KEYNOTE SPEECH

MAKING THE CASE FOR ACCESSIBILITY
NEW DIRECTIONS, NEW POSSIBILITIES

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Abstract: Technology is accessible if it can be used just as effectively by people with disabilities as it can by those without. Many people are surprised to learn just how much of the world's population is affected by a disability, and how valuable accessible design is to government, private industry, and educational institutions.

To understand the impact, one has to look no further than the World Health Organization which indicates that people with disabilities are the world's fastest growing minority group. With the world's population aging and the likelihood of developing a disability or other mobility limitations increasing with age, the growth in the number of people with disabilities can be expected to rise dramatically.

An inclusive and universal design approach to technology is critical to organizations wishing to serve the disabled population, and to tap into the many possibilities now made available through advancements in assistive technology.

The purpose of this paper is to review current and pending Worldwide Electronic and Information Technology (E&IT) accessibility trends, regulations, standards and guidelines and understand their impact on the end user. The objective is to identify and analyze significant issues, risks and opportunities and to develop recommendations to assist E&IT decision makers in planning and positioning so that they can take advantage of opportunities.

This paper will provide a baseline for monitoring trends in each of these areas and a repository of legislation, regulations, standards, guidelines and best practices to guide E&IT researchers in making decisions with regard to the accessibility of E&IT products, programs, services and information.

Keywords: Accessibility, usability, assistive technology, best practices, guidelines

SESSION 1

TERRAIN ANALYSIS FOR BLIND WHEELCHAIR USERS: COMPUTER VISION ALGORITHMS FOR FINDING CURBS AND OTHER NEGATIVE OBSTACLES

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Abstract: We are developing computer vision algorithms for sensing important terrain features as an aid to wheelchair navigation. These algorithms interpret the visual information obtained from images collected by video cameras mounted on the wheelchair. This paper focuses specifically on computer vision algorithms for detecting curbs and other *negative obstacles* (i.e. anything below the level of the ground, such as holes and drop-offs), which are important and ubiquitous features on and near pavements (sidewalks) and other walkways. The algorithms we are developing combine depth information and monocular intensity cues obtained from stereo video cameras (i.e. pairs of cameras mounted close together), since either form of information is unreliable when used alone. We demonstrate experimental results on images of sidewalks photographed from a wheelchair.

Keywords: Blind, visually impaired, wheelchair, assistive technology, computer vision, curbs, obstacle detection.

BIOMIMETIC SPACE-VARIANT SAMPLING IN A VISION PROTHESIS IMPROVES THE USER'S SKILL IN A LOCALIZATION TASK

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Extended Abstract

Since the pioneering work of Bach-y-Rita in the 60's (Bach-y-Rita, 1969), much progress has been made in the field of sensory interfaces. Their capacity, however, remains restricted. The largest available interface developed to date hardly reaches 1000 stimulation points (VideoTact, ForeThought Development Ltd, undated), while a standard webcam is composed of 80000 pixels. Therefore, the need to reduce the amount of information coming from the video-camera is critical when designing a visual prosthesis.

Recent advances in the comprehension of visual perception in terms of sensorimotor contingencies (O'Regan & Noë, 2002) as well as knowledge of signal processing in the early visual system (Hérault & Durette, 2007) provide new pathways to explore this question. Image sampling in the human visual system is highly non-uniform. Photoreceptor density strongly decreases with eccentricity (Osterberg, 1935) in accordance with a law which is compatible with the Log-Polar retinotopic transform of the primary visual cortex (Schwartz, 1977). This can be considered as a means of reducing the number of neural fibres while keeping good resolution where it is most useful. The human visual sampling scheme may also be understood as a means of enhancing sensorimotor coupling: it involves a linear link between the movement of optic signals in the retina and "time to contact" with the object. In addition, it gives sampling rate invariance with respect to forward movement (see e.g. Hérault & Durette, 2007).

In this experiment presented in this paper, we tested the hypothesis that a 'retina-like' sampling pattern can improve the efficiency of a visual prosthesis. Subjects wearing a visual-auditory substitution system were tested for their ability to point at visual targets. The test group (retina-like sampling), performed significantly better than the control group (uniform sampling). The pointing precision was enhanced, as was the speed of finding the target. Surprisingly, the time required to complete the training was also reduced, suggesting that this space-variant sampling scheme facilitates the mastering of sensorimotor contingencies.

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EXPERIMENTS IN VIRTUAL NAVIGATION AS A STEP IN THE DEVELOPEMENT OF A NAVIGATION TOOL FOR BLIND PEOPLE

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Abstract: This paper introduces a formalized definition of an external space representation and proposes a virtual navigation paradigm as a means of space integration from tactile snapshots. Rules for the design of indoor experimental environments to be used in virtual navigation are presented; they take into account posture modifications of the subject and the cognitive load of the elementary tasks inherent to physical navigation.

