken due to cost. Therefore Internet services must be accessible for all!

This chapter is divided in to three major parts:

- Currently the personal computer is the most prominent tool for accessing the Web and it is the most flexible supporting individual configuration of soft- and hardware and driving assistive technology. Chapter 13.2 focuses on methods for disabled persons to access the computer. For using the Internet with other devices see the relevant chapters.



- A barrier free Internet presumes a proper use of all Internet technologies. They are described in detail in chapter 13.3.

- An important factor in the growth of the Web is Electronic Commerce: The ability to buy, sell, and advertise goods and services to customers

and consumers. This is done by extensive use of Internet technologies. Chapter 13.4 focuses on some special aspects for making these important services accessible for all.



Access to the Computer

Currently the computer is the most prominent tool for accessing the Web with the help of special software, the so called Web browser. The way persons with different disabilities access the Internet therefore depends highly on the techniques they use to access the computer and the browser.

This chapter will focus on persons with a high degree of disability who often need assistive technologies for computer access. But this is of course the group of persons who could most benefit from the Internet.

Home banking, Internet shopping, information retrieval and the new facilities of communication are inconceivably large steps for the single individual living independently.

Because of the necessity of special devices, most internet usage takes place at home or at work.

In general, operating systems are preferable which provide a clear user concept like Linux or Windows NT. Special settings for the

environment are dedicated to a user. Other users, for example a non-handicapped member of the family or a colleague, may use the same computer with their own settings and need not accept the settings of the disabled person. In this case, the non-disabled user may not be able to change settings of the disabled user accidentally or with good intention. This is very important. For example, a screen reader program for a Braille display is told to identify an error message in a certain program by a colour attribute. If this attribute is changed, the blind user isn't able to work with the program. Help of a sighted person is required.

Some applications need response in a certain time interval. For example: a boot manager will start a predefined operating system if there is no other selection by the user within a few seconds. If this mechanism can't be disabled, those persons, who need some time to recognise the situation or to handle the keyboard will have problems.

Physically or Motorically-Impaired Persons



This group of people often need special furniture/ equipment in which to place the input and output devices of the computer in order to be able to use it. In most cases, they are able to use the standard monitor, but may profit (as can all users) from the space saving and light weight of the new flat screen TFT monitors. In general, a wireless remote control for monitors is desirable (in principle, it is sufficient if there is a remote control version available for each monitor type, but currently there isn't one for the TFT types on the market.)

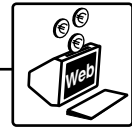
Most operating systems offer basic accessibility support for standard keyboards and mice like macro definition, sticky key support (press one key only at a time) etc.

Special keyboards are available with extra large keys for people with reduced motor capacities/ skills. Small keyboards enable people with

Thalidomide-induced handicaps, MS patients, people with only one hand and those who only can operate the computer by using mouth-sticks, to handle the PC. Miniature versions are available for people with severely restricted movements. Keyboards for patients with muscular dystrophy are available with a specially adapted grip panel so that they can be operated with the minimum amount of physical effort.

Most keyboards are provided with a continuously adjustable keystroke delay, double keystroke prevention, adjustable key repeat speed and a latch for the modifier keys such as SHIFT. In addition, all special PC keyboards can be provided with a mouse or trackball control which is specially adapted for handicapped persons.

These are good examples where ICT standards exist for assistive technologies, because these



devices use well known computer interfaces like PS/2, serial port, USB and they are not detected as special devices but ordinary equipment by the PC and the operating systems. Wireless keyboards and mice allow a wide range of placement of the devices. But this facility is not currently provided on special keyboards and pointing devices.

Additionally, pointing devices like a head mouse or an eye mouse allow pointing and select operations by the motion of the head or the eye. Even a keyboard may be simulated! These devices are a combination of hardware and software and therefore not independent from the operating system. They are available for Win95/98/NT/2000, but currently not for other operating systems.

Speech control of the PC and speech recognition is also very convenient for this user group. The current solutions need a huge amount of processor power and have to be trained for the voice of the operator for reliable results. The quality of recognition is rather good but the user has to observe the system for correct detection and reaction and has to intervene immediately. Incidentally this is the

reason why blind users don't prefer voice input; often they are even faster with a correct ten finger writing on an ordinary keyboard. Speech recognition is currently available for Win95/98 and OS/2. Development for Linux and others are in progress.

The rapidly growing market for speech recognition does not currently address the individual end user but professional use like call centre. Interfaces to speech control and speech recognition engines are:

- SAPI 4.0 (Microsoft Speech API) including text-to-speech:
(<http://www.microsoft.com/IIT/OnlineDocs/intro2SAPI.html>)
- JSAPI 1.0 (JAVA Speech API) including text-to-speech:
(<http://www.javasoft.com/products/java-media/speech/>)

Other less popular interfaces are defined by several companies. Of great significance is the lack of a standard of a platform independent specification for the semantics and contexts that a recognition engine may expect.

Strong Hearing Impaired or Deaf Persons



Current computer user interfaces are in general optically orientated which means more than 90% of the information is presented to the user in an optical way.

Hearing is often involved due to beeps or jingles for attracting the users attention for status or progress information, warnings and error messages. This information is very important. The visualisation of these signals is either integrated into the disability features of some operating systems or available as special programs (freeware) for all operating systems.

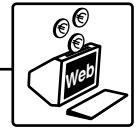
In contrast to sight, hearing is a surround sense. That means, you will hear an acoustic signal even if you are doing other things like reading a book and listening to music. The visualisation of acoustic signals on the screen requires attention of the user more

or less the whole time, especially when an immediate interaction response is demanded. The optical signal should not disappear without confirmation. Otherwise it may be overlooked.

Imagine pushing a program's help button and the system dials in to a server overseas to download brand new information by the modem automatically. Without hearing sounds from the modem you might not recognise this expensive event!

Currently there seems to be no standard for visualisation of acoustical signals.

Games are using sounds extensively for animation, but this sound rarely delivers additional information. That means, you can play most games without sound (and less fun).



Of course, a deaf person will not recognise sounds like voice mails, background sounds of internet sites, MP3-Files, etc. But though they are excluded from all information which is delivered exclusively in a pure acoustic mode, audio services will be provided more and more in the near future as a result of growing bandwidth available to the Internet.

On the other hand, most deaf persons have pronunciation problems and so they are not able to use a speech control or speech recognition system successfully. If voice is the only opportunity for device or application operation, they are excluded from using it.

Visually Impaired, Strong Visually Impaired or Blind Persons



The differentiation of the three groups is very important because of very different computer access. But the borders are rather flexible. In general the step from textual to graphical user interfaces (GUI) is a big advantage for well sighted persons, but not for the visually impaired.

GUIs presume the user is able to observe a complete screen at a glance, to identify and handle objects, to recognise symbols and identify functionality behind them, and to point to and select things.

Often information is given by the topology of elements on the screen, by colours or by motion. Some information will be presented for a short time only.

In general, the smaller the perception focus on the screen, the greater the problem of observing the complete screen. This problem increases with the enlargement of very small regions of the screen or by the use of nonoptical devices. Working as closely as possible to the original GUI ensures the unaltered information presentation. But a growing degree of visual impairment leads to an increasing level of abstraction: for example the mapping of the GUI to an acoustical user interface (AUI) which works in a quasi sequential manner.

For this reason one can observe visually impaired persons working with a voice output device or Braille display in the environment of well known applications but switching to enlargement tools or even the original screen presentation for a fast orientation or in unexpected situations and environments. Because of stress, this will work only for a short moment.

Visually Impaired Users

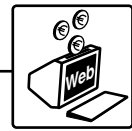
They try to access the screen by the use of physical vision aids like special glasses, loops, etc., and by large monitors. Persons with visual impairments often work with their nose immediately in front of the screen. And even if the monitor is TCO95 compatible, the danger of magnetic fields and radiation still remains for this very short distance. The higher illumination of TCO95 in contrast to ISO9241 is also very helpful.

A good replacement for conventional monitors are the new TFT flat screen monitors. They have less radiation, high luminance, are nonflickering and because of size and weight, can be placed optimally. But TFT flat screens are not feasible for all sight deficits. And the preferred large ones are currently very expensive.

Most of the current operating systems include some functionality for changing fontsize, fontstyle, colours of background and Text, ordering of the screen etc. This encloses all basic functionality of the operating system.

This user specific setting can be overtaken by applications. But many ignore this mechanism and have their own settings, which are sometimes but not always changeable by the user.

In contrast to many MS Windows applications, most Linux applications are featuring these concepts.



Strong Visually Impaired Users

They access the screen by the use of enlargement programs so called "screen magnifiers". In principle, a screen magnifier enlarges the content of the screen up to 30 times. As the physical screen presents only a small part of the virtual screen, mechanisms for adjusting the focus and for the continuous movement of the focus etc. are needed. The colours may be changed to the special needs of the user.

Most screen magnifiers work purely in a graphic mode. They don't know anything about the content (like a fax machine). But there are new screen magnifiers derived from screen readers for Braille displays (see next section) which differentiate text and graphic.

These tools may change fonts of a text and even read a text to the user by a synthetic voice to unburden the eyes. Sometimes they are combined with a Braille display.

Since enlargement tools are software based they are therefore highly dependant upon the operating systems.

The concepts and handling of enlargement programs differ. It follows that a visually impaired person can use his configured PC very well, but a change to another computer isn't easy, even if a screen magnifier is installed.

Screen magnifiers for Linux are not available yet. The probable reason is that current window managers of Linux are scaleable in such wide ranges, that special solutions are not required. This saves the user from learning and handling an additional abstraction layer.

Keyboards with large printed letters on the keycaps with a high contrast are not only welcome for visually impaired users. Such a simple modification helps a great deal for searching infrequently used characters for non visually impaired.

Note: If there is a keyboard with an enlarged signature on the market, the enlargement is done only for the well known characters but not for special characters!

Additionally high efficiency LED's might help identify the current state of toggle keys (e.g. NUMLOCK). (There are programs available, mapping status information to the screen or presenting status toggles by sound.)

The realisation of these features in a multimedia keyboard (integrated speakers and microphone) or in a notebook would be extremely usefull.

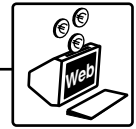
Blind Users

They access the screen by the use of so called screen reader or bridge software which translates the variety of concurrently presented information on the visual screen into an adequate textual presentation for perception on a tactical Braille display or by synthetic voice so called text-to-speech (TTS). Main tasks are:

- identify and handle objects,
- recognise symbols and name them,
- identify functionality behind symbols,
- point to and select objects by mouse simulation,
- follow cursors, (system, mouse or attribute cursor),
- watch specified events,
- identify information presented by topology, colours or motion,
- support for application specific profiling by a script language,
- orientation and movement of the current focus (currently presented part of the virtual screen),
- synchronisation of the focus of speech, Braille and enlargement.

Obviously, screen readers for GUIs are much more complex than for textual user interfaces like Linux or DOS. Though a blind user is not familiar with the visualisation techniques of GUIs, their interaction must be learned in any way, because of integration at work or the necessity of use that software all others are using. But sometimes, when only the result of work is requested but not the way to achieve it, a blind user may choose a tool which is more feasible for him (if it exists). For example he can write a letter by use of a WYSIWYG publishing system, a graphic wordprocessor with layout control, a text based word processor or a text compiling system. The result is of nearly the same quality, but handling of fewer graphical tools is easier for a blind user.

Screen readers are highly dependent on the operating system. OS/2 is the only operating



system which is provided with a screen reader developed by the supplier. The PAL (Profile Access Language) is IBM's well defined interface to the off-screen-model. (<http://www.austin.ibm.com/sns>).

A large number of screen reader programs are developed for Microsoft Windows GUIs by specialised rehabilitation companies with a delay of up to two years. Their solutions differ very much in the strategy of transformation and presentation of information. These individual solutions often support only the vendor's own Braille displays or speech output devices.

This situation seems to be changing, because of exploding costs for development and support of screen readers with their increasing complexity and a decreasing number of installations of screen readers in the professional world due to unemployment.

The three most prominent screen readers will no doubt survive, supplied by specialised companies providing their solutions as a toolkit world wide to the established national distributors who do local and language support (including documentation), support of their Braille displays and speech synthesisers, training, and possible adaptation to a large variety of applications by developing suitable scripts. Perhaps this concentration will lead to cost reductions and hopefully closer co-operation between developers and the vendor of the operating systems together with a solution for new operating systems of Microsoft.

If these screen readers set a defacto standard for accessing Microsoft Windows, blind users can access any PC provided with the screen reader and Braille display and speech synthesiser like a sighted person does. Systems will still differ in the handling of the output devices, configuration of the applications, appropriate individual screen reader settings etc.

The work of a screen reader program can be improved by a well defined interface to the off-screen-model of the operating system and the applications themselves.

In 1998 Microsoft started to integrate MSAA (Microsoft Active Accessibility) into current operating systems and applications.

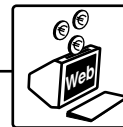
(<http://www.eu.microsoft.com/enable/msaa/default.html>, release 1.2.2, July 1999.) Active Access means, the programmer of an application may add additional text information to graphic elements and so the screen reader is enabled to ask for them. Applications which support MSAA recommendations are relatively easy to use by the blind, but most applications still ignore this enhancement. No company is forced to achieve better accessibility to their applications by MSAA. Many software developers don't know of MSAA.

Additionally software designers have their own vision of the look-and-feel of their products e.g. to establish the co-operate identity. They often use their own graphic libraries which do not support MSAA. This is extremely annoying for applications for which no alternatives are available. Examples include homebanking applications, applications for driving telephone switchboards, call centres, workflow management systems, etc.

For the GUI of Apple MAC OS there is currently no screen reader available. For the different window managers of Linux some research and development seems to be in progress. Probably the good access to the textual user interface which covers most functionality delayed this work. But with the rapidly growing propagation of Linux and suitable applications there is a very strong demand for a reliable screen reader for at least one window manager. The suppositions are very good, because basic research is done, the interfaces are well defined and the source is open. But currently there seems to be no funding for this complex software development.

In general, a platform and operating system independent definition of an off-screen-model would make screen readers, window-mangers and other nongrafical user interfaces independent from the underlying operating system. Such a standard would make development of screen readers much more efficient, because no special developements are needed for each operating system. But such a standard is not in the scope of providers of current operating systems.

Additionally, scripting languages for the configuration of screen readers are not



standardized. That means, scripts have to be developed for each screen reader and for each application.

For speech synthesisers some company specific interfaces are available which can be seen as defacto standards:

- SSIL (Speech Synthesiser Interface Library) V1.0 by Arkenstone (<http://www.arkenstone.org>)
- SAPI 4.0 (Microsoft Speech API) including speech recognition: (<http://www.microsoft.com/IIT/OnlineDocs/intro2SAPI.html>)
- JSAPI 1.0 (JAVA Speech API) including speech recognition: (<http://www.javasoft.com/products/java-media/speech/>)

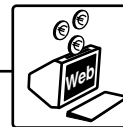
Other less popular interfaces are defined by several companies.

Braille displays differ in size, handling, hard- and software protocols which make them incompatible to each other. Even the character representation is rather different in most

European countries. Though all Braille displays support a user defined character set, this is an intolerable situation. Imagine, the ISO8859-1 character set would have different signs for most countries!

Computer Braille (DIN 32980) has been the first step to standardisation. For making the 8 dot Euro computer Braille an international standard, the blueprint of ISO CD 11548 was released in 1998. But there is has been no progress in standardisation up to now.

The usability of Braille displays is a new topic of development. The main task is to reduce the mechanical movement of hands and fingers between keyboard of the PC, Braille display and the keys for controlling the Braille display. While good solutions are going to the market, an opposite evolution takes place in the world of notebooks: Modern design has moved the keyboard from the leading edge to the trailing edge of the notebook to place the touch pad, speakers and handholds in front. But this maximises the mechanical distance between keyboard and the Braille display placed underneath the Notebook.



Overview: Access to Different Operating Systems

	Physically or Motor Impaired Persons	Strong Hearing Impaired or Deaf Persons	(Strong) Visually Impaired Persons	Blind Persons
DOS (Text and Graphic Mode)	-Speech Recognition	- Special Applications	- Special Applications - Screen Magnifiers - Software Text to Speech	- Screen Reader (text mode only) - Software Text to Speech
WIN 3.X WIN 9X WIN NT WIN 2000	- Head and Eye Mouse -Speech Recognition (built in) - Input adaptation (built in)	- Optical Audio Signs (built in) - Special Applications	- Special Applications - Screen Magnifiers - Software Text to Speech	- Screen Reader - Software Text to Speech
LINUX (Text and Graphic Mode)			- Special Applications - Configuration of window managers	- Screen Reader (text mode only) - Software Text to Speech
MAC OS	-Speech Recognition		- Special Applications - Screen Magnifier - Software Text to Speech	
OS/2	-Speech Recognition (built in)		- Special Applications - Screen Magnifier - Software Text to Speech	- Screen Reader - Software Text to Speech
OS independent	- Special Keyboards and Pointing Devices		- Optical Vision Aid - Large TFT Monitor - Hardware Text to Speech	- Braille Displays - Hardware Text to Speech



Access to the Internet

The World Wide Web Consortium (W3C) (www.w3.org) is an international industry consortium carried by more than 350 members from leading companies, organisations and institutes around the world. Although W3C is funded by industrial members, it is vendor-neutral, and its products are freely available to all.

The W3C was founded in October 1994 to lead the World Wide Web to its full potential by developing common protocols that promote its evolution and ensure its interoperability.

Other services provided by the Consortium include:

- a repository of information about the World Wide Web for developers and users
- reference code implementations to embody and promote standards
- various prototype and sample applications to demonstrate use of new technology.

The Consortium is jointly hosted by the Massachusetts Institute of Technology - Laboratory for Computer Science (MIT/LCS) in the United States, the Institut National de Recherche en Informatique et en Automatique (INRIA) in Europe, and the Keio University Shonan Fujisawa Campus in Japan, all three of which provide local support and perform core development.

The W3C was initially established in collaboration with CERN, where the Web originated, and with support from DARPA and the European Commission.

The Web Accessibility Initiative (WAI) (www.w3.org/WAI) at the W3C addresses accessibility in the areas of technology, guidelines, tools, education & outreach, and research & development.

Even though the W3C seeks to promote standards for the WWW technologies and the WAI has strong mandate on making and keeping the Web accessible for all, nobody is forced to follow these jointly released standards.

Even members of the W3C extend defacto standards or modify them for their products to differentiate from competitors or even to be incompatible with them.

In addition, Internet technology is developing so rapidly, nobody will wait until a new standard is released by the W3C.

The market leaders often have the power to set up new defacto standards by their new products. In these cases so far, accessibility plays a minor role.

It is the freedom of the Web to follow the released accessibility guidelines of the WAI. And even those information providers willing to do so or forced by law (e.g. public institutions), have a major challenge to bridge the gap between attractive and thrilling Web sites and accessibility for all.

The Web Accessibility Initiative (WAI) addresses accessibility in different areas. Its International Program Office is supported in part by funding from about 10 organisations and company including the European Commission's DG XIII Telematics Applications Programme for Disabled and Elderly.

The Internet, in essence a visual medium, consists logically of two parts:

Servers which provide content in the HTML (Hypertext Markup Language) format and the browsers (or clients or agents) which run on the users computer, retrieve the content and present it to the user. The Internet is a so called pull medium: The user selects information and determines how long he will stay on this site. Therefore sites have to be exciting and that means graphic, motion, interaction, and sound. The Internet has moved rapidly from a simple information transport medium to a modern medium for advertisement, Electronic Commerce and communication. For these reasons, the primary used HTML is extended by several techniques like scripting, multimedia enclosures etc.

For an unaltered outfit of their sites, Web designers want to force the user to view their site with a certain browser. That means the



sites are specially constructed (and tested) for a certain browser version. Other browsers may render this site in another, unwanted way. On the other hand, designers like to present information as a picture, because pictures are presented by all browsers without modifications. This behaviour is completely in contrast to Web Accessibility.

Web Content Accessibility

WAI's Web content accessibility guidelines 1.0 (5 May 1999) are a recommendation. (<http://www.w3.org/TR/WAI-WEBCONTENT>). They explain how to make Web content accessible and are intended for all Web content developers. However, following them will also make Web content more available to all users, whatever browser they are using (e.g. voice browser, mobile phone, mobile computer, etc.) or constraints they may be operating under (e.g. noisy surroundings, under- or over-illuminated rooms, in a hands-free environment, etc.). The guidelines do not discourage content developers from using images, video, etc., but rather explain how to make multimedia content more accessible to a wide audience.

Clients

WAI's user agent accessibility guidelines 1.0 (28. Jan. 2000) are a candidate for recommendation. (<http://www.w3.org/TR/UAAG10>) They are designed to help developers understand and thereby reduce accessibility barriers that impede access to the Web. Though developers may believe that implementing accessibility features in their products is difficult or of limited use, considering accessibility during the design phase of a product leads to more flexible, manageable, and extensible software.

The guidelines include relevant information for a wide class of user agents: graphical desktop browsers, screen readers, speech synthesisers, multimedia players, text browsers, voice browsers, plug-ins, etc., with a particular focus on graphical desktop browsers and

The way to design thrilling and accessible sites is shown by the WAI in several documents donated to the different Web components and technologies. Of course, a large number of web accessibility guidelines can be found on the web. In principle they all are derived or covered by the WAI documents.

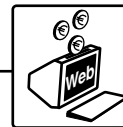
The following topics are explained in detail:

- Provide equivalent alternatives to auditory and visual content.
- Don't rely on colour alone.
- Use markup and style sheets and do so properly.
- Clarify natural language usage.
- Create tables that transform gracefully.
- Ensure that pages featuring new technologies transform gracefully.
- Ensure user control of time-sensitive content changes.
- Ensure direct accessibility of embedded user interfaces.
- Design for device-independence.
- Use interim solutions.
- Use W3C technologies and guidelines.
- Provide context and orientation information.
- Provide clear navigation mechanisms.
- Ensure that documents are clear and simple.

dependent user agents, which rely on other user agents for input and/or output. Dependent user agents include screen magnifiers, screen readers, alternative keyboards and pointing devices. The guidelines emphasise interoperability between these two classes of user agents.

The following topics are explained in detail:

- Support input and output device-independence.
- Ensure keyboard access to user agent functionalities.
- Provide accessible product documentation and help.
- Allow the user to configure the user agent.
- Allow the user to turn off features that may reduce accessibility.



- Ensure user control over document styles.
- Ensure user access to document content.
- Provide navigation mechanisms.
- Help orient the user.
- Notify the user of document changes.
- Support applicable W3C technologies and guidelines.
- Observe system conventions and standard interfaces.

Dependent user agents have the advantage that they will follow new internet technologies immediately, especially, when the necessary interfaces are build in. A very interesting alternative for visually impaired persons is a text browser which presents the content of Internet sites directly in a textual mode directly feasible for Braille display, speech synthesiser or text mode terminal. The big advantage is to leave

out the presentation layers of a GUI, the GUI screen reader and the browser interfaces. This requires a minimum of learning and supports even not Windows approved Braille displays. You need not buy an expensive new one. The Lynx browser (<http://lynx.browser.org>) is a widely used tool for the blind. It is available for most operating systems including DOS. The problem with this software is related to licensing proprietary internet technologies, and the voluntary developer community has not the power to follow new technologies within a short time. This extremely useful tool for the blind should be sponsored by funding development resources and some licensing problems (not technical but legal) should be cleared (for example the usage of RSA technologies outside the US).

Servers and Internet Service Providers

Internet servers provide the content of Internet sites. In principle they are doing their job in the background and are invisible for the user. But sometimes they do not allow access for a browser they don't like! This may prevent people using text based browsers or voice browser. But in many cases there is really no reason for this exclusion.

There are some international Internet Service Providers (ISPs) which permit Internet access via their points of presence only by the exclusive support of their own software distribution. This is done by not using a standard connection protocol like PPP but a proprietary protocol. This might reduce support problems, but also excludes those people who are not able to use their software distribution. Users who need special browsers have to use other Internet Service Providers.

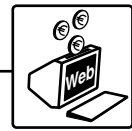
Authoring tools and Generators

WAI's authoring tool, Accessibility Guidelines 1.0 (3. Feb. 2000) are a recommendation. (<http://www.w3.org/TR/ATAG10>)

They are designed to help authoring tool developers understand, and thereby reduce, barriers to the creation of accessible Web content. The term authoring tool refers to the wide range of software used for creating Web content, including:

- Editing tools specifically designed to produce Web content (e.g. WYSIWYG HTML and XML editors).
- Tools that offer the option of saving material in a Web format (e.g. word processors or desktop publishing packages),

- Tools that translate documents into Web formats (e.g. filters to translate desktop publishing formats to HTML),
- Tools that produce multimedia, especially where it is intended for use on the Web (e.g. video production and editing suites, SMIL authoring packages),
- Tools for site management or site publication, including tools which generate Websites dynamically from a database, on-the-fly conversion and Web site publishing tools,
- Tools for management of layout (e.g. CSS formatting tools).



An accessible authoring tool is accessible software that produces accessible content for the Web. Because most of the content of the Web is created using authoring tools, they play a critical role in ensuring the accessibility of the Web.

The following topics are explained in detail:

- Support accessible authoring practices.
- Generate standard markup.
- Ensure that no accessibility information is missing.
- Provide methods of checking and correcting inaccessible content.
- Integrate accessibility solutions into the overall look-and-feel.
- Promote accessibility in documentation and help.
- Ensure that the authoring tool is accessible to authors with disabilities.

A lot of current accessibility problems would be solved by leading the user of authoring tools to a proper configuration. For example, most of the non English Web sites contain the language specification for English (default setting of authoring tools). Therefore this specification never can be used for a reliable language selection for speech synthesisers.

Hypertext Markup Language and Style Sheets

HTML is the publishing language of the World Wide Web. The latest version released by the W3C in December 1999 is HTML4.01 (<http://www.w3.org/TR/html401>). In addition to the text, multimedia, and hyperlink features of the previous versions (HTML2.0 released 1994, HTML3.2 released Jan.1996), HTML 4.0 (released Dec. 1997) and its successor HTML 4.01 support more multimedia options, scripting languages, style sheets, internationalisation of documents, better printing facilities, and documents that are more accessible to users with disabilities.

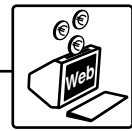
HTML 4.01 is an SGML (Standard Generalised Markup Language) application conforming to International Standard ISO 8879.

In addition to the more global "Web content accessibility guidelines" (chapter 13.3.1), WAI has published a specific document on "Accessibility Improvements in HTML4.0" in September 1999 (<http://www.w3.org/WAI/References/HTML4-access>) which also can be addressed to HTML4.01 and deals with:

- improved structure,
- style sheets,
- alternate content,
- easier navigation and orientation.

HTML was not designed with professional publishing in mind; it is intended to organise content, not present it. Consequently, many of the language's presentation elements and attributes do not always meet the needs of power page designers. To overcome layout limitations the task of presentation is assigned to style sheet languages which are fully integrated into html4.0. The CSS2 (Cascading Style Sheets, level 2) language was released by the W3C in May 1998 (<http://www.w3.org/TR/REC-CSS2>). It allows authors and users to attach style (e.g. fonts, spacing, and aural cues) to structured documents. By separating the presentation style of documents from the content of documents, CSS2 simplifies Web authoring and site maintenance. It supports media-specific style sheets so that authors may tailor the presentation of their documents to visual browsers, aural or Braille devices, handheld devices, etc. The specification also supports content positioning, downloadable fonts, table layout, features for internationalisation, automatic counters and numbering, and some properties related to user interface.

XHTML1.0, the Extensible HyperText Markup Language, is a Reformulation of HTML4.x in



XML 1.0 (s. below). It was released by the W3C in Jan. 2000 (<http://www.w3.org/TR/xhtml1>).

This is a big improvement because it not only guarantees backward compatibility to all HTML-documents but also brings the Web forward as an environment that better meets the needs of all its participants, allowing content creators to make structured data that can be easily processed and transformed to meet the varied needs of users and their devices. Both WAI's accessibility guidelines for HTML4.0 and XML1.0 will address XHTML1.0 accessibility. Probably WAI will work on a merged and improved accessibility guideline for XHTML1.0.

CSS2 benefits accessibility primarily by separating document structure from presentation. WAI has published a note on "Accessibility Features of CSS" in August 1999 (<http://www.w3.org/TR/CSS-access>) which summarises the features of CSS2 known to directly affect the accessibility of Web documents:

- reduction of HTML element and image misuse,
- precise control over font size, colour, and style, spacing, alignment, and positioning,
- allow users to override author styles,
- support for automatically generated numbers, markers, and other content that help users stay oriented within a document,
- support of aural style sheets, which specify how a document will sound when rendered as speech,
- precise control over the display of alternative content.

Currently, widely deployed browsers do not implement CSS2 consistently. Therefore there is no experience available. This potentially promising way highly depends upon the proper implementation of Web authors.

Multimedia presentations rich in text, audio, video, and graphics are becoming more and more common on the Web. The SMIL (Synchronised Multimedia Integration Language 1.0) was released by the W3C in June 1998 (<http://www.w3.org/TR/REC-smil>) and allows integrating a set of independent multimedia

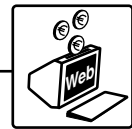
objects into a synchronised dynamic multimedia presentation. Using SMIL, authors can:

- describe the temporal behaviour of the presentation,
- describe the layout of the presentation on a screen,
- associate hyperlinks with multimedia objects.

WAI has published a note on "Accessibility Features of SMIL" in September 1999 (<http://www.w3.org/TR/SMIL-access>) which focuses on SMIL1.0 features helping to create accessible presentations. Dynamic multimedia presents a number of challenges to people with disabilities and to authors of accessible content:

- Authors must provide alternative equivalent content to audio and video. Text content is most valuable.
- Alternatives to video and audio content must be synchronised with video and audio tracks. Improperly synchronised alternatives may be so confusing as to be unusable.
- A presentation may occupy multiple sensory channels in parallel. Any content that is presented to a given sense must be coordinated to ensure that it remains intelligible when rendered with other content meant for that sense.
- The very nature of synchronised multimedia, content changes without user interaction, poses an orientation challenge to users who are not able to access the information in the predefined time interval. They may still access a presentation as long as the author has provided adequate alternatives and players allow sufficient control over the presentation.