Keywords: Blindness, tactile representation of space, virtual navigation

BODY MOUNTED VISION SYSTEM FOR VISUALLY IMPAIRED OUTDOOR AND INDOOR WAYFINDING ASSISTANCE

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Abstract: The most challenging issue relating to assistive navigation systems for visually impaired people is the instantaneous and accurate spatial localization of the user. Most of the previously proposed systems based on GPS sensors have insufficient accuracy for pedestrian use, can only be used outdoors and often fail in urban areas. This paper presents an interesting alternative localization algorithm using a body mounted single camera. Instantaneous accurate localization and heading estimates of the person are computed from images as the trip progresses along a memorised path. An initial portable prototype has been tested for outdoor as well as indoor pedestrian trips. Experimental results demonstrate the effectiveness of the vision based localization system for keeping the walker in a navigation corridor less than one meter width along the intended path. Future work will investigate the use of multimodal adaptive interfaces, which take account of psychological and ergonomic factors for blind end-users, in the design of a suitable guiding solution for blind and visually impaired people.

Keywords: personal localisation and heading system, navigation assistance, blind people.

SESSION 2

IMPROVING SOCIAL LIFE AND COMMUNICATION OF PEOPLE WITH DISABILITIES BY USING INTERNET FACILITIES

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Abstract: This paper presents a number of European initiatives developed within the Socrates Programme to provide support for disabled people to use new technologies. The disadvantages of the existing software designed for visually impaired people and the criteria that have to be considered in developing virtual learning applications for visually impaired people are discussed. The paper includes a proposal for improving existing software for searching for information and use in communication by disabled people, the first version of the FORThSIGHT Programme, developed in the framework of a Grundtvig 2 Learning Partnership.

Keywords: e-learning, new technologies

TOWARDS A METHODOLOGY FOR EDUCATING STUDENTS WITH SPECIAL NEEDS

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Abstract: Educating people with special educational needs (SEN) is a hot topic these days. Many multimedia educational tools have been developed with the support of ICT to assist children receiving SEN education. Teaching supported by new technologies should guarantee contents accessibility. However, these tools are not 100% suitable because the adaptation process they implement does not take into account all of the pupils' educational needs. In this article, we argue that SEN teaching can be improved by a) better curriculum adaptations, and b) a better definition and use of accessible multimedia tools. We also consider that it would be helpful to use semi-automatic tools to help educators to create or select adapted programmes of study for pupils with SEN. We present a framework to support teachers and the developers of multimedia educational tools in educating SEN pupils and the application of this framework in *Proyecto Aprender* (Learn Project).

Keywords: E-learning, web accessibility, software accessibility, education.

SOCIALLY INCLUSIVE eLEARNING MODELS IN COMPANIES

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Abstract: This paper considers the different factors involved in developing socially inclusive eLearning models to aid disabled people in improving their working lives and to facilitate their integration into small and medium sized companies (SMEs) or other organizations. Two international cooperation projects that have the main aim of developing and implementing eLearning models for disabled people who work for different SMEs and for groups of SMEs with similar profiles, within virtual communities of practice, are presented as an example.

Keywords: eLearning, eInclusion, eLearning models, virtual communities.

INCORPORATING ACCESSIBILITY WITHIN PEDAGOGICAL ENVIRONMENTS

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Extended Abstract

Accessible solutions are required by anyone who requires assistance in using the mainstream solution. This could be because a user is dyslexic, blind, visually impaired, or impaired in some other way, but increasingly this is age-related. Accessible solutions can range from small assisted applications (such as a screen magnifier), to full-scale operating systems and screen reading environments. The traditional problem with accessible solutions is that they are normally implemented as an afterthought or piggy-back solution. This results in solutions which are not fully integrated (or not well integrated) with the mainstream solutions. These independent applications are then at a disadvantage when software versions or operating systems are updated. In order to make this integration process easier, and provide more intuitive designs for the future, it is essential that “Design for All” and accessible design methodologies are widespread. Standards, policy and legislation also help ensure that accessibility designers have a solid standard to meet to ensure future-proofing.

There has been a decline in the teaching of Braille music to visually impaired children in recent years. In order to revitalise interest in Braille music, better pedagogical models must be utilised which incorporate Braille music into the musical curriculum in countries across Europe. One of the essential components in achieving this is the integration of Braille music production methods with current pedagogical technologies to ensure that Braille music representations are always close to hand in the same environment as mainstream representations. In order to revitalise the teaching of music in accessible formats, a pedagogical model has to be adopted which injects life into the dwindling communities of teachers, users and students who use music in alternative formats.

The i-Maestro project will utilise and improve upon current standards related to music education. The project aims to explore a unified educational model to maximise efficiency, motivation and interests in the learning processes and to contribute to :

- the deployment and improvement of ISO MPEG-SMR (Symbolic Music Representation) to support music education,
- the implementation of music notation/representation into MPEG-4,
- the production of guidelines on how music tuition courseware can be implemented in standard tools and models for distance learning.

The main technical objectives of the projects include: basic research and development of new solutions and enabling technologies to support traditional pedagogical paradigms for music training; novel pedagogical paradigms, such as cooperative-working, self-learning and class study, with a particular focus on Symbolic Training paradigms and Practice Training paradigms for string instruments, exploring interactive, gesture-based, and creative tools; and a framework for technology-enhanced music educational models and tools to support the creation of flexible and personalisable e-learning courses to improve accessibility to musical knowledge.