The XML (Extensible Markup Language 1.0) was released by the W3C in February 1998 (<http://www.w3.org/TR/REC-xml>). It is a meta-syntax, used to declare grammars (called DTDs - Document Type Definition) for new computer languages and formats (called markup). DTDs can be used in two ways:



- Machine-centric: The content being marked up is only for machine consumption.

- User-centric: For user interface oriented structural textual rendering (e.g. HTML) or specialised rendering (e.g. VRML). XML is a subset of SGML. Its goal is to enable generic SGML to be served, received, and processed on the Web in the way that is now possible with HTML.

WAI has published a draft note on "XML Accessibility Guidelines" in September 1999 (<http://www.w3.org/WAI/PF/xmlgl.htm>) which deals with the user-centric part of XML and provides guidelines for new DTD/Schema/Profile designers and editing tool developers. In general:

- An XML DTD is accessible if it enables and promotes the creation of accessible documents.
- A document is accessible if it can be equally understood by its targeted audience regardless of the device used to access it.

Guidelines for designers for creating user interface oriented XML DTDs are:

- follow general principles of separation of structure/content and presentation,
- enable text-only presentation of your documents,
- provide rich native structural/navigational constructs,
- provide atomic semantic markup,
- support a key-based (discrete) input model.

XSL (Extensible Stylesheet Language) is a language for expressing stylesheets. It consists of:

- a language for transforming XML documents, and
- an XML vocabulary for specifying formatting semantics.

An XSL stylesheet specifies the presentation of a class of XML documents by describing how an instance of the class is transformed into an XML document that uses the formatting vocabulary. The XSL specification is a working

draft published in April 1999 by the W3C (<http://www.w3c.org/Style/XSL>).

Accessibility features are still missing in current XSL specifications but the results of the meta language should follow in principle the intention of the accessibility guidelines for CSS.

Examples for XML DTDs are:

- VRML: (Virtual Reality Modelling Language) Unfortunately access hooks such as alternative text nodes were not included in the VRML 2.0 specification (VRML'97, ISO/IEC 14772-1) (http://www.vrml.org/fs_specifications.htm). As discussion continues on how VRML should evolve, the Centre for Academic and Adaptive Technology (CAAT) will advocate the inclusion of access hooks in subsequent standards so information presented in a VRML environment can be accessible. The organisation now responsible for creating the next VRML standards is the Web3D Consortium (<http://www.web3d.org>).

- MusicML: (Music Markup Language) The "Connection Factory" has implemented Sheet Music just for studies on XML (<http://195.108.47.160/3.0/musicml/index.html>). It is an interesting approach for presenting music notes. Perhaps this can be developed as a substitute for notes presentation in Braille printing which differs - for historical reasons - in its coding from country to country. Accessibility features are not mentioned in MusicML up to now.

- SVG: (Scalable Vector Graphics 1.0) SVG is a language for describing two-dimensional vector and mixed vector/raster graphics in XML. The working draft was published in August 1999 by the W3C (<http://www.w3.org/TR/SVG>). Appendix E of the SVG specification deals with accessibility support.

- MathML: (Mathematical Markup Language 1.01) MathML is a low-level specification for describing mathematics as a basis for machine to machine communication. It provides the inclusion of mathematical expressions in Web pages. MathML is intended to facilitate the use and re-use of mathematical and scientific content on the Web, and for other applications



such as computer algebra systems, print typesetting, and voice synthesis. MathML can be used to encode both the presentation of mathematical notation for high-quality visual display, and mathematical content, for applications where the semantics plays more of a key role such as scientific software or voice synthesis. The W3C has released MathML 1.01 in July 1999 (<http://www.w3.org/TR/REC-MathML>). Accessibility features are directly integrated ("Design Goals of MathML" chapter 1.2.4). Perhaps MathML can be developed as a substitute for mathematic presentation in Braille printing which differs - for historical reasons - in its coding from country to country and even in the same country. This is a unacceptable situation.

- **VoiceXML:** (Voice eXtensible Markup Language) The VoiceXML (formerly VXML) specification is expected to simplify creation and delivery of Web-based, personalised interactive voice-response services and enable phone and voice access to integrated call center databases, information on Web sites, and company intranets. The VoiceXML specification also will help enable new voice-capable devices and appliances. More than 40 leading companies joined the VoiceXML forum and have contributed their work "PhoneML", "SpeechML", and "VoiceML" to create an open specification. The forum has published its preliminary specification for VoiceXML 0.9 in August 1999 (<http://www.voicexml.org>). Voice implies a kind of accessibility and this is perhaps the reason no special accessibility features are mention in the VoiceXML specification.

Scripting and programming languages

The Common Gateway Interface (CGI 1.1) is a standard for interfacing external applications with information servers, such as Web servers. A plain HTML document is static, which means it exists in a constant state and doesn't change. A CGI program, on the other hand, is executed in real-time, so that it can output dynamic information e.g. from a data base query. A CGI program can be written in any language that allows it to be executed on the server, but scripting languages are preferred.

A script is a sequence of instructions that is interpreted or carried out by another program rather than by the computer processor. In the context of the World Wide Web, Perl (Practical Extraction and Reporting Language), VBScript (Visual Basic Script), AppleScript, TCL (Tool Communication Language), and similar script languages are designed to handle forms or other services for a Web site and are processed on the Web server. Therefore they are called Servlets.

PHP3 (Personal Home Page Tools) (<http://www.php.net>) is a script language and interpreter, that is freely available and used primarily on Linux Web servers. The PHP script is embedded within a Web page along with

its HTML. Before the page is sent, the Web server calls PHP to interpret and perform the operations called for in the PHP script. Like ASP (s. below), PHP can be thought of as dynamic HTML pages, since content will vary based on the results of interpreting the script.

All programs executed on the Web server provide HTML documents. These dynamically generated documents should of course fulfill the same Web accessibility requirements as static documents.

The scripting language JavaScript can be run at the server as in Microsoft's Active Server Pages (ASPs). But most times it is embedded in HTML pages and interpreted by the Web browser to achieve interaction and minimise traffic.

Some examples:

- Automatically change a formatted date on a Web page,
- Cause a linked-to page to appear in a popup window,
- Cause text or a graphic image to change during a mouse rollover,
- Check users form entries before sending them.



Both Microsoft and Netscape browsers support JavaScript, but sometimes in slightly different ways. Currently there is no support of JavaScript in special browsers like Lynx, because it is not easy to find adequate textual presentations for the primary graphic facilities. Some work on this is in progress.

JavaScript uses some of the same ideas found in Java, the compiled object-oriented language derived from C++. A Java applet is a small program that is sent as a separate document along with a Web (HTML) page. Java applets can perform interactive animations, immediate calculations, or other simple tasks without having to send a user request back to the server. Currently there is no support of Java applets in special browsers like Lynx, because it is not easy to find adequate textual presentations for the primary graphic facilities.

Java applications (<http://www.java.sun.com>) run on a wide variety of host operating systems, many of which already have assistive technologies available for them. In order for these existing assistive technologies to provide access to programs written in the Java programming language, they need a bridge between themselves in their native environments and the Java Accessibility support that is available from within the Java virtual machine (Java VM). This bridge, by virtue of the fact that it has one end in the Java VM and the other on the native platform, will be different for each platform it bridges to. Sun Microsystems Inc. is currently developing both

the Java programming language side of this bridge, and the Win32 side and intends to make similar bridges available for other platforms over time.

The JAVA Accessibility Interface, API (<http://www.sun.com/products/jfc/jaccess-1.2/doc>) provides a clean interface that allows assistive technologies to interact and communicate with the JFC (JAVA Foundation Classes) and the AWT (Abstract Window Toolkit) components. Development of this API has followed an open design process.

The unparalleled accessibility built into the JFC software makes it possible for software vendors to satisfy accessibility needs. Analogous to MSAA, the software providers are responsible for using these excellent features.

The Java Speech Markup Language (JSML, 0.5, august 1997) (<http://www.javasoft.com/products/java-media/speech/forDevelopers/JSML>) is used by applications to annotate text input to Java Speech API speech synthesisers. The JSML elements provide a speech synthesiser with detailed information on how to say the text. JSML includes elements that describe the structure of a document, provide pronunciations of words and phrases, and place markers in the text. JSML also provides prosodic elements that control phrasing, emphasis, pitch, speaking rate, and other important characteristics. Appropriate markup of text improves the quality and naturalness of the synthesised voice.

Wireless Application Protocol

The WAP 1.1 (<http://www.wapforum.org>) is an open, global specification for a set of communication protocols to standardise the way that wireless devices can be used for Internet access, including e-mail, the World Wide Web, newsgroups, and Internet Relay Chat (IRC).

The WAP Forum is the industry association comprising over 200 members that has developed the de-facto world standard for wireless information and telephone services. The WAP 1.2 specification is under

development. This chapter will only focus on WML (Wireless Markup Language), formerly HDML (Handheld Devices Markup Language), which is a language that allows the text portions of Web pages to be presented on cellular phones and Personal Digital Assistants (PDAs) via wireless access. WML is based on XML and is intended for use in specifying content and user interface for small narrowband devices. The resulting constraints are:



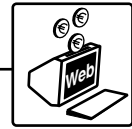
- Small display and limited user input facilities,
- Narrowband network connection,
- Limited memory and computational resources.

And indeed, these restrictions result from a kind of disability. Small displays and narrowband networks force content providers to design their information in a proper way:

- focus on the real information,
- easy navigation,
- no redundant information,
- good structure of information,
- simple layout,
- hard restriction on the usage of images and multimedia,
- restricted user interaction.

These requirements are obviously matching the recommendations of the Internet access guidelines (chapter 13.3.1) perfectly. Disabled

persons may have problems in using mobile handheld devices. But it is a very promising idea to retrieve information in WML format via Internet and present them on a computer with a special browser or with the help of the normal Internet browser which uses a WML-to-HTML proxy or filter. The advantage of this is clear: WAP compatible content will grow rapidly with the implementation of WAP services and the availability and market acceptance of WAP devices and, because of the restriction of the devices, an easy access to WML documents is enforced. Information providers will have to create accessible sites in HTML, for all users of WAP devices, not just for a minority of disabled users! And they will be able to review their design immediately by using WAP devices themselves.



Access to E-Commerce

An important factor in the growth of the Web is E-Commerce (Electronic Commerce, EC) or E-Business: The ability to buy, sell, and advertise goods and services to customers and consumers.

The Global Business Dialogue on Electronic Commerce (GBDe) forum (<http://www.gbde.org>), launched in 1998, consists of several hundred of leading companies and trade associations. At the GBDe conference in September 13, 1999 world business leaders for the first time agreed on the fundamental principles of global electronic commerce:

- authentication and security,
- consumer confidence,
- content and commercial communications,
- information infrastructure,
- intellectual property rights,
- jurisdiction,
- liability,
- protection of personal data, and
- taxes and tariffs.

These recommendations are a very important step, but statements on accessibility, barrier free E-Commerce (for disabled people) or social responsibility are not mentioned.

Also the W3C is concerned with the evolution of the medium itself. The Electronic Commerce Interest Group (<http://www.w3.org/ECommerce>) has started activities to understand the problems and work with W3C members to contribute to the solutions. They focused their work on protocols like micropayment, etc. The needs for accessibility are not pointed out to now.

E-Commerce includes:

- E-tailing (online retail selling) or virtual storefronts on Web sites with online catalogues, gathered into a virtual malls,
- the gathering and use of demographic data through Web contacts,
- Electronic Data Interchange (EDI), the business-to-business exchange of data,

- E-mail and fax and their use as media for reaching prospects and established customers (e.g. newsletters),

- Including buying and selling,

- the security of business transactions.

This chapter will focus only on the consumer accessibility aspects of E-commerce, not on things like protocols (e.g. micropayments, cryptography) which does not affect user interfaces directly.

From the users point of view, the Internet browser is the tool for visiting online shops. Although the Web sites advertise the products and their providers by the usage of all Internet facilities, these sites should follow the accessibility guidelines (chapter 13.4.1, 13.4.5). This is an evident recommendation but today's designers of virtual market places feel thrilling presentations and accessibility are mutually exclusive, but a minority of providers demonstrate that this is not true!

Virtual market places are often coupled with data bases and there Web presentation is done by generator and authoring tools and scripting (chapter 13.3.4, 13.3.6). Scripting on the client site causes some problems for disabled users. Therefore it is very helpful, if interaction is also provided (perhaps as an alternative) without usage of JAVA Script or JAVA Applets or certain plugins. Most special browsers do not support these techniques, and therefore encryption based on these techniques is not possible. Security via build-in SSL (secure socket layer) is currently not supported by all special browsers (chapter 13.3.2) for juristic reasons (US export control) but a practicable way.

New protocols for E-Commerce, e.g. payment, micropayment, authentication, HBCI (Home Banking Computer Interface) etc. have to be open to all so that they can be implemented into non mainstream browsers.

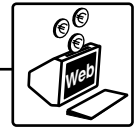
Conferencing tools, tools for voice-over-IP (Internet telephone) and applications for business-to-business buying, selling and data interchange are based on the standard Internet



protocols. These applications should be accessible for disabled persons (chapter 13.2). The accessibility recommendations are also applicable to helper tools like mediaplayers (shockwave, mpeg, quicktime, Real Audio) or mail clients etc. In this context Internet homebanking applications cause a lot of trouble for blind users. As they are designed for a specific browser and operating system and

provide a very specific graphical user interface without MSAA support, current solutions are not feasible for the blind.

The old BTX based homebanking solution, a favourite of blind users because of its textual user interface, is no longer supported. An equivalent substitute based on Internet technology is not available.



Conclusion

This chapter has noted today's solutions and problems of disabled persons for accessing the Internet and E-Commerce and as a precondition the general access to computers.

At the exhibition "Reha International" (November 1999) - the most important international forum for people with special needs - current solutions for computer access were presented. It appeared, especially for the visually impaired users, that solutions for accessing mainstream operating systems and applications are available in about two years time. The number of bridge software solutions (screen readers) will decrease and the dominance of two or three products is obvious. Considerable problems come from graphical applications which present information in a graphical way only and do not support accessibility techniques like MSA or even simple things like colour settings or configuration of the screen layout. Such applications are major barriers to visually impaired persons. The techniques for making even special applications accessible are well known, but only a few user interface designers are willing to support them. The reasons for this may stem from ignorance/ unawareness, and increasing software development costs and / or misunderstanding guidelines.

And when software is declared "accessible" by the creator, this is perhaps true in his mind but not approved by the handicapped users. A certification of accessible software by a neutral institution with high experience in assistive technologies and with disabled employers who judge software from the point of own experience may be considered a possible solution.

Additionally laws can enforce accessibility of software, the Internet and E-commerce. On the basis of the US "Americans with Disabilities Act" (ADA, 1990) in November 1999 the National Federation of the Blind sued America Online inc. for Internet services that were inaccessible to the blind.

But laws and regulations are not a perfect solution, because it takes a long time and money to enforce them in one country only.

But software and the Internet are international

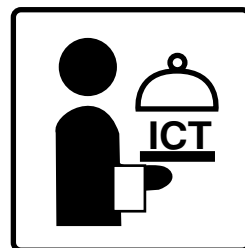
and fast moving media. Although, accessibility guidelines for the Internet and indirectly E-commerce are well defined by the WAI, nobody is forced to follow them. Public institutions are often forced to make their Internet sites accessible, and the results are of more or less good quality. But everybody may create his or her own Web site. How to force persons, companies and institutions to take care of accessibility, is an unsolved problem. Public relations of the WAI and many other national and international interest groups are well done since years and led to a minimum of awareness and sensibility. A promising possibility is to make the Internet more accessible by construction by separating document structure from presentation in HTML4, CSS2 or XHTML1.0. It is the daily experience of the blind author of this chapter to visit Web sites which are more or less accessible or even completely inaccessible (e.g. documents in a graphic format), also in the context of research for this article.

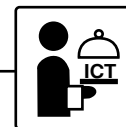
In this article, many upcoming technologies and their accessibility features are described. Comparing this with the solutions presented at the REHA exhibition, there seems to be a wide gap between design of solutions and their practical implementation..

New operating systems will be much more graphically orientated, Internet presentation will go more in the direction of multimedia and virtual reality, and E-Commerce will grow very rapidly. We have to make these technologies accessible to all users and not just for a majority of users. We have to remind main players not to only focus on those user group they expect most commercial success from. They should also have a look on the group of disabled and elderly persons as they are groups with the most important benefit from the Internet and E-Commerce. Doing so, shows the social competence of those companies.

Chapter 14

Services





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Introduction

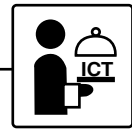
The main focus for this section is access to services for people with disabilities and older people using telecommunications. Typically, the use of telecommunications by people with disabilities and older people is characterised as an access problem to the telephone terminal. But due to the increasing sophistication of network technology this approach needs to be changed. It is now necessary to consider how the person, with a physical or sensory impairment, interacts with the whole system at a service level. (See Fig 14-1 below). Access barriers or ease of use problems may arise within the network resources that a customer needs to invoke to carry out the communications task he or she wishes to use the public network for.

For this reason five distinct groupings of service are considered in this section. Firstly, the most fundamental service is that which connects two or more users in a real time conversation over a distance. For many groups of elderly and disabled people, voice is combined in various ways with text in what are known as Total Conversation services, and these can be seen as an extension of such mono-media services. Secondly, network services. These range from basic supervisory tones which give feedback on the progress of a call, e.g. ringing tone, to more advanced level network services to enhance use of the network, e.g. ring back when free. Thirdly, interactive speech services. These can be as diverse as banking, home shopping,

directory enquiries, information services, etc. Fourthly, healthcare services. These are services designed to allow frail, elderly or disabled people to maintain independence and quality of life through the use of ICT. Finally, the integration of computing and telecommunications. This technology has the potential to improve access to the workplace, education, community services, shopping, etc. for people with special needs. But in order to realise these benefits there needs to be a greater involvement of people with special needs within the research, development, design and standardisation of these services. "Design for All" in this way will drive up quality and accessibility and drive down costs.

The use of any service using telecommunications can be considered as having two components. The first is access to suitable terminal equipment and the second is the user interface presented by the service provider. However, there are other issues that must be addressed for services to be supplied on an equal basis. These are such issues as availability, affordability, awareness and legislation. These issues are beyond the scope of this report, although affordability is mentioned briefly below in the context of "Universal Service".

In addition to the telephone network many of the services mentioned below are also accessible via the Internet. Guidelines for access to

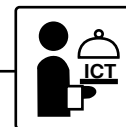


the internet are being developed by the Web Accessibility Initiative (WAI), but this topic is outside the scope of this section of the report. For a full description the activity in WAI see Section 15.3 “Access to the Internet” in the section of this report on “Internet and Electronic Commerce”. (Further information of the WAI guidelines can also be found at <http://www.w3.org/WAI/References/>).

The legal background

The liberalisation of telecommunications services across Europe has resulted in a more open market. The quality of these services has been influenced more by the forces of competition than any requirement that they should be accessible to all users. This has come about because the existing obligations placed on national regulators and service providers are more about fair trading conditions rather than the accessibility of the services.

The next stage in the liberalisation of telecommunications is a requirement for “Universal Service”. This is defined as a minimum set of services available to all users at an affordable price regardless of their geographical location. EU members will be required to ensure access to, and affordability of, these services for people with disabilities. Proposals for a directive on ‘Universal Service’ are currently being considered, but at the time of writing there is no implementation date for this Directive.



Service Sectors

Total Conversation

Many users need text as a medium in conversation, because of a disability in hearing or speech or for other reasons. By including text conversation facilities in the design of communication devices and telecom services, they can be “designed-for-all”, thus satisfying the needs of both disabled and able-bodied users. Text conversation may be provided in new environments, like mobile networks and the Internet. Then, it is natural to establish inter-working functions for communication with text telephones in the telephone network, in the same way as is done for voice telephony. Only by accepting that there are people who cannot use voice telephony fully, and need other media for distant conversation, can the needs of these users be satisfied. Many more users than those who use text telephones today will be attracted by the possibilities of combining text, voice and video simultaneously in innovative ways. It still needs to be a telecom service if it is to utilise the same support from society as voice telephony gets. Online text communication over the internet is becoming an important alternative, but the need to build proper services with defined addressing, possibility to call users between networks and with a defined quality of service is the same for IP text telephony as for IP telephony. Therefore Design for All for conversational services and communication devices can only be achieved by including text in the general offerings.

Network services

Users of telecommunications networks have access to a wide range of services that are directly related to their use of the network. The most basic of these are supervisory tones that give feedback on the progress of a call. For example, dial tone, ringing tone, engaged tone, etc. In particular, textphone users are unable to monitor the progress of their call because most text phones cannot distinguish between different network tones. Text terminals need a visual display of the line status, i.e. dialling, busy, connected, etc. Across Europe there are approximately 2 million deaf people who could benefit from using text communication.

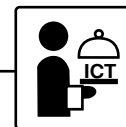
At a more advanced level, network operators may offer services to enhance use of the network. For example, ring back when free, calling line identification, call diversion, conference calling, charge-card calls, etc. Many elderly and disabled people have problems using these services. This is often due to the poor design of the user interface that fails to take account of the needs of elderly and disabled people with cognitive impairments. These can be categorised as memory, perception, problem-solving and conceptualising impairments. Also included in this group is dyslexia, which can cause significant problems in remembering number sequences. It is estimated that across Europe there are 9 million people with cognitive impairment.

Interactive speech services

Many services are accessed via the telephone network. There are many emerging applications for interactive speech services. These include:

Type of service	Examples
Voice store and forward	CallMinder UK network based telephone answering service.
Finance	Banking, stocks and shares, insurance quotations, credit cards
Entertainment	Betting, horoscopes, games
Information	Timetables, yellow pages, news
Telemarketing	Promotions
Tele-shopping/Reservations	Theatre, airlines, catalogue shopping
Field operations	Data operation and retrieval, job despatch, voice access to email
Automatic operator	Network services, call centre.

Figure 14-1



There is an increasing trend for callers to these services to be greeted by an automated call handling system that asks for responses either as DTMF tones via the telephone keypad, or as voice responses. At present the vocabulary that can be recognised by such systems is limited, but future systems will be able to handle much larger vocabularies and in a natural dialogue style.

The benefit of speech technology when used to search for and retrieve information is that it makes the technology accessible to people who are not computer literate. It hides the complexity of real systems and services behind a very natural interface. It has the additional advantage for people with limited dexterity that it offers an alternative to the telephone keypad, the standard 102 key keyboard and the mouse as input devices. Because it is hands and eyes free, it enables information to be retrieved with just a microphone and a communications channel. This will ultimately lead to the development of small mobile devices and wearable computers.

However, interactive speech based services present significant barriers for deaf and hard of hearing people as well as people with speech impairments. The complexity of some voice services is also a barrier to people with cognitive impairments such as memory, perception, problem-solving and conceptualising disabilities. It is estimated that in the European Union there are 6 million people with visual impairments ranging from moderate impairment to blindness and 9 million people with cognitive impairment.

Healthcare services

Telematic technology is becoming increasingly used in the area of healthcare. This has the potential benefit of allowing frail, elderly or disabled people to maintain independence and quality of life. The use of telematics in this sector is still relatively new and very few specific standards exist. The rapid growth in telematics healthcare services has been market lead rather than dictated by standards. However, there are still many existing standards

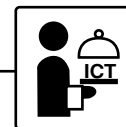
in other fields that are applicable to some healthcare services. For example, a public booth offering walk-in health monitoring would need to be accessible to wheelchair users and have an interface that was adaptable to individual needs such as large text, voice input, etc.

One topic that it is generally agreed requires standardisation is the electronic handling of health care records. The health care of a patient may be shared by several organisations, but their patient records will be held on a wide range of incompatible systems. To provide the highest possible level of care these systems need to be able to share information and a standard protocol for transferring electronic records is needed.

Another area that requires standardisation is medical imaging transmission over public networks (teleradiology). This is a growth area thanks to the recent developments in broadband technologies such as ADSL.

Computer telephony integration (CTI)

This technology has the potential to improve access to the workplace, education, community services, shopping, etc. for people with special needs. Since 1960 our ability to transport information over any distance has doubled each year. A low-cost electronic wrist watch now has more processing power than a mid-range computer of the 1960s, whilst the personal computer is now realising a processing, storage and display ability that surpasses mainframe computers of only ten years ago. If elderly and disabled people are to share the benefits of CTI their needs must be taken into account. The hardware needed to access information via CTI is already the subject of a wide range of standards.



Existing Standards and Guidelines

ISO

The majority of ISO standards relating to elderly and disabled people are concerned with the physical aspects of disability. For example, ISO/TR 9527:1994 Building construction -- Needs of disabled people in buildings.

Relevant standards

ISO/IEC 13714 "User interface to telephone based services – voice messaging applications."

ETSI

The majority of standardisation work in ETSI relating to the needs of elderly and disabled people is carried out by Technical Committee Human factors (TC/HF). Founded in 1989 the terms of reference of TC/HF cover user interface (Man-Machine Interface - MMI) standards and guidelines for telecommunication equipment and services, including the requirements of people with special needs (i.e. the elderly and disabled). For a list of published and current work items see "Relevant ETSI recommendations" in the section of this report on "Communication Devices".

In addition to TC/HF there is the ETSI User Group. The term "user" has various possible meanings ranging from a manufacturer using a standard to produce a product or service, to the end-user (or consumer) of such a product or service. The User Group in ETSI gives guidance on how user requirements can be taken into account during the standardisation process.

Relevant standards

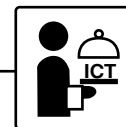
EG 201 219 "User requirements; Guidelines on the consideration of user requirements when managing the standardisation process".

ITU-T

The majority of work that is relevant to services is taking place in ITU-T Study Group 2 "Network and service operation".

Question 5/2	Network related quality of service aspects of facsimile communication".
Question 10/2	Management and development of PSTN-based telecommunication services".
Question 11/2	New services and service enhancements brought about due to ISDN capabilities".
Question 12/2	New services for broadband ISDN (B-ISDN)".
Question 13/2	Mobile/personal telephone, telegraph, telematic, data, audiovisual and multimedia services".
Question 15/2	Universal personal telecommunication (UPT) service".
Question 16/2	Human factors issues in telecommunications affecting multiple services or not related to specific services".
Question 17/2	Human factors aspects of voice and non-voice services using public terminals".

Figure 14-2



Published Recommendations

ITU-T E.121 (07/96) - Pictograms, symbols and icons to assist users of the telephone service.

ITU-T E.133 (11/88) - Operating procedures for cardphones.

ITU-T E.134 (03/93) - Human factors aspects of public terminals: Generic operating procedures.

ITU-T E.135 (10/95) - Human factors aspects of public telecommunication terminals for people with Disabilities.

ITU-T E.136 (05/97) - Specification of a tactile identifier for use with telecommunication cards.

ITU-T E.137 (User instructions for pay phones) (Oct. 1997).

ITU-T E.138 (Public terminals for the elderly) (Sept. 1998).

ITU-T F.901 (Usability evaluation of telecommunications services).

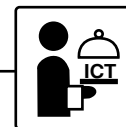
ITU-T F.902 (Interactive services design guidelines).

Guidelines

Dialogues 2000 "Dialogues engineering style guide", edited by Martin Bartholomew (Periphonics), Chris Durrant (BT) and Mervyn Jack (CCIR). This set of guidelines for voice based services has been developed jointly in the UK by Periphonics, BT and the Centre for Communication Interface research (CCIR) at the University of Edinburgh. The style guide defines three main issues in dialogue engineering, ease of learning, consistency & reliability and cognitive load.

<p>Ease of learning</p> <p>Ease of learning is encouraged by building on prior experience with similar services, considering commands, terminology and dialogue structure.</p>
<p>Consistency & reliability</p> <p>Consistency and reliability comes about by creating designs which are externally consistent with other systems and internally consistent within themselves.</p>
<p>Cognitive load</p> <p>Cognitive load is about recognising that users should not have to learn long lists of instructions. Services should be structured so that a variety of paths can be followed through the dialogue.</p>

Figure 14-3



Outputs from Projects

COST 219

The work in COST 219 had two aims. Firstly, to investigate how telecommunication services and terminals could be made accessible to people with disabilities and older people. Secondly, to investigate how telecommunication and teleinformatic services could support people with disabilities and older people in their daily lives. A number of reports produced by COST 219 are relevant to the area of services.

“Telecommunications as a means for independent living” March 1994

“Smart cards and disability” November 1994

“Speech technology applications for disabled and elderly people” March 1995

“Services for independent living” June 1995

“Databases and information systems for people with disabilities” November 1995

“Universal services issues – a theme paper from COST 219bis” February 1998.

EURESCOM

“Telecommunications for elderly and disabled people, recommendations for the role of EURESCOM (Task T1.4 Final Report)”

This document reports the results of the work of EURESCOM project team S33 which investigated the current situation in Europe. It describes the ideal situation for disabled and elderly telecommunications users and the barriers to attaining it. From this base the team was able to identify the opportunities and challenges for EURESCOM in moving towards the ideal situation.

In order to face the challenges of provision and build the market opportunities for European PNOs EURESCOM needs to be active on 3 levels.

Immediate actions - inclusion of activities in work programme

Strategic actions - building the research base in Europe

Internal organisation - enhance EURESCOM sensitivity to this area

The barriers to access do not just appear at the terminal interface. With the increasing sophistication of the network they are moving into the network to be a function of the service being employed. A simple model is shown in Fig 14-4 to indicate the major interfaces, from the user perspective, where barriers may arise.