The outcomes will be validated through a set of tools and methodologies including:

- tools and methods for music courseware production;

- interactive and creative tools for instrumental training in different environments such as classrooms and cooperative work, on different devices such as PC and Tablet-PC;
- assessment and pedagogical models for music training.

DEDICON are responsible for the accessibility aspects of the project which aims to build on previous work in the area and incorporate accessible music solutions within cutting edge music education environments. Work is currently underway on a a state of the art analysis of user requirements, file formats, standards and technologies for accessible music tuition. It is intended that this will enable the field of accessible music learning to be established to such an extent that analysis of the accessibility issues and their impact on music education for regular learners and those with special needs can be made for the i-Maestro project. The assistive technologies relating to accessible music and accessibility in general (Sonification, screen readers, gesture and posture analysis, alternative representation and devices, zooming, spoken music, etc.) are overviewed to that the technology will be available for incorporation in technologies that are developed in the other work packages of i-Maestro.

The project aims to create author-ware for lesson packages; this requires consideration of the many aspects of accessibility relating to the content, the software and the music excerpts used. This section overviews what is required to create environments which offer solutions for Accessible Music Education, and what tools are available to assist in the creation of these environments.

There are three groups of accessibility choices for learners defined within AccessForAll:

1. Display (how the user interface and content should be presented)
2. Control (alternative ways of controlling a device)
3. Content (specification of auxiliary, alternative or equivalent content requirements).

From the state of the art, information specific difficulties in learning music from the user perspective can be detected to enable these modalities to be incorporated within i-Maestro technologies, and this can feed back into the i-Maestro project. This will allow the specification of user requirements. Extensible systems, which are outlined in previous work packages, can then be used to link to the models used for learning, so that the technologies can be tuned to provide the correct mechanisms which are suited to the user needs.

Based on this analysis, an accessibility evaluation framework has been constructed for i-Maestro. Using this framework, the technologies created during the development stages of the project will be assessed and then improved in terms of accessibility, based on both technologies created by i-Maestro and assistive technologies native to the operating system being used. It is expected that after initial evaluation there will be several key problems which will need to be tackled to create accessible learning tools.

This paper will present the latest work in this area, and demonstrate an implementation of integrating accessibility and adaptive technologies with cutting edge initiatives for Music education and pedagogy in general. The paper will present a first prototype of the learning environments being created for the project.

SESSION 3

DESIGNING TANGIBLE TABLETOP INTERFACES FOR PATIENTS IN REHABILITATION

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Abstract: This work deals with Tangible Tabletop (TT) interfaces for rehabilitation. We investigated the acceptance of new technologies and new interaction paradigms in functional and neural rehabilitation. Our goal was to determine whether TT systems are adequate for rehabilitation and its sub categories and whether these tools have the potential to create added value for both patients and therapists. We also searched for conventional practices and rehabilitation tools that could be adequately adapted to TT interfaces. Based on theoretical work and on the results of two focus groups we developed three concepts for TT tools and used them to construct paper and interactive prototypes. During the design process five general conditions proved to be important for the acceptance of TT systems in rehabilitation.

Keywords: tangible tabletop interfaces, rehabilitation, visual and cognitive impairments, fine motor skills, design process, focus groups.

E-VOTING – A KEY TO INDEPENDENCE FOR ALL

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Abstract: The paper addresses the experience of Estonia in strengthening democracy through the use of information and communication technologies (ICT) to bring decision-making closer to the citizen. The presentation focuses on e-Voting and enhanced use of ICT in democratic practices as key elements in achieving independence for everyone, including disabled people. This paper draws on the analysis of secondary sources for the development of information society and e-Voting in Estonia. In addition, the results of a pilot study of the accessibility and usability of e-Voting environments for visually impaired people during the parliamentary elections in March 2007 are discussed.

Keywords: e-Voting, e-Democracy, e-services, ID card, accessibility, usability

THE AMBIENT INTELLIGENCE AND THE ASSISTIVE TECHNOLOGIES FOR ELDERLY, VISUALLY AND HEARING IMPAIRED USERS IN SLOVAKIA

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Extended Abstract

In this paper we describe the main activities, goals and the approach used in the international project MonAMI (Mainstreaming on Ambient Technology). The overall objective of MonAMI is to mainstream accessibility in consumer goods and services, including public services, through applied research and development and the use of advanced technologies to help ensure equal access, independent living and participation for all in the Information Society. The MonAMI project will demonstrate that accessible, useful services for elderly and disabled people living at home can be delivered using mainstream systems and platforms. The project will be carried out in close cooperation with end users and will involve key mainstream actors throughout the whole process. In the case of MonAMI, mainstreaming means that services for elderly people and disabled people are part of the ordinary supply of services offered to the general public. These services are already used by elderly and disabled people, but there is still further potential to increase their usability.

Our initiative is to build a new laboratory – FU centre in Slovakia (Feasibility and Usability centre) based on the experiences of the Department of Instrumental and Biomedical Engineering and the Access Centre. We need to choose appropriate technologies and services which are matched to the needs of the proposed target group.