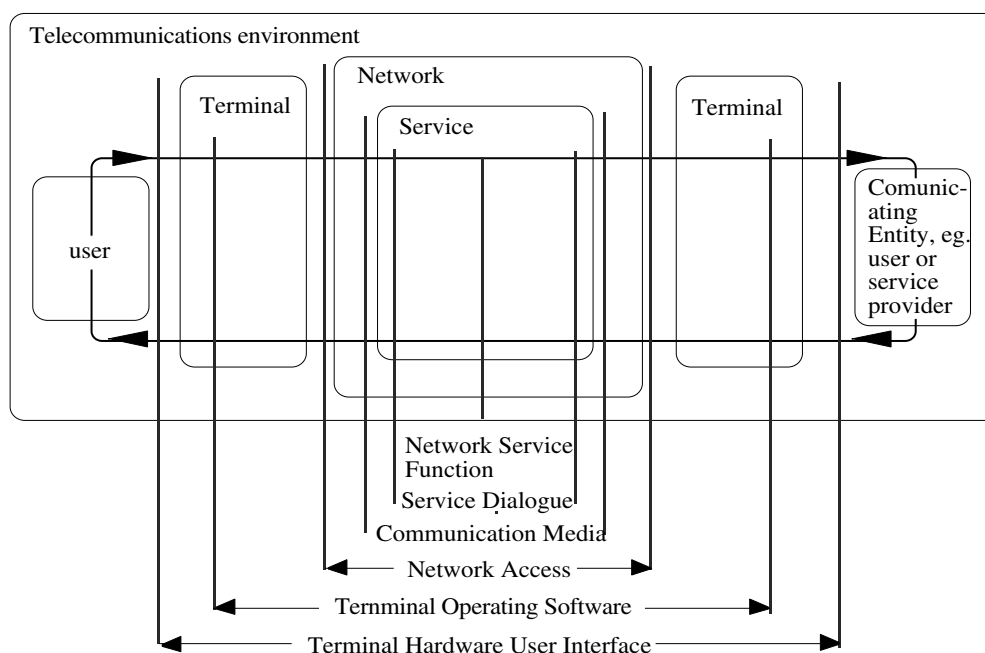
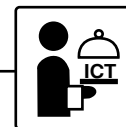


Figure 14-4: A simple model of the barriers faced by disabled and older people



HEART

(Horizontal European Activities in Rehabilitation Technology)

The HEART study was an interdisciplinary investigation of the rehabilitation technology situation in Europe. It was funded by the TIDE (Technology Initiative for Disabled and Elderly persons) programme. One of the six lines of the HEART study was Line A “Standards, testing and certification/specification of rehabilitation technology”. Of particular relevance to services is Report A.3.4 “A model for user influence on standardisation”. The recommendations from this report are included in the conclusions at the end of this chapter.

VISTEL

(Visually Impaired Screen based TELEphony)

The VISTEL project (Visual Impaired Screen based TELEphony) which began in January 1997 is investigating the adaptation of new “screenphones” with graphical displays, for blind and deaf-blind users. The project aims firstly, to clearly identify the barriers faced by visually impaired and deafblind people in gaining access to screenphone technology and to gather specific user requirements to facilitate this access. Secondly, the project will implement appropriate adaptations to services, network components and terminals and potential users will evaluate these in a number of European countries.

Data is currently being analysed from a questionnaire study which sought to identify the problems foreseen by visually impaired and deafblind people in the use of screenphones, as well as to establish the considerations they feel are important to ensure their access to this technology. The results of this survey are being used to identify possible solutions and to develop prototypes for evaluation. One possible solution to the problem of screenphone access for visually impaired and deaf-blind people is to provide Braille output and experiments are being conducted to investigate the acceptability and ease of use of different Braille solutions.

Finally, appropriate methodologies are currently being devised for the evaluation of prototypical solutions as they are developed.

Workshops

The EU/ETSI workshop on “Standardisation and disability in Europe” (Amsterdam 1996) produced a set of fourteen recommendations that fell into three categories;

Market awareness,
Improvement of the standardisation process, and
Need for legislation.

The recommendations were directed at the EU Commission (1, 2, 4, 8, 11, 12, 13), CEN/CENELEC/ETSI (3, 5, 6, 9, 10), national governments (11, 12, 13, 14) and national standardisation bodies (3, 5, 7). The recommendations directed at CEN/CENELEC/ETSI and national standards bodies (3, 5, 6, 7, 9, 10) are detailed below.

Market awareness

Recommendation 3

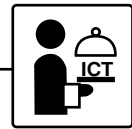
The standardisation organisations – both European and national – should make necessary information about ongoing standardisation work and its output easily accessible to everybody, i.e. at low costs, including electronic means (such as WWW).

Improvement of standardisation processes

Recommendation 5

Organisations of users and people with disabilities and older people should participate in standardisation work on the European level and be supported on the national level: programming/planning by European user organisations and expert institutes/R&D etc. technical work by experts (coming from manufacturers, user organisations, expert institutes, etc.)

The same applies to organisations which produce specifications (x-open, ATM forum, etc.)



Recommendation 6

Contacts/interaction between user organisations for people with disabilities and older people and standardisation bodies (technical experts) should be organised via reference groups in CEN, CENELEC and ETSI. The same applies to specification providers. These reference groups could also monitor progress.

Recommendation 7

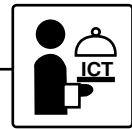
A focal point/reference group on the national level managed by the national standardisation organisations is strongly recommended. At the same time research into the best ways of involving users in the process should continue.

Recommendation 9

Additional areas where standardisation work is needed were identified by the workshop and should be taken into consideration.

Recommendation 10

The pre-eminence of world-wide standards is recognised. However, where world-wide standards are not available, European standards should initially be produced, which could later contribute to world-wide standards.



User Requirements

Physical Handling of the Terminal



Home Environment

- A suitable terminal for accessing the service, adapted to the users needs.



Public Environment

- Same as for home, but with physical access to the terminal, e.g. access to buildings and access from a wheelchair, as additional requirements.



Mobile Environment

- Factors such as weight, display size and key size must meet the needs of the individual.

Requirement

Standards



Physical

- None identified.



Auditory

- Noise excluding handset.



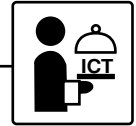
Visual

- Enlarged keys.



Dexterity

- Ergonomically shaped handset.
- Lightweight handset.



Requirement

Standards



Cognitive

- Keypad not in the handset in order to avoid problems with timeouts.



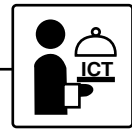
Combination

- None identified.



Speech

- Non-slip base, especially when terminal contains QWERTY keyboard.



User Interface (UI)



Home Environment

- Exchange information in a format and at a pace which suits the needs and abilities of the user.



Public Environment

- Must take account of environmental conditions and need for confidentiality.



Mobile Environment

- Must be adaptable to a user-defined profile.

Requirements

Standardisation



Physical

- None identified.



Auditory

- Amplification, inductive coupling, visual/tactile key feedback, use of text via keyboard and visual display.



Visual

- Enlarged keys, tactile key markers, high contrast lettering, large text, tactile display.



Cognitive



Dexterity

- Dial out buffer memory (as used in mobile phones). Longer time-outs.



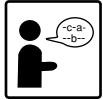
Requirements

Standardisation



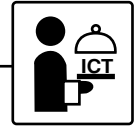
Combination

- None identified.
-



Speech

- Text sending via keyboard combined with a visual display of text.



User Dialogue



Home Environment

- Should support the user in achieving their goal.
-



Public Environment

- Should be tolerant of background noise.
-



Mobile Environment

- Should support a range of dialogue methods.

Requirements

Standardisation



Physical

- None identified.
-



Auditory

- Accept input from a textphone.
-



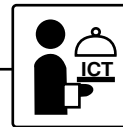
Visual

- Provide spoken instructions.
-



Cognitive

- Wording of the dialogue should be unambiguous and avoid the use of double negatives.



Requirements

Standardisation



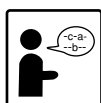
Dexterity

- Time-outs should allow for slow responses.



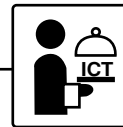
Combination

- None identified.



Speech

- Accept input from a textphone or speech synthesiser.



Adaptation to a User Profile



Home Environment

- User preferences stored by service provider and invoked automatically (e.g. by using CLIP to identify the caller and their pre-defined requirements).



Public Environment

- Facility to adapt public terminals to a user profile, possibly through use of a smart card.



Mobile Environment

- Mobile terminals adapted to user preferences using smart card.

Requirements

Standardisation



Physical

- None identified.



Auditory

- Provide amplification and/or alternative outputs, e.g. text, sign language, etc.



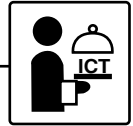
Visual

- Provide speech output, larger text, high contrast displays, auditory key feedback and tactile markers.



Cognitive

- Provide sub-sets of functions and simplified instructions. Set longer time-outs to allow more thinking time.



Requirements

Standardisation



Dexterity

- Set longer time-outs to account for slower movements.



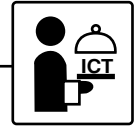
Combination

- None identified.



Speech

- Use alternative inputs, e.g. text, DTMF, etc.



Security



Home Environment

- User identification should be appropriate to the abilities of the user.



Public Environment

- Public terminals should ensure privacy of personal information.



Mobile Environment

- Mobile terminals should support a range of authentication methods.

Requirements

Standardisation



Physical

- None identified.



Auditory

- Provide text based authentication.



Visual

- Provide security of spoken output in public places. Consider alternative outputs such as Braille.



Cognitive

- Use of iris scan, finger print or voice print for secure identification.



Requirements

Standardisation



Dexterity

- Use of iris scan or voice print for secure identification.



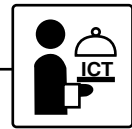
Combination

- None identified.



Speech

- Use of iris scan or fingerprint for secure identification.

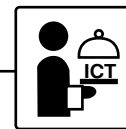


Dialogue Principles

Dialogue is defined as “The interaction between a user and a system to achieve a particular goal.” The following seven principles have been identified to be important for the design and evaluation of system dialogue.

Dialogue principle	Description
Suitability for the task	A dialogue is suitable for the task when it supports the user in the effective and efficient completion of the task.
Self-descriptiveness	A dialogue is self-descriptive when each dialogue step is immediately comprehensible through feedback from the system or is explained to the user on request.
Controllability	A dialogue is controllable when the user is able to initiate and control the direction and pace of the interaction until the point at which the goal has been met.
Conformity with user expectations	A dialogue conforms with user expectations when it is consistent and responds to the user characteristics, such as task knowledge, education and experience, and to commonly accepted conventions.
Error tolerance	A dialogue is error tolerant if, despite evident errors in input, the intended result may be achieved with either no or minimal corrective action by the user.
Suitable for individualisation	A dialogue is capable of individualisation when the interface software can be modified to suit the task needs, individual preferences and skills of the user.
Suitability for learning	A dialogue is suitable for learning when it supports and guides the user in learning to use the system.

(Source: ISO 9241-10)



Conclusions

Equality of access to services for older people and people with disabilities can be considered under four headings:-

- Terminal equipment (used to access the telecommunications network);
- User interface (designed by the service provider);
- Support services (e.g. billing in alternative forms such as audio or braille);
- Legislation (e.g. the Display Screen Equipment Directive and the multi-part standard ISO 9241).

The following is a combined list of demands that the terminal manufacturers, network operators, service providers and standards bodies must address.

- The standardisation organisations – both European and national – should make necessary information about ongoing standardisation work and its output easily accessible to everybody, i.e. at low costs, including electronic means (such as the Internet).
- Consumer organisations and organisations representing elderly and disabled people should participate in standardisation work on the European level and be supported on the national level.
- Contacts/interaction between organisations representing elderly and disabled people and standardisation bodies (technical experts) should be organised via reference groups in CEN, CENELEC and ETSI. The same applies to specification providers. These reference groups could also monitor progress.
- A focal point/reference group on the national level managed by the national standardisation organisations is strongly recommended. At the same time research into the best ways of involving users in the process should continue.

- The pre-eminence of world-wide standards is recognised. However, where world-wide standards are not available, European standards should initially be produced, which could later contribute to world-wide standards.

- Operators of services should be made more aware of the requirements of elderly and disabled users. They should be encouraged to develop and present business plans in the area of special services for elderly and disabled users. They should also develop and present business plans to give elderly and disabled users access to other services.

- Inductive coupling in all telephones.

- Variable amplification in all public telephones.

- A mandatory European communication protocol for text telephones.

- Public text telephones in selected sites.

- Network facilities to provide text information in parallel with (or in place of) voice information.

- Notched cards for all payphones and tactile identifiers on other pay cards.

- Specialist directory enquiry and service help facilities.

- Standardised layout on keypads.

- Prohibition of disconnecting telephones for outgoing calls.

- Bills available in alternative formats, e.g. large text, audio, Braille.

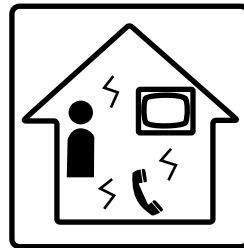
- Access to directory enquiries for text telephone users.

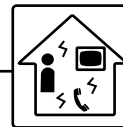
- A national text relay service for deaf, hard of hearing and speech impaired people.

- Alternatives to PINs for user identity verification.

Chapter 15

Smart Housing





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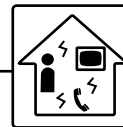
Introduction

A smart house is a system that consists of a data network that connects and integrates key electrical appliances and allows them to be controlled from a central source, or to interact with each other. Electrical appliances and functions include, but are not limited to items such as: heaters, lighting, alarm systems, "white" and "brown" household appliances, remote controls and communication devices.

Smart houses allow interaction between those elements controlled, and this is what makes the systems different from ordinary environmental control systems. The smart systems use electric power, twisted pair cables, coaxial cables, telecommunication systems, infrared, Internet or radio frequency or a combination of several as communication and control media. A basic smart house installation is easily programmed to fit each individual user's needs, and therefore very well adapted to the principles of design for all.

Smart house systems include control by user, automatic control functions through interaction between components and connection and interaction with different communications media.

Because the smarthouse is a system, integrating products and devices, the user requirements must apply to all the separate components, as well as the system and how the components are integrated and interact within the system. Therefore the user requirements must relate to functions, as well as separate products.



Standards

In the process of defining user requirements, **ISO/DIS 13407: Human centred design of processes for interactive systems** must be followed. In this document the active participation of users is described

The rapid development of the technology and its potentials and work to converge technology and standards makes it difficult to keep abreast of developments and provide standards that take into consideration the needs of consumers, especially elderly and disabled consumers. Recent developments show that smart house systems will be closely co-ordinated with other technological developments through convergence and new industrial partnerships. The combinations may create problems for consumers. The PC companies think they know, the TV companies think they know and the smart house systems suppliers think they know what is best. Who will benefit most, the industry or the consumers or both?

It is therefore important that the standards for smart housing are seen in conjunction with standards for digital broadcasting, mobile communications, Internet, PCs, PDSs voice

services. Consumers have as a rule not been included in the standards work in the smart housing area, but the more developed consumer issues that have been dealt with in the telecommunications area may be of benefit for smart housing consumers as well.

There are many different communication media for smart houses, for example: twisted pair cables, coaxial cables, power line, radiofrequency, infrared, Internet. This is the reason why the standards relating to smarthouses may be found within CEN, CENELEC or ETSI, or as combinations of standards within these areas. ICTSB has considered these issues, and has started co-ordinated effort by organising two ICTSB Ad Hoc meetings on Smart Housing in 1999. The two meetings are building on the ANEC Consumer Report, but have gone deeper into the issues.