The FU centre will identify end user needs in relation to the services to be tested; define the technologies and services that will be delivered to users to meet their specific needs; and implement technologies in tested sites. This will require the purchase and/or construction of mobile and communication devices.

The review of existing technologies and services will be followed by the selection and development of a set of accessible services. The focus will be on mainstream services which can be adapted for e-Inclusion through the Design For All approach. The selected services will first be tested in our Feasibility and Usability centre at TUKE with user tests in laboratory conditions.

Once the services and applications have been found to be feasible, usable and appropriate to user needs, large-scale validation will be carried out in validation centres in four countries. Hundreds of users will try out the services in their homes and the impacts and consequences will be analysed. The economic viability and long term sustainability of the services will be investigated in order to facilitate real mainstream implementation.

The services will be selected from the following types of services:

- home safety and control (e.g. detection of intruders, home automation, videoconferencing, emergency alarms, heating, lighting, inactivity detection)
- safety and security (e.g. fall detection, detection of unusual behaviour, management of technical alarms, visitor validation)
- activity detection (of the elderly person)
- household appliances (e.g. refrigerator, washing machine, oven, cooker, dishwasher, microwave)
- home appliances (e.g. set top boxes, DVD player, recorder, TV)
- communication devices (e.g. telephones, Internet)
- activity planning (e.g. agendas and reminders, palm-tops)
- support for wheelchair navigation (e.g. assistance in passing doors and automatic or semi-automatic navigation, opening and closing windows and doors, switching on/off the devices, including at a distance and devices which are not easy to reachable)
- health (e.g. monitoring of the use of medication, health monitoring, telemedicine)
- information (e.g. community video-on-demand, building community, translation, education, e-Democracy, video telephony, specialist TV channels)
- entertainment
- shopping and retail transactions

The paper contents can be outlined as follows:

1. Introduction – the need for ICT and assistive technology support for daily living activities, increasing autonomy for elderly people, the current situation with regards to services for elderly people, and assistive technologies.
2. Existing technologies and services in Slovakia – a brief overview of the current situation in the field of products, assistive technologies and services available and accessible to elderly and disabled people in Slovakia.
3. New challenges – new services for elderly and disabled people on the basis of Mainstreaming and Ambient Technology.
4. The main goals and activities – to extend the market for existing products and services (ICT, professional and advisory services, home care, health services, telemedicine, education for elderly and disabled people, environmental control including security and safety issues, transport and navigation, delivery systems for products and services – e-shopping, e-banking, e-government)
5. Discussion – the criteria of service quality, and users' quality of life.
6. Conclusions

WORKSHOP

MULTIMODAL ACCESS TO MATHEMATICS: THE LAMBDA SYSTEM

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Abstract: The workshop illustrates the following applications of the LAMBDA system (Schweikhardt et al., 2006):

- writing and processing text and mathematical expressions for a Braille display and speech synthesizer;
- communicating with sighted people through the linear representation of mathematical expressions and through the MathML viewer;
- using mainstream programs to write mathematics to produce documents to be edited in the LAMBDA system;
- exporting documents to be viewed with mainstream viewers.

The workshop will be held by one person and one or two assistants. Three workstations, including one notebook with the LAMBDA system loaded and one Braille display will be made available. Additional workstations may be required.

The workshop will be held by the Unione Italiana Ciechi (Verona) on behalf of the AScience thematic network. AScience is a thematic network supported by the eContentPlus Programme which aims at setting up a working group on access to university science courses by visually impaired students. This working group is sharing information about best practice useful tools and access to scientific books. It aims to produce guidelines to support blind students in university courses.

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SESSION 4

AN ACCESSIBLE AND USABLE E-BOOK AS EDUCATIONAL TOOL: HOW TO GET IT?

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Extended Abstract

The "Individuals with Disabilities Education Act" (IDEA) was passed in 1975 by the American government and was revised for the first time in 1997 and again in 2004. As a result, the focus of special education moved from providing ad-hoc services to disabled students to educating disabled students in mainstream classrooms. Thus, US schools are now required to place disabled students in inclusive classrooms, when appropriate, in order to provide them with the social skills and academic tools of the other students.

However, in inclusive classrooms, disabled students do not always have access to the same learning tools as their classmates. For example, students with visual impairments rely on alternative-format books (such as large print or Braille). However, the time-consuming process of turning books or other materials into Braille, audiotape, or large-print editions means that disabled students often start the school year without their textbooks. Thus, while the other students receive complete printed books, blind children receive their books chapter by chapter with the risk that they do not arrive in time to follow the learning schedule. Moreover, visual learning tools often do not meet the learning requirements of blind students. As a consequence, students must rely on teachers or classmates, who have to try their best to describe the visual contents clearly and appropriately. This situation can severely limit the educational opportunities open to blind students.

Accessible electronic publications, such as electronic books, journals, and training tools, can be useful for students or workers who require learning materials with special adaptations. E-books can offer many advantages to both disabled and non-disabled users. For example, they offer the facility to quickly locate specific chapters or sections and to place bookmarks for future reference. E-books can also offer quick access to glossary definitions or indexed terms, adjustable fonts for easier reading, recorded or synthetic speech to aid in comprehension, and built-in practice questions, multimedia and interactive activities. In addition to providing these important features, a digital publication ensures that every student, new employee or worker undergoing training is using the same learning materials, and that everyone receives these materials at the same time.