This overview of State of the Art in smart house standardisation shows the most important areas for standards work, and some related activities which need to be considered in this project.

CENELEC

CLC/TC 205 - Home and Building Electronics Systems (HBES)

Scope

This technical committee defines the general technical requirements of a Home and Building Electronic System. It concerns cabling and technology, electrical and functional safety, environmental conditions and behaviour in case of failures as well as specific HBES installation rules.

The HBES also includes the interfaces of devices and equipment providing connection to the HBES. Parts of devices and equipment not providing HBES functionality are not included.

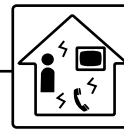
For such parts the relevant product standards apply.

Scope of the TC

To prepare standards for all aspects of home and building electronic systems in relation to the Information Society.

In more detail: To prepare standards to ensure integration of a wide spectrum of control applications and the control and management aspects of other applications in and around homes and buildings, including the gateways to different transmission media and public networks taking into account all matters of EMC and electrical and functional safety.

TC 205 will not prepare device standards but the necessary performance requirements and necessary hardware and software interfaces. The standards should specify conformity tests.



TC 205 will perform the work in close co-operation with relevant CENELEC TCs and those in CEN and ETSI.

Sub committee 205A Mains communications systems

To prepare harmonized standards for communication systems using low voltage electricity supply lines or the wiring of buildings as a transmission medium and using frequencies up to 30 MHz which will allow all type of telecommunication systems and services to be provided on power lines.

Working groups under CLC TC 205

Some working groups are more relevant than others, and it seems that WG 3, WG 5, WG 8, WG 9, WG 12, WG 14 and WG 15 are of interest, and this needs to be defined in co-operation with responsible persons within TC 205.

WG 3 HBES-Part 2-2 prA1
Systems Overview – General Technical Requirements, First Ammendment

WG 5 HBES – Part 6-4.1 to 6-4.5
Gateway between HBES and Telecommunication Networks

WG 8 HBES – 9.1
Installation Requirements – Generic Cabling for HBES class 1, Twisted Pair

WG 9 HBES – Part 5-4
Use of Infrared

WG 12 HBES – Part 9-2
Installation – Inspection and testing of HBES Installation

WG 14 HBES – Part 8:
Conformity Assessment (Guidelines for electrical contractors, installers or inspectors on checking and approving of an installed HBES

WG 15 ,HBES – Part 5-5:
Network based on Radio Waves (RF medium)

Expert appraisal

The working groups under this CENELEC TC 205 are the most relevant to take up the issues in relation to smart housing issues. This is particularly true, as the smart housing developments are merging into the combination of different media for transmitting and communication the integrated products and services, and because digital services gradually will be combined with smart house installations. (Developments like Bluetooth and Jini).

CENELEC Technical Report R105-002 concerns cabling.

Expert appraisal

The standard does not include user or consumer aspects of smart houses. It relates to technical aspects of installation buses, particularly where cabling is used. It is therefore important for the smart house systems that are most commonly in use, but will probably not apply to the same degree for the new developments where the communications media will consist of wire- and cableless communications systems. However, there exist working groups that relate to these issues.

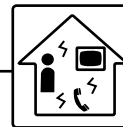
TC13

Which relates to control and metering of gas, water and electricity supply.

TC 79 - Alarm systems

Social alarm systems.

To prepare harmonized standards for detection, alarm and monitoring systems for protection of persons and property, and for elements used in these systems. The scope includes in particular intruder and hold-up alarm systems, access control systems, periphery protection systems, combined alarm – fire alarm systems, CCTV-systems, other monitoring and surveillance systems related to security applications, as well as associated and dedicated transmission and communication systems. The standards shall specify conformity tests.



These standards must be integrated with smart house standards in order to give standard infrastructure for alarms from smart houses to the care services and other service providers. Advantages can be achieved if this work results in easier and safer installations and communications. This is of utmost importance if smart houses are going to be a supplement to the efficient care of the growing number of persons in need of care.

IEC/TC79:

Alarm systems- Social alarm systems – Part 1: System requirements.

Alarm systems-Social alarm systems – Part 3: Local unit and controller

Alarm systems – Social alarm systems, Part 7: Application guidelines, EN 50133-1:1996 (PR2489).

PrEN 50134-3 (PR=4967) This standard defines requirements for service centres and requirements.

CENELEC standard prEN 50134-1-2: 1993E

Cenelec standard no. prEN 50134-1-2: 1993E defines requirements to alarm centres, but does not include interface with smart house receptors and alarms.

CENELEC mandate 273: ICT and disabled and elderly people

This work has been considered by TC 79, who did not think this was of relevance to their working area, but they are awaiting a response from other committees.

Expert appraisal

CENELEC Mandate 273 is recommended to be co-ordinated with TC 79. There may be other relevant areas within TC79, especially because integrated alarms and transmission of these into other alarm systems is one of the main aspects that relate to smart house technology for universal design purposes. In addition, assistive technology needs to be

integrated into the requirements in order to allow disabled persons to send alarms.

The requirements spelled out in these standards are good and relevant, but they do not treat the interfaces that are necessary between a smart home installation and the social service centre or home care service.

TC 100X

Which works with audio-video systems and equipment.

TC 206

Which works with Consumer requirements for entertainment equipment.

TC 215

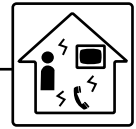
Which works with the electrotechnical aspects of telecommunication equipment. This is particularly used within industry and commercial buildings. The TC concentrates on the cabling and passive components such as plugs and sockets, but does not cover active components and protocols.

Expert appraisal

TC 100X and TC 206 are related to digital services and combinations with smart housing.

CENELEC Standard EN-50065-1

This standard regulates smart house installations that do not use special cables, but the mains cables. In Europe the biggest systems are EIB Powernet, LonWorks (US) and CEBus (US). The last one is not approved by CENELEC.



CEN

CEN TC 225

This committee works with data-capture, automatic identification. Examples of this are service logs with bar code registration, identified presence and arrivals, etc. It can be seen in conjunction with smart house entry systems.

ISO/IEC JTC 1, subcommittee 31

This parallel action is carried out in a committee between CEN and ISO works with biometric methods, for example for admission to buildings or other controls. This could be advantages for disabled people, but also represent challenges of understanding.

CEN TC 247

This committee standardises control devices for mechanical building services. These EN standards will include performance criteria to optimise the energy consumption in smart houses.

EN12098-1 Symbols for user interfaces to improve the operation of HVAC plants. The committee works in close co-operation with TC 205.

The committee has prepared prENV 13154-1 "Data Communication for HVAC Application Field Net; Part 1: Application Objects" and ENV 13154-2 "Data Communication for HVAC Application Field Net: Part 2: Protocols" to support the connection and application of open products and systems in a common communication network for smart house.

ETSI / IETF etc. W3C

Current developments show that within a decade, Internet will be integrated with smart house systems. Internet standards must therefore be adapted to be related also to standards that take into account smarthouse user aspects.

See Chapter 14.

CEN TC 293

This TC is about environmental control systems. It does not relate to smart house systems until now.

Expert appraisal

There are many similarities and overlaps between environmental control systems and smart house systems, and the standards of the two must be seen in connection. It is not recommended to install different systems with different interfaces and control units into smart houses with universal design of installations, because several installations and several interfaces makes the house complicated to use and expensive.

CEN TC 294

This TC works with remote control and metering of gas, water and electricity supply. The work started in 1991 and is still at the pre-standardisation stage.

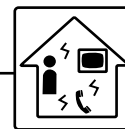
Expert appraisal

As managing energy resources is one of the most important consumer aspects of smart houses, the standards work going on in this area needs to be adapted to be integrated with the smart house applications.

In order to make energy savings a potential benefit of smart houses for property managers as well as for individual home owners, standards must be revised to recommend flexibility of use through availability of a variety of different user interfaces and control options.

Expert appraisal

Standards work in the Internet area is very technical and the development happens so fast that it is possible that user requirements must be introduced at a running basis into other organisations than the standards organisations. However, it is of utmost importance that universal design consumer issues are taken into account in the Internet developments.



COST 219 Bis

COST 219 has worked with universal design issues in telecommunications for many years. This European action has made guidelines for ICT products and systems, including smart houses, with regards to the requirements of elderly and disabled consumers. (See www.stakes.fi/cost219/smarthousing.htm).

Expert appraisal

The web site is very extensive and contains many useful links and useful information about Smart House issues, and it is recommended to read the guidelines in conjunction with this chapter. In addition it is recommended to make simpler Guidelines for planners and purchasers throughout a planning and implementation process. The Nordic project NORDICT also recommends this.

Other Activities and Developments

Convergence

This initiative is a European combined effort of European Installation Bus (EIB), European Home Systems (EHS) and BATIBus to reach an agreement for a common standard. The work was finished in 1999, and is now a fact.

EIB has the leading De Facto standard for bus systems in Europe, and has influenced this new standard to a great extent.

These developments may indicate easier and safer use of smart houses in the future, but we do not know how user aspects are being considered in the development, and which standards are able to keep abreast of the developments.

Expert appraisal

There is an urgent need for including user and design for all issues into these new and still inadequately converging developments.

Bluetooth Technology

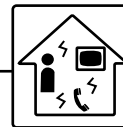
This technology converges computing and communications. It allows for the replacement of proprietary cables that connect one digital device to another with a short-range radio link. The first products with Bluetooth radios in them will be available in year 2000, and companies such as Ericsson, IBM, Intel, Nokia, Toshiba and about 200 others have signed up in a Bluetooth Special Interest Group. This may indicate that smart house systems could be one of the applications, and that standards for the inclusion of consumer interests will be considered.

IEEE Standard for High Performance Serial Bus

Which brings together IT and telecommunications, as well as the regions with their leading technologies.

Sun Microsystems` Jini

Many of the world's leading producers of technology are developing products with Jini codes. Functionally this means that we will have a mixture of broad-band information «pipes» and wireless high-speed data transfers that connect items in the house and office with each other and with the Internet. A radiofrequency net will broadcast throughout the house, independent of wires.



Output from Projects

User requirements identified in other projects
User requirements which have been identified in several EC and national projects focus on the following issues:

- safety
- security, easy access to personal help in emergencies
- comfort
- convenience
- independence
- social contact and communication
- energy savings

The TIDE project **HomeBrain** (TIDE Project number DE 3209) has analysed user requirements in relation to smart houses in the following projects:

ASHoRED
DEFIE
HS-ADEPT
BESTA
CASA

HOME SYSTEMS (1998, **HomeBrain** D2.3 Report on methodology for user needs research).

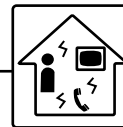
The conclusion in the project is that even though the projects used very different methods, all projects found that user requirements mainly

relate to the fact that everyone desires to stay in their own home for as long as possible. The surveys also showed that the user requirements were very similar no matter what the actual purpose of the project and regardless of nationality.

Another interesting finding is that the user requirements do not seem to vary during the eight years that the above projects span. Society and attitudes to technology may have changed during that period, but basic needs seem to remain the same.

A good user interface seems to be the single, most important user requirement. "Ease of use" of the actual product and system is another crucial point. The product must provide support to the user, i.e. the product must be operated intuitively and provide feedback to the users of various kinds (BESTA). Information is another important element.

This chapter does not refer specifically what each project has concluded. For additional information, include web site COST BIS 219, Guidelines for smarthouses. (See www.stakes.fi/cost219/smarthousing.htm).



User Requirements

General universal design issues

Smart house systems can be useful for many user groups. Installed in an ordinary house, it gives potential to adapt the house to changes in the resident's needs and functional capacity. There is a clear consumer tendency to start looking at the potentials smart house installations can offer in ordinary dwellings. But up till now, most smart house installations in Northern Europe are in commercial buildings, as well as in groups of houses built or adapted for elderly people or people with disabilities.

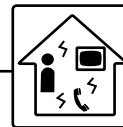
Smart houses offer potential cost benefits for society by making residents in need of care more safe and independent, and by optimising the personal care. New convergence developments can also enable them to manage many activities in connection with household appliances and entertainment.

Elderly people who move from their present home into a house with smart installations represent one of the biggest challenges of modern society. Usually they experience progressing age related changes in vision, hearing, sense of touch, mobility, reaction time and memory. Because of these changes, there is a fear of accidents and other problems that may arise when they live alone. Smart houses can also be of use and support in residential care units through helping the care personnel to know about accidents or other undesired situations.

Cognitively impaired people

Cognitively impaired persons may include psychologically handicapped persons, persons with a brain injury (for example after a head injury) or persons with dementia or psychiatric conditions. In this report we have not specified requirements for one user group that could benefit from smart houses, but where little or no experience is present: mentally handicapped persons that are moving out of psychiatric care into a more independent living situation. There is a need to define user requirements for this group, because they may benefit from smart houses.

The user requirements related to smart houses are mostly general, and apply to all users. The functions can easily be reprogrammed or other components or functions added. Therefore it is most important that the user requirements are defined in accordance with Design for All /Universal Design principles.



Locating and Physical Access



Home Environment

- The smart house represents entirely new ways of operating controls and appliances in the home. Confusing elements and unfamiliar components must be avoided in the home, for example “smart” light switches that look like something else.
- Provide a clear line of sight to the necessary elements.
- The control components must be placed in accessible positions for all users, preferably not in corners and at a certain height over the floor, but with esthetical considerations taken into account.
- The controls must be accessible for all the activities that are controlled by users of smart house systems.
- Lighting outside the house must be good and not give glare. High contrast.



Public Environment

- CEN TC 225, JTC1, subcommittee 31 sets standards for admission to buildings. Quite frequently public office buildings and other public buildings have smart house installations, but it is rarely up to the public to control them.
- In order to make them accessible for the work of all types of persons the same requirements as for a home apply in these environments.



Mobile Environment

- The smart house can be controlled from the outside via telecom or other media, and then the same requirements apply as for these, *See Chapters 6 and 9.*

Requirements

Standardisation

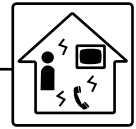


Physical

- Free and unimpeded access requires that all control units are located and designed in such a way as to be operable by wheelchair, walker or cane user (e.g. level floor surface) or by persons with reduced physical strength and reduced endurance.

Requirements

- Requirements are the same as for access to houses (life cycle standard)
- CENELEC TC 205 and CENELEC TC 105 and and ISO/IEC JTC1 SC31 must relate to smart house entries



Requirements

Standardisation



Auditory

- Acoustic signals must be audible by persons with reduced hearing, and visual or tactile alerts to be alternatives for deaf persons.

Requirements

- Standards within CEN TC 225 CEN and ISO/IEC JTC1 SC31 must be adapted to accommodate the needs of persons with auditory disabilities.



Visual

- Signs must have high contrast (e.g. white or yellow characters on a dark background) and illuminated]. For blind people it is required that other media is used for status information, for example a loudspeaker .
- Provide visually clear access to functionality (on / off).
- All interaction elements (e.g. keys) must be easily detectable and recognisable.

Requirements

- Standards within CEN TC 225 and ISO/IEC JTC1 SC31 must be adapted to accommodate the needs of blind and visually impaired people.



Cognitive

- Perceivable information is an important requirement, especially as smart houses are unfamiliar to most people.

Requirements

- Standardised and user tested symbols and terminology which is understandable to others than engineers must be requirements to be standardised for suppliers of smart house systems.



Dexterity

- If the smart house system requires manipulating controls to get access to the house, all this requires adapted and various different ways of handling the control.

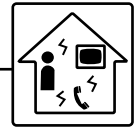
Requirements

- CEN TC 293 environmental control systems must be revised to make interfaces integrated with smart house systems.



Combination

- None identified



Physical Handling of Smart House Devices and Controls



Home Environment

- The components must be placed within easy access for people with all physical varieties and mobility modes, as well as auditory, visual and cognitive needs.
- Provide failsafe features.



Public Environment

- Only applicable in public buildings where persons work, because smart house installations are normally not handled by the public.



Mobile Environment

- Mobile devices can be used to manipulate and control environmental components in the home, so the same requirements apply here as for mobile telephones and other mobile equipment
- See Chapter 6.

Requirements

Standardisation



Physical

- Normally a smart house can substitute the need for handling controls in the home, but user requirements for universal use must always be present for manual options.

Requirements

- CENELEC TC 205 must include in their work user aspects and design for all related to the installation of smart house systems.
- Standardised interface must be developed for input devices across smart house systems and suppliers.
- Convergence of different modes for operation is recommended.

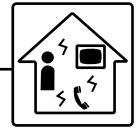


Auditory

- Handling also includes being able to hear alerts and alarms. All audio events (signalling, receiver and loudspeaker) should be presented in scaleable volume, and in visual displays or vibrating components, especially in dangerous situations.

Requirements

- Standardised interface to external amplification system is recommended.



Requirements

Standardisation



Visual

- All interaction elements must be easily detectable and recognisable, and logically distributed in terms of the interaction process. Display resolution and illumination should be adequate.
- Tactile markers for orientation on the keypad must be used. When new ICT is used to operate and handle controls of smart houses, they need to be accessible also through tactile media.

Requirements

- Standardised symbols e.g. for on-off, and standardised interface to external display system (e.g. TV, large display) should be developed.
- There is a need for standards for tactile markers.



Cognitive

- Simple, intuitive use and tolerance for error is important when operating a home, because implications of errors can be serious in an automated environment. This applies to operating controls as well as understanding and accepting automatic functions.
- All the interaction points must be easily detected and recognised. Flexibility for different mental models of how the house works must be accessible. In some cases the user cannot be expected to operate the smart house, but the system must be intelligent enough to do it for him when necessary.

Requirements

- Guidelines for ethical procedures to ensure informed consent and ethical use of technology to improve quality of life can be a European project, but need to be adapted to the legislation issues in each country.
- Develop standard guidelines and courses for electrical suppliers and installers in order to understand how to incorporate procedures for securing user needs into their planning and installations. This is a task for electrical contractors associations quality assurance systems, in close co-operation with potential planners and purchasers.

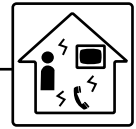


Dexterity

- In relation to assistive technology devices like environmental controls, these must be customised to each user if he is going to be able to control the house. Many functions can be automated to ease use, for example automated lights and heating controls or door and window openers.

Requirements

- CEN TC 293 is about environmental control systems, and needs to adapt their work to relate to smart house systems in order to be integrated and achieve added benefits for both systems.



Requirements

Standardisation

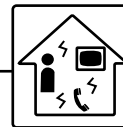


Combination

- The interaction elements should offer the possibility of multimodal feedback (acoustic, tactile and visible). Service help facilities available.

Requirements.

- Create common standards on interaction elements (shape, colours, feedback, dimensions...) for physical and screen controls and status feedback. Relate to ISO/DIS 13407.



User Interface (UI)



Home Environment

- UI must be consistent with user expectations and intuition.
- Arrange information consistent with its importance.
- Provide compatibility with a variety of techniques or devices used by people with sensory limitations.
- Discourage unconscious action in tasks that require attentiveness.



Public Environment

- If the public is required to operate smart house systems, make requirements for better public instruction panels.



Mobile Environment

- UI adjustable to individual needs (individualisation, user profiles).
- The UI must be consistent independently from environmental influences (e.g. type of mobile communications network).
- The UI of components used by mobile care workers must be easy to understand with logical and consistent user interfaces. *See Chapter 6.*

Requirements

Standardisation



Physical

- It is necessary to be able to operate the smart house system with as many different individually adapted user interfaces as necessary through a life time.

Requirements

- Make a list of standard basic installation of the most frequently used modes of control, with potentials for individual adaptations.

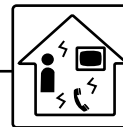


Auditory

- Optional provision of redundant presentation of visual and acoustic feedback when operating the system or in case of status messages or alarms.
- Scaleable volume is recommended on the auditory information providers. Human voices are preferred. Ensure low background noise.

Requirements

- CENELEC TC 100 X and TC 205 must include universal design into their work.
- Create standards on hearing aid coupling (inductive loops, possibility to plug in hearing aids).



Requirements

Standardisation



Visual

- The entire user interface must be adaptable so it is “readable” by a visually impaired persons.
- Do not invent “strange” new interfaces that have not been tested and evaluated with representatives for “all users”.
- Provide auditive feedback and possibilities for interface with speech control.

Requirements

- Develop standard visual and auditive displays for feedback of status and control messages in co-operation with human factors specialists and standardise trials methods with users representatives. These ideas for standard interfaces and pictograms must be accessible by all suppliers and systems.



Cognitive

- Option for no operations being expected by the user.
- Simple and intuitive use. Use established graphical symbols for common functions.
- Use consistent and distinguishable UI layouts for different applications. Tolerance for error. Consistency of UI across systems and suppliers.
- Provide continuous feedback during operation. Avoid confusing information or too much information at once.

Requirements

- Continue co-operation between CEN, CENELEC and ETSI on these issues. This is recommended for a specific European standards project:
- Create standards on UI symbols for smart houses.
- Create standards on feedback typology for all major user groups.



Dexterity

- User interfaces that require small manipulations will be a problem to many users, especially older ones.

Requirement

- Provide standard choice of different interfaces, individually adapted.

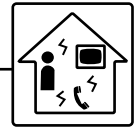


Combination

- Follow the Universal design guidelines for all UI.

Requirements

- User tests of interfaces must be carried out before putting them on the market.
- ISO/DIS 13407, a specific project is recommended under the IST Programme: Human centered design of processes for interactive systems.



Operation



Home Environment

- Consistent dialog requirements between home and alarm centre or home care service.
-



Public Environment

- Standardised modes of communication and operating alarm messages and potential remote control. CLC/TC 79 needs to include this in their work.
-



Mobile Environment

- Same requirements as for Mobile communications.

Requirements

Standardisation



Physical

- Requirements for the control devices, like environmental controls

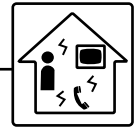
Requirements

- It is necessary to integrate the work on standards for Environmental controls; CEN TC 293 and work on standards for smart houses.
 - Consumer issues must be included in the work of CENELEC TC 205
-



Auditory

- Operations should be possible without auditory alerts, but visual or tactile



Requirements

Standardisation



Visual

- Operations must be possible without visual alerts and feedback. For example, use voice messages and/or tactile input prompts or biometric systems. As it is common to display status feedback on a display in the home, these must be designed to accommodate visual impairments by standardised signs with accompanied text (in national language) displayed in sufficient size and placed in close context with where the user is most likely to notice it. Auditory alerts help.

Requirements

- Include consumer issues in the work of CEN TC205



Cognitive

- Here are special requirements because many elderly people and people with cognitive dysfunction find smart houses entirely new and unfamiliar. Therefore the principles for universal design are even more important for these user groups than for "all".
- Use the necessary minimum of new and unfamiliar information and operations.
- There has to be sufficient time to understand and react, and user support is particularly important. One requirement is that there should always be a manual option to operating elements of a smart house, for example a light switch.
- Prompts should be recognisable, clear and unambiguous.

Requirements

- Continued co-operation between CEN, CENELEC and ETSI on the standards or recommendations for different modes of operating smart houses, taking non-proficient users into consideration.



Dexterity

- Make different modes for operation, some that do not require dexterity, or with large and easy to manipulate controls

Requirements

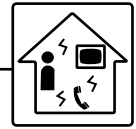
- It is recommended to integrate the work on standards for Environmental controls; CEN TC 293 and the work on standards for smart houses.



Combination

- Universal design principles, particularly flexibility in operation

- Include Design for All issues into TC 79 work.



Adaptation to User Profile



Home Environment

- Make individual adaptation to the different residents' needs and desires. The basic installation must be flexible enough for these options afterwards and as users needs change.
- Modularity is important; and standard procedures for periodically adapting the system and the service.



Public Environment

- Not many public spaces have possibilities for adaptations of the smart house installations, but in some working places it may be necessary.



Mobile Environment

- Provide possibilities for adapting the remote operation of functions in the house to individual profiles.

Requirements

Standardisation



Physical

- For example, provide flexibility through integrating the smart house with environmental controls, or by providing automatic functions as much as possible and desired by the user.

Requirements

- Necessary integration of work on standards for Environmental controls; CEN TC 293 and standards for smart houses.
- Develop standard requirements for the basic functions a house must have, and where they are placed in the building to provide flexibility. CENELEC TC 205 must take on this responsibility.

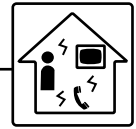


Auditory

- For example, provide a choice between visual or tactile feedback, and/or with possibilities for varying the volume. Adaptation to hearing aids must be possible.

Requirements

- Additional auditory signals in dialogues are recommended. Create standards for interface between hearing aids and smart houses.



Requirements

Standardisation



Visual

- Visual alerts and feedback needs to be visually adaptable for varying visual abilities, as well as auditory and tactile modes of operation and response. Flexible basic installation must allow for these adaptations.

Requirements

- Ensure standard interface between smart houses and assistive technology. Co-operation between CENELEC 205 and CEN TC 293 is recommended.



Cognitive

- Provide options for different requirements for persons who cannot understand how to operate the smart house themselves. Some may require that the house is so smart that it looks after them. Ethical implications are present in case of surveillance. Hazardous elements must be eliminated, isolated or shielded.

Requirements

- It is necessary to develop procedures for ensuring legal issues, informed consent and other issues in connection with cognitive dysfunction and surveillance, for example for people with dementia. This could be discussed in a CEN/ISSS or ICTSB workshop.



Dexterity

- Require options for input, for example through voice control or other environmental control systems.

Requirements

- Recommend necessary integration of standards for Environmental controls; CEN TC 293 and standards for smart houses.

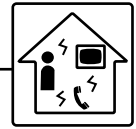


Combination

- All requirements from universal design can be applied to individual adaptation.

Requirements

- Include procedures for ensuring universal design in all standards relating to users and consumers.



Security of Operation



Home Environment

- The system must be fail safe and easy to learn.



Public Environment

- The system must not be accessible to undesired users that can put it out of function.



Mobile Environment

- As for Mobile communications.

Requirements

Standardisation



Physical

- Provide individually adapted operation mode to give security of operation, despite physical dysfunction.

Requirements

- CEN TC 247 and EN 12098-1.
 - CENELEC TC79 for social alarm systems.
 - CENELEC standard prEN 50134 1-2, 1993E.
- All these working groups must adapt their work to smart housing issues.



Auditory

- Require understandable alerts, for example louder, in relevant positions, visual or tactile.

Requirements

- Develop standard adaptation to hearing aids.
- CENELEC TC79 to include the issues.

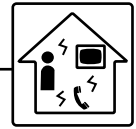


Visual

- Provide different modes of operation without seeing, for example speech input and output or bio-metric prompts.

Requirements

- CEN TC 225 (bar codes), and ISO/IEC JTC1 SC31 sets standards for biometrics, for example for admission to buildings. This must be adapted to be combined with smart house standards work.



Requirements

Standardisation



Cognitive

- Confusion can lead to insecure operation., therefore it is particularly important that the system is easy to understand and error safe. Controls with dangerous implications must be kept out of reach of users with cognitive dysfunction.



Dexterity

- Replace PIN by biometric identification (e.g. fingerprints or bar code).

Requirements

- CEN TC 225, and ISO/IEC JTC1 SC31 sets standards for biometrics, for example for nurses or alarm personnels admission to buildings. This must be combined with smart house standards work.

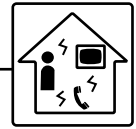


Combination

- Service and maintenance

Requirements

- Require quality assurance for work by electrical contractors associations and planners.



Issues not Covered by the Tables

Automatic smart house functions

There are some smart house functions that do not fit into the above tables, but still represent some of the main advantages of smart houses with regard to universal design.

These functions do not require action from the user, but the system carries out the necessary functions automatically upon messages from other components in the smart house system. An example is a fire alarm that is set off by the smoke detector in the house, automatically sending a message to the fire department, opening all entrances and turning on the lights to make evacuation easier, and sending a message to the home care service.

Another example is lights and heating being automatically turned off of when there is nobody present or when the person leaves the house, for energy savings purposes. Remote control and metering of energy supply are advantages that all users are interested in, regardless of their functional level.

Programmable flexibility

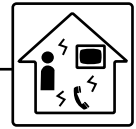
The modularity of smart house systems makes it easier to achieve flexibility. This is important because it makes the house easily adaptable to individual changes and new needs. This is easier to achieve if there is interoperability between smart house systems, and between different suppliers within the same system. The programming is normally done on a PC, stationary or portable, or by a mobile or Internet telecommunications system. This requires the same standardisation issues as chapter 7 and chapter 14 and 10.

Alarm services connected to smart houses

When smart house installations are used for elderly and disabled people, it requires a chain of services that connects the alarms in the house with the home care service and an alarm centre. There are specific requirements for this

transmission and how the interaction functions between the residents and the helpers.

- A standard interface between alarm systems and smart house systems must be developed.
- Different actors should be alerted for different accidents.
- The messages must be differentiated in order to help the carers to act relevantly and quickly.
- It is particularly important that the alarm system and the smart house system functions in a fail safe way.
- The alarm reception must be operated on a 24 hour basis.
- There must be a contract between the user and the alarm centre that specifies what can be expected, for example maximum how long the user can be expected to wait for a response and how long they can be expected to wait for a visit in an emergency.
- There is a need to always be an open two-way communication between the alarm receiver and the alarm giver when an alarm is activated.
- There must be active, as well as passive alarms available.
- There must be regular maintenance and service of the system.
- Safety alarms need to be a natural part of an installation, which is covered by the public social service.
- Alarms must not mean reduced personal and social contact for the user, but optimise the personal contact by taking away some of the chores of controlling the user.
- Alarm presentation must be standardised. This is both with regard to alarms in buildings and in control centres. Alarm presentation includes choice of media (visual, acoustic) signal characteristics (intensity, pitch, duration) and presentation (e.g. symbol, message, etc).
- Alarm handling techniques such as grouping of alarms, alarm prioritisation needs to be standardised.



Conclusions

The conclusions, challenges and recommendations of the ICTSB Consumer requirements project in relation to Smart Housing issues and standardisation are seen in relation to today and in relation to the future. The conclusions are divided into:

- standards work areas
- codes of practice
- research and development work required
- inclusion of consumer influence

Standards Work

CENELEC TC 205, 122, 215

Combine the work of CEN TC 293 with CENELEC TC 205 to standardise the interface between assistive technologies (for example IR environmental control systems) and ordinary consumer products on one hand and the smart house systems on the other.