In several countries, specific accessibility laws have been passed which require publishers to provide an electronic accessible version of school textbooks. However, the electronic format created by publishers may not provide adequate support for disabled students. In fact, making an electronic book truly accessible and usable requires a number of specific rules and steps to be followed. In addition, the procedure for obtaining accessible and usable e-texts can differ depending on whether they are created from the original file or by manipulation of another (non-original) file version.

The format of some e-books (e.g. narrative ones) is relatively simple and therefore easy to modify for accessibility. However, in the case of scientific books, the e-text can contain complicated explanations, graphs, tables, and formulae. It is therefore more difficult to create an accessible and usable version, since a complex net of alternative explanations and complementary descriptions needs to be included in the elaboration.

Publishers could build an e-text in a suitable manner for blind readers by applying specific rules and steps from the start of the creation process. Unfortunately this is not the case since books are mostly created using graphical techniques and accessibility and usability rules are rarely taken into account. For example, publishers usually provide documents in PDF (portable document format) version. PDF texts are often not accessible and their content is inappropriate (figures are not provided with useful descriptions and tables are difficult to comprehend and to read in a sequential way). Consequently, the electronic document needs to be modified in order to make it suitable for readers who interact through assistive technologies. Therefore, a semi-automatic tool can be a very useful aid in carrying out the conversion procedures.

In this article I present the project “S.T.E.L.A.E” (*Scienza e Tecnologia per Libri Accessibili Elettronici*/Science and Technology for Accessible e-books). Overall, this project aims at addressing the accessibility and usability issues in electronic publishing. In particular, it aims at finding solutions to overcome the main obstacles to the creation of cultural/scientific e-books that are accessible and usable by disabled users. Recommendations for creating accessible e-texts and modifying inaccessible ones to make them accessible are also provided.

In this paper I will first introduce the problem and explain the basic motivations leading to the research in this field. Then, I will discuss the new and fundamental role of the e-text as a learning tool to be used for distance or in-school education. I will also describe the accessibility and usability issues to be considered to obtain a suitable e-text. Finally, I will briefly introduce a semi-automatic tool, which is being developed to support the conversion of e-books to an accessible and usable format.

Keywords: accessibility, usability, e-book, e-text, e-learning, information access.

HAPTIC AND AURAL GRAPHS EXPLORATION FOR VISUALLY IMPAIRED USERS

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Abstract: The ability to access and understand graphs is required by several web sites and e-learning platforms. However, perceiving and understanding the graph of a mathematical function can be very difficult for a blind user who studies mathematics. The ability to read cartographic (map) representations is useful and sometimes essential for studying geography. The paper presents an innovative solution that allows haptic and aural exploration of the graphs of a mathematical function. The application starts from a Latex file that describes the function and its domain and uses a very cheap device connected to the audio output of the PC (AudioTact™). Preliminary experiments show that blind users can improve their graph exploration capability, thereby obtaining a better mental image of the graph. The proposed solution and the architecture of the described system allow the exploration of graphs generated for other application domains (e.g. statistical or historical data).

Keywords: accessibility of multimodal graphs, vocal and haptic feedback, accessibility for visual impaired people.

SPEECH AND BRAILLE TOOLS TO IMPROVE ACCESS TO UNIVERSITY SCIENTIFIC COURSES

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Extended Abstract

1. Introduction

Writing, reading, understanding and processing mathematical expressions are particularly difficult tasks for blind students. The main barriers are not the complexity of the mathematical concepts, but the lack of suitable tools to write and process mathematical expressions effectively, efficiently and satisfactorily through speech and Braille output. Furthermore, technical drawings are often used in scientific courses, both to describe concepts and to perform procedures (e.g. to prove the correctness of algorithms). The thematic network, AScience, was established to share information about good practices in science learning by blind students and to assess and contribute to the emerging technologies to support blind students studying university courses,. The founding members are universities and associations for visually impaired people all over Europe. AScience aims to involve further institutions. In this context, some emerging tools were investigated. This paper introduces the objective of the AScience thematic network and some of the tools which have been investigated.

2. AScience thematic network

In order to enhance access to scientific resources and materials during university studies for blind and visually impaired students a project called "AScience" has been established. The ongoing two year project has been developed within the framework of the European Union eContentplus programme and is coordinated by the Universita' degli studi di Milano in Italy. The aim of this project is to facilitate the enjoyment of digitally available scientific resources by university based visually impaired students and researchers. The consortium consists of the coordinating Universita` degli Studi di Milano (Italy), the University of Linz Institute Integriert Studieren (Austria), the Katholieke University Leuven (Belgium), the Commenius University Faculty of Mathematics, Physics and Informatics (Slovakia), the Union of the Blind in Verona (Italy) and the Pierre et Marie Curie Université (France). The AScience multilingual website (http://www.ascience.eu) is the access point to the thematic network on the Internet. This website provides information on the aims of the thematic network, the most relevant events about the accessibility of science to visually impaired people, thematic events organized by the AScience network, how institutions can join the network, how to contact network members and how to subscribe to the services being delivered by the network (e.g. the newsletter and documents for downloading). This website is also the portal to the repository of documents and tools. This repository will be added to by network members during the project lifetime. It will collect documents about tools, best practice and guidelines for science learning by visually impaired students at university and programs useful in science courses. Furthermore, the web portal provides access to a mailing list and thematic forums.