Develop standardised links between the smart house installations and the alarm centres and the system for ambulant care through co-operation with TC 79.

It is necessary to sort out which issues from the Consumer Report and which recommendations must be dealt with by TC 205 and TC 215 working groups respectively. The recommended issues are:

Recommendations within TC 205

Create consistent user interface
Standardise user interface of smart house systems
Make smart house systems interoperable
Require upward compatibility of systems
Create standard choice of different interfaces, individually adapted
Provide failsafe features and manual override systems
Create standards on feedback typology for all major user groups.
Develop standard requirements for which basic functions a house must have, and where they are placed in the building to provide flexibility.

The issues are primarily placed within the CENELEC and CEN areas, but in all parts of smart house systems that require medias for communications within the house or to the outside, ETSI standards are of importance.

Recommendations to be sorted out within TC 205 and TC 215

Require flexibility and modularity
Develop standardised installation aspects
Provide centrally placed and easily accessible technical centre in the house

The components must be placed within easy access for people with all physical varieties and mobility modes, as well as auditory, visual and cognitive needs. Standard height for hidden conduits.

Provide sufficient room for extra components and extensions for electricity and ICT in the technical centre

Hide conduits to windows and doors for electricity for control or alarms

Within TC 122

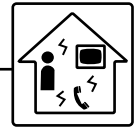
Create standardised interface to control and input devices across smart house systems and suppliers

Convergence of different modes for operation

Within other TCs

Standardised symbols e.g. for on-off.
Standardised interface to external display system (e.g. TV, large display).

Adapt standards on interaction elements (shape, colours, feedback, dimensions...) for



physical and screen controls and status feedback. Relate to ISO/DIS 13407.

Standardised and user tested symbols and terminology which is understandable to others than engineers must be requirements to be standardised for suppliers of smart house systems.

Adapt standards on UI symbols for smart houses, like metaphors, icons, navigation. (ISO 10646).

Include standards for good lighting in smart house standards, (co-operate with CENELEC TC on lighting)

CENELEC TC 79

CENELEC TC79 for social alarm systems. Include Design for All issues into TC 79 work. Adapt CENELEC standard prEN 50134 1-2, 1993E.

Provide standard adaptation to hearing aids.

CENELEC Mandate 273

CENELEC Mandate 273 is recommended to be co-ordinated with TC 79. There may be other relevant areas within TC79, especially because integrated alarms and transmission of these into other alarm systems is one of the main aspects that relate to smart house technology for universal design purposes. In addition, assistive technology needs to be integrated into the requirements in order to allow disabled persons to send alarms.

CENELEC TC13, IEC TC13 and CEN TC 294

Include smart house issues into their work on control and metering of gas, water and electricity supply. Make these issues easy to understand and use for consumers.

CENELEC TC 100 X and TC 206

Adapt standards to require audio/video and other entertainment systems to be compatible with smart homes. Create standards on hearing aid coupling coupling (inductive loops, possibility to plug in hearing aids).

CEN TC 225, and ISO/IEC JTC1 SC31

Include user issues in standards for admission to buildings and include smart house issues.

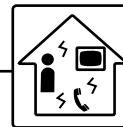
CEN TC 247 and EN 12098-1

The TC and the standard must include users issues in their work on energy savings systems.

Future standards

Future standards must be influenced to enable all users to take advantage of new developments in the area of wireless and Internet applications in the smart home, outside the home and in other buildings. Entirely new paradigmas will put new demands on the users, and this is why their needs must be included in the convergence related development and standards in Europe, US and Asia. Wireless media will dominate the smart house communications systems, for example with power line, wireless, radio frequency, Internet and coaxial cables. All these have their own standardisation issues and varying degrees of open standards. A strategic plan for how user requirements are integrated in the future developments must be made. This plan must include and converge standards in relation to digital services and products.

Technical developments are faster than the standards work, and the standards increasingly belong within several areas; CEN, CENELEC and ETSI, and depend on standards within IEC and ISO, and for example Asian standards. It is recommended that the co-operative activities that have started within ANEC and ICTSB are intensified. A special meeting of officials of all TCs involved must be arranged by ICTSB.



Codes of Practise

Some of the recommendations are the responsibility of the planners, some of the electrical suppliers and contractors or their organisations.

Identify and manifest minimum quality guidelines and courses for electrical suppliers and installers in order to incorporate procedures for securing user needs into their planning and installations. This is a task for electrical contractors associations quality assurance systems, in close co-operation with potential planners and purchasers.

Make standard recommendations for ensuring reliability and maintenance and recommend service contracts with clear division of responsibilities.

Develop guidelines and procedures for ensuring legal issues, informed consent and protect against invasion of privacy in connection with cognitive dysfunction and surveillance, for example for people with dementia. This is an issue for legislation.

Develop procedures for standard and compulsory quality assurance and user testing before putting new components into use. This is a task for electrical contractors associations.

Develop standard procedures for testing systems after installation and before actual use. This applies to all elements and functions of the system, and the installer as well as the users must be present and go through the installation with "hands on" experience. This must be the responsibility of the electrical contractor and installer.

There must be standard procedures for service and periodic maintenance, and clear lines of responsibility. This is a task for electrical contractors associations.

Research and Development Work Required

Develop guidelines for identifying and ensuring universal user needs as well as individual user needs and requirements at each step in the process of planning and implementing smart house systems. Such a project is urgently recommended and must build on existing experience with implementations and users.

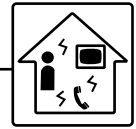
Create standard visual and auditive displays for feedback of status and control messages in co-operation with human factors specialists and standardise trial methods with users representatives. These ideas for standard interfaces and pictograms must be accessible by all suppliers and systems. They must relate to and be included into ETSI, CEN and CENELEC issues.

This is a clear task for suppliers and developers

of the technology, in conjunction with the standards developments.

Evaluate how existing, simple light switches are designed to enable people who are unfamiliar with "smart" designs on switches to turn on the light manually in a smart house without learning entire new controls and smart fixtures. The results must be design recommendations for the manufacturers.

In order to raise the safety, security and efficiency issue of using smart housing alarms to help look after people in care housing, a project must sort and standardise the user aspects of the connections and interfaces between smart house systems and alarm services. To be seen in conjunction with standards work in CENELEC TC 79.



Ethical issues of surveillance must be discussed in a European workshop, for example organised by ICTSB, but needs to be adapted to the legislation issues in each country.

Targetted projects are recommended on European level, in conjunction with ISO/DIS 13407

Make a list of standard basic installations of the most frequently used modes of controlling the smart house, with potential for individual adaptations. This could be a project or national organisations task.

Inclusion of Consumer Influence

Recommend co-operation between consumer organisations and standards organisations.

Require cost transparency upon planning and buying smart house systems.

Final Conclusion

The flexibility that smart houses can offer make universal design desirable for all users through a life time, therefore standards work is particularly important for future homes and other buildings.

The work being done in CEN, CENELEC and ETSI must be integrated with the developments of codes of practice and recommended research projects and consumer involvement.

ICTSB has tried to monitor the work and ensure proper co-ordination of the work done in the respective organisations and report back to ICTSB, but so far very little progress has been made. This is particularly important in the smart house area, because smart house standardisation and developments are indeed complex and the concerns of many organisations and many related technologies.

Chapter 16

Annexes

Annex 1

Addressing the Needs of the Elderly and of People with Disabilities in Standardization Work

Draft ISO/IEC Policy Statement

Introduction

It is important for the whole society that all people have access to products, services and environments. The importance of accessibility was recognized when UN member states signed the UN Standard Rules on the Equalization of Opportunities for Persons with Disabilities and the UN Principles for Older Persons. The situation has become more critical with the increasing percentage of elderly people in the population worldwide. While not all the elderly have disabilities, the prevalence of disability is highest amongst this demographic group.

The increasing prevalence and complexity of technology in everyday life presents both opportunities and challenges. So that the elderly and people with disabilities may participate in society on equal terms, it is necessary to improve the accessibility of products, services and environments. Improved accessibility further enhances the quality of life and reduces discrimination.

The advantages of greater accessibility extend to other domains, as well. Accessible products, services and environments will be used by a larger group of people, so economies of scale can be attained. Moreover, products that meet the essential requirements of these consumers will generate an increase in world trade, as goods become more user-friendly for the entire population. This, in turn, will benefit society as a whole. An illustration of this principle can be found in the development of the remote control for the television set, which came out of improvements made to assist people with disabilities.

Including the requirements of these groups of people at the early design stage will enable producers to design and produce more products and services that more people can use, at little or no extra cost.

Standardization greatly influences the design of products and services that are of interest to the consumer and can therefore play an important role in this field. The elderly and people with disabilities are important user and consumer groups. However, their needs have not been adequately addressed when standards are made or revised. Standards that take into account the needs of these users will have much greater market relevance and help to make products and services more accessible and usable for ALL.

In addition, the use of visual, auditory or tactile signals (such as raised dots, notches, sounds, pictograms or graphical symbols) should be standardized so that any one signal will convey the same meaning to users worldwide. This concept has generated a “de facto” standard for numerical telephone keypad orientation and a raised mark on the central 5 key, which are understood and used in the same way throughout the world.

ISO and IEC recognize the need to include the requirements of the elderly and people with disabilities in all relevant standards production and revision work. This can clearly be achieved by following the basic principles of:

- Universal and Accessible Design;
- direct consumer representation of the elderly and people with disabilities; and
- relevant information exchange.

What is Accessible Design?

“Accessible Design” is the term used for the process of extending mass market product design to include people who, because of personal characteristics or environmental conditions, find themselves on the low end of some dimension of performance (e.g., seeing, hearing, reaching, manipulating). Accessible Design is not – or should not be – separate from standard mass market design. Rather, it is an extension or elaboration of general design principles to cover a wider range of human abilities or limitations than has traditionally been included in designing products, services and environments.

Thus Accessible Design is a subset of Universal Design 2 . Where the term Universal Design covers the design of products for all people and encompasses all design principles, Accessible Design focuses on principles that extend the standard design process to those people with some type of performance limitation (the lower ability end range of Universal Design).

Accessible Design is a balancing act. To begin with, we must acknowledge that it is not possible to design everything so that it can be used by everyone. There will always be someone with a combination of severe physical, sensory and cognitive impairments, who will not be able to use any one specific product. However, it is equally unreasonable to rely on the existence (or development) of special designs for each major product category, to accommodate each and every one of the immense variety of disabilities and combinations of disabilities.

Therefore, it is necessary to envisage a combination of approaches to meet the needs of people with disabilities, ranging from the incorporation of features that will make products more widely and directly usable (“from the box”) to the inclusion of features that make it easier to modify products for accessibility.

For example, Accessible and Universal Design can be achieved for many information technology products by bundling together separate components into customized solutions, using standard hardware and software interconnections.

Policy recommendations

Standards bodies are encouraged to consider that the elderly and people with disabilities have market relevance, and to adopt the following recommendations in developing policies and strategies, so as to include their needs in all relevant standards production and revision work.

a) Promotion of Universal Design and Accessible Design

Standards bodies should:

- promote standardization work to ensure that products, services and environments are available, accessible, usable and safe for all consumers, including the elderly and people with disabilities, and adopt the general concepts of Universal Design and Accessible Design (presented in the introduction to this statement) when developing and revising standards;
- raise awareness and provide information for standards developers on the issue of accessible design;
- coordinate between the standards committees dealing with mainstream products and those with responsibility for technical aids and accessibility standards for the elderly and people with disabilities;
- increase the availability of standards and information products in accessible formats;
- promote the standardization of specific features or adaptations, where they exist, to make products/services more accessible and usable;
- promote to non-standards-developers the benefits that can be obtained through the use of guidelines provided in documents such as the ISO/IEC guides related to the elderly and people with disabilities.

b) Consumer representation of the elderly and people with disabilities in standardization work

It is important for standards bodies:

- to ensure the direct participation of the elderly and people with disabilities, as consumers, in the standardization process;
- to provide these representatives with the guidance and/or training they require concerning the standardization process, and to ensure that meetings and committee documents are accessible.

c) Links between research programmes and standardization

Standards bodies should promote:

- cooperation and information exchange with research programmes on accessibility issues;
- the use in standards work of the results of existing research in:

- technical research programmes in ergonomics (including those taking into account the full range of abilities of the elderly and people with disabilities) to provide basic information for standardization in the relevant fields;

- technical research programmes related to product/service accessibility, in order to more adequately address, in standardization, the needs of the elderly and people with disabilities.

1 Guidelines for the design of consumer products to increase their accessibility to persons with disabilities or who are aging; Trace R&D Center of University of Wisconsin – Madison, 1992.

2 “Universal design is the design of products and environments to be usable by all people, to the greatest extent possible, without the need for adaptation or specialized design”; the North Carolina State University Center for Universal Design.

Annex 2 The seven principles of Universal Design

Source: The Center for Universal Design at North Carolina State University:

1. *Equitable use*: The design is useful and marketable to any group of users.

- Provide the same means of use for all users: identical whenever possible; equivalent when not.
- Avoid segregating or stigmatizing any users.
- Provisions for privacy, security and safety should be equally available to all users.

2. *Flexibility in use*: The design accommodates a wide range of individual preferences and abilities.

- Provide choice in methods of use.
- Accommodate right- or left-handed access and use.
- Facilitate the user's accuracy and precision.
- Provide adaptability to the user's pace.

3. *Simple and intuitive use*: Use of the design is easy to understand, regardless of the user's experience, knowledge, language skills or current concentration level.

- Eliminate unnecessary complexity.
- Be consistent with user expectations and intuition.
- Accommodate a wide range of literacy and language skills.
- Arrange information consistent with its importance.
- Provide effective prompting for sequential actions.
- Provide timely feedback during and after task completion.

4. *Perceivable information*: The design communicates necessary information effectively to the user, regardless of ambient conditions or the user's sensory abilities.

- Use different modes (pictorial, verbal, tactile) for redundant presentation of essential information.
- Provide adequate contrast between essential information and its surroundings.

• Maximize "legibility" of essential information in all sensory modalities.

- Differentiate elements in ways that can be described (i.e. make it easy to give instructions or directions).
- Provide compatibility with a variety of techniques or devices used by people with sensory limitations.

5. *Tolerance for error*: The design minimizes hazards and the adverse consequences of accidental or unintended actions.

- Arrange elements to minimize hazards and errors; most used elements, most accessible; hazardous elements eliminated, isolated or shielded.
- Provide warnings of hazards and errors.
- Provide fail safe features.
- Discourage unconscious action in tasks that require attentiveness.

6. *Low physical effort*: The design can be used efficiently and comfortably and with a minimum of fatigue.

- Allow user to maintain a neutral body position.
- Use reasonable operating forces.
- Minimize repetitive actions.
- Minimize sustained physical effort.

7. *Size and space for approach and use*: Appropriate size and space is provided for approach, reach, manipulation and use regardless of the user's body size, posture or mobility.

- Provide a clear line of sight to important elements for any seated or standing user.
- Make reach to all components comfortable for any seated or standing user.
- Accommodate variations in hand and grip size.
- Provide adequate space for the use of assistive devices or personal assistance.