3. Tools to process mathematical expressions

This section focuses on some of the emerging tools which promise to improve access to mathematics by visually impaired students. The main difficulties encountered by blind students in accessing mathematics are explained. In particular, national characteristic are taken into account, both for Braille codes and speech output in national languages. Subsequently, specific tools for accessing the content of university programmes are discussed and illustrated. The most relevant tools, which will be described are: the LAMBDA system, MathPlayer and the library UMCL.

3.1 The LAMBDA system

The LAMBDA system is the result of the LAMBDA project supported by the European IST Programme (Schweikhardt et al., 2006). It is a system to facilitate writing, reading and processing text and mathematical expressions using a Braille display and speech synthesizer. The LAMBDA system is made up of two components: a mathematical linear code and a multimodal mathematical editor. The editor provides the user with techniques to input mathematical expressions through keyboard short-cuts and context-based operations, strategies to understand the structure of the mathematical expression and advanced editing operations. A MathML (W3C, 2003) converter allows the exchange of documents with mainstream applications. Advantages and drawbacks of the system will be discussed with respect to its use in science courses at university.

3.2 MathPlayer

MathPlayer (Soiffer, 2005) is a web browser extension which interprets MathML markup language to produce both a visual description of the mathematical notation and speech output. In the context of the AScience network, its benefits and users' experiences were evaluated and integration with other assistive tools was designed to take account of national languages.

3.3 The Universal Maths Conversion Library

The UMCL library, developed at Pierre et Marie Curie Universite', groups a set of conversion functions which interpret MathML to produce Braille output. It can be embedded in programs which use MathML in Braille conversion. It is able to produce many European national Braille codes. The library was evaluated with XHTML+MathML documents useful for university science courses.

4. Conclusions

All of the tools introduced show a direction of development based on the use of MathML markup language in conjunction with assistive technologies to generate speech and Braille output. Further software evaluation will be carried out in the context of the AScience thematic network and the best tools will be documented and distributed by the network.

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E-LEARNING PLATFORM FOR INTERACTIVE ACCESS TO MULTIMEDIA MATERIALS IN DAISY FORMAT

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Abstract: The paper presents a multimedia system for accessible distance education. The system comprises a multimedia browser, which is accessible to visually impaired people, and a content distribution streaming server integrated with an e-learning management system, which allow interactive online access to materials stored in DAISY 3 (ANSI/NISO Z39.86 2005 Specifications for the Digital Talking Book) format.

The DaisyReader developed offers new functionality for interactive multimodal (visual and voice) presentation of structured information, including tables, lists and maths formulae. DaisyReader supports new MathML Modular Extensions (2007) of the Daisy standard.

Keywords: e-learning, accessibility, multimedia presentation, maths.

PANEL DISCUSSION*:* Assistive Technology and Social Inclusion for Deaf and Hearing Impaired People from Ethnic and Other Minority Groups

ASSISTIVE TECHNOLOGY FOR DEAF AND HEARING IMPAIRED PEOPLE FROM ARABIC CULTURE

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Extended Abstract

Awareness of the need for Assistive Technology (AT), its benefits and the need for assistance for purchasing AT, is growing in Arab culture. People are more aware of the need for AT for the habilitation and rehabilitation of disabled people (in general) and the role of new technologies and scientific progress in ensuring the equalization of opportunities for employment and full social integration of disabled people. Many Arab countries are passing new legislation or improving and implementing existing legislation to guarantee equal rights and the social integration of disabled people.

In this context, I will focus in this panel on AT for deaf and hearing impaired people from Arabic culture. I will present mainly the state of the art in the following two areas:

1- Education: I will present the efforts deployed in many Arabic countries, in particular in Tunisia, to insure equal opportunities for the education of deaf and hearing impaired people from early childhood within mainstream institutions, in regular classes or in specialized institutions when integration is not possible, and to provide the necessary means and assistive equipment to facilitate learning and education, including the use of computers and other modern technologies. It is also worth highlighting the importance of raising awareness among parents and society in general of the importance of integrating deaf and hearing impaired children into the mainstream educational system and training schools.

2- Developing Arabic Sign Language: I will present here some of the relevant Arabic experiences in the development of the national Arabic Sign Language and the use of ICT to develop sign language dictionaries. I will present, in particular, the original and very promising project to develop the Common Arabic Sign Language Dictionary that currently contains more than 3000 words. Sign language experts from all the Arab countries with the support of many Arab governments and organizations have been working on it for more than nine years.

BLACK ETHNIC MINORITY END-USER EXPERIENCE CONSIDDERATIONS

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Abstract: The complex needs of Black Minority Ethnic (BME) Deaf people are often misunderstood and inappropriately catered for. A lack of understanding around cultural differences and language needs, can leave the individual very isolated and marginalised in society. It is important to understand the backgrounds of BME Deaf people, their identity issues, their communication, family and social surroundings, in order to encourage more appropriate and well designed communication and cultural sensitivity when working with this niche community, with the overall aim of improving the end-user experience. This will assist in building self-esteem, belonging and confidence, with a generally more positive involvement in society, be it Deaf or hearing.

Keywords: Accessibility, BME Deaf, guidelines, Deaf friendly

ADAPTIVE, INCLUSIVE SOFTWARE DESIGN FOR PEOPLE WITH VISION AND HEARING IMPAIRMENTS

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Extended Abstract

Adaptive, inclusive software design is an area of research that aims to devise technologies and techniques to give equal access to educational materials and to assist all learners, regardless of their impairments, to reach their full educational potential within inclusive educational environments.

An inclusive software design approach seeks to address the user interface and the interaction needs of all learners with a specific focus on those who are vulnerable to marginalisation and exclusion. In educational environments inclusive software design is therefore concerned with providing appropriate responses to a broad spectrum of user interaction and acquisition needs in both formal and non-formal settings.

When designing inclusive software technologies for students in educational environments, it is necessary to tailor both the user interface and the educational material so that the learning needs of different students can be addressed. Adaptive, user interaction research investigates the techniques used to extend traditional user systems with features, which enable a user's interaction to be personalized and content to be tailored on an individual basis. Such systems use information provided by, or captured from, learners to tailor the user interaction process. Through the application of this information, adaptive techniques can be used to support users in learning tasks by tailoring content and presentation, customizing user interfaces and providing additional guidance and support. Adaptive techniques have proved useful in learning tasks where users have differing learning requirements, disabilities, histories and preferences.

At present the majority of software learning technologies assume students have no impairments. When these technologies are used in classrooms there is the risk that certain students may be excluded from learning tasks due to their inability to access or use the software. Furthermore, students with vision or hearing impairments are often marginalized as they have to use different technologies within the same classroom to accomplish the same tasks as those without disabilities.

This Panel will discuss the potential issues concerned with using adaptive, inclusive software design techniques to develop Software technologies for learners with impairments.

Providing equality and parity in access to software-based educational materials in classroom environments where students have a range of impairments is therefore a serious and important educational challenge to designers of software.

SESSION 5

SUBPAL: A DEVICE FOR READING ALOUD SUBTITLES FROM TELEVISION AND CINEMA

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Abstract: The primary focus of this paper is the accessibility barriers encountered by visually impaired people and people with dyslexia. Due to their impairments some of these people have limited access to the subtitle content presented on television and in the cinema. It is very important to be able to participate in such social and cultural events, but if the material is presented in an unfamiliar language they are unable to understand it. The problem primarily occurs in non-English speaking countries, which do not use dubbing, such as the Scandinavian countries and the Netherlands.

A solution to this problem is SubPal, a text to speech device which can be connected to the television or to a video camera. The subtitle content in the video stream is read aloud through a multilingual speech synthesizer. Hence, the solution is applicable for television and the cinema, in several different countries. The solution comprises three major modules. The first module samples the analogue video signal to produce a binary image of the subtitles. The second module carries out optical character recognition to convert the binary image of the subtitles into characters that can be recognized by a computer. The third module is a speech synthesizer that reads the decoded subtitles aloud. The system is quantified and a method for sampling the video signal is proposed and verified. Requirements for the optical character recognition algorithm are discussed, and parallel studies of similar algorithms are considered. The speech synthesizer is discussed in the context of user and technical requirements, and a best candidate synthesizer is evaluated. The conclusions imply that there is potential for further studies with the aim of developing a prototype.

Keywords: assistive technology, optical character recognition, sampling, speech synthesis, text to speech

OCR-ALGORITHM FOR DETECTION OF SUBTITLES IN TELEVISION AND CINEMA

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Abstract: The OCR (optical character recognition) algorithm described in this paper is a module in the assistive device SubPal, which is being developed to read subtitles from television and camera aloud. The SubPal system is described in detail in (Nielsen & Bothe, 2007). By sampling the television signal (PAL) a binary image is created. This binary image is analysed using the OCR algorithm for generating text-strings that can be passed on to a speech synthesis box. The requirements and the implementation of the OCR are discussed and some initial results are presented. The algorithm is developed with the purpose of later being implemented in hardware (FPGA).

Keywords: optical character recognition, subtitles, visually impaired people, dyslexic

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EMOTIONAL SUBTITLES: A SYSTEM AND POTENTIAL APPLICATIONS FOR DEAF AND HEARING IMPAIRED PEOPLE

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Abstract: Subtitling is a popular communications technology with over 7.5 million users in the UK. Many Deaf and hard of hearing people use subtitles to gain access to the audio content of educational television and film presentations. A significant limitation of the present generation of subtitling techniques and technologies is their failure to express the emotional nuances of dialogue such as intonation and volume. Subtitles have been criticised for their lack of emotional content and inability to communicate the subtext of a rich dialogue.

At present subtitles are limited to telling the viewer what is being said, but not how it is being said. Often people that rely upon subtitles, such as Deaf and hard of hearing people, draw attention to the "emotional gap" that is generated, and the important emotional information that is lost. In several interviews we conducted, Deaf and hard of hearing people indicated that what was lacking from subtitles was any degree of emotion. They found that, although they could follow the dialogue, it felt shallow, somehow 2- dimensional rather than 3-dimensional.

In this paper we introduce a system that demonstrates the presentation of subtitles that depict the emotions behind the words used on screen. The system also provides viewers with the ability to personalize and adapt their interaction with subtitles, so as to assist them in their learning. In conducting this research we aimed to gain a comprehensive understanding of the issues associated with emotional subtitling and to provide guidance for future producers of subtitled materials.

SESSION 6

THE NEED TO DEVELOP DEAF FRIENDLY MATERIALS FOR BLACK ETHNIC MINORITY DEAF EXPERIENCING IDENTITY ISSUES

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Abstract: A challenge facing Black Minority Ethnic (BME) Deaf people is the lack of cultural sensitivity or understanding towards their heritage and their Deaf identity. BME deaf adults have less exposure to their own ethnic culture than their hearing counter-parts (Chamba et al, 1998). Although ethnic and religious diversity is more evident, services still cannot fully accommodate the language needs of BME Deaf populations. This leads to a variety of problems recognised by young Deaf families and professionals. Language choices, such as BSL, English and a variety of home languages, are complex and usually such decisions about language are affected by personal knowledge and preferences on part of the parents (Ahmad et al, 1998).

Interpreters are not always familiar with BME culture and working with the BME community. Therefore, they are often unable to understand the full cultural implications for the BME Deaf. This has raised several issues alongside the fact that there is limited research into BME Deaf peoples' profiles. This lack of research is probably why so many services are unable to accommodate the needs of BME Deaf people. Following some initial research into the make-up of BME Deaf people, we are establishing a deeper understanding of this community and aim to continue our research and development of appropriate visual material for BME Deaf communication needs. In this paper we will share our initial findings and our initial guidelines for this specialised community.

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END-USER INVOLVEMENT IN ASSISTIVE TECHNOLOGY DESIGN FOR THE DEAF – ARE ARTIFICIAL FORMS OF SIGN LANGUAGE MEETING THE NEEDS OF THE TARGET AUDIENCE?

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Extended Abstract

Several different systems have been developed to meet the increasing demand for access to information and services by Deaf and hard of hearing people in the often preferred language of British Sign Language (BSL). This has led to the development of several different artificial forms of sign language which are based on sign languages themselves. The aim of such systems is to be closer to the natural language of the Deaf, use an efficient and transferable format and ease of reproduction. These systems will be referred to as Digital Representations of Sign Language (DRSL). In this research, these systems have been categorised as follows: notation (symbolic depictions of sign language (Sutton, 2007)), animation (artificial characters that can sign (Anon, 2007)) and streaming video systems (filmed and edited sequences of sign language (Inclusive Learning Scotland, 2007)).

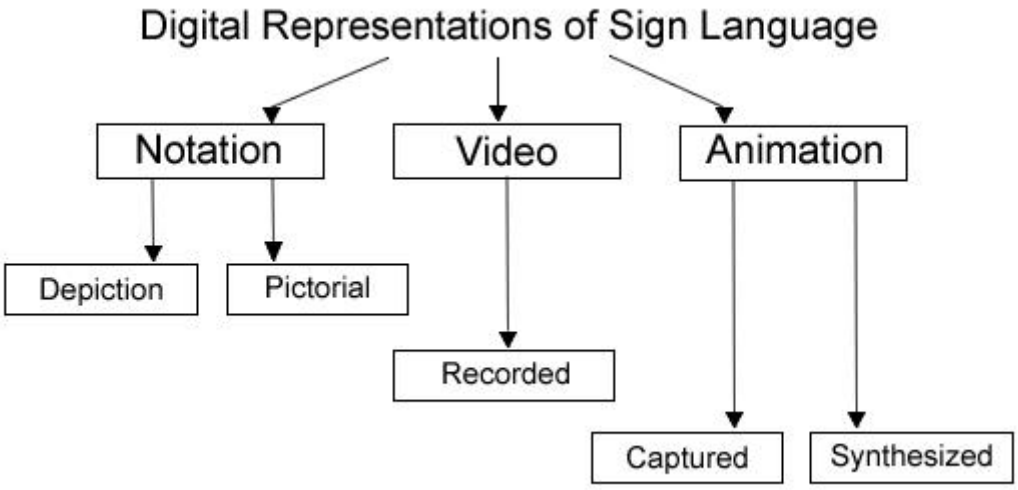

Figure 1, Breakdown of current categories of DRSLs

Developing DRSL to assist in the distribution of deaf friendly information via the digital domain has resulted in a variety of communication systems (Cox et al., 2002; Ohene-Djan et al., 2003, 2004). Some systems are widely used while others receive very mixed reviews and are being compared to older systems. Thus there has not been a real and effective transition to new and more advanced and effective technologies based on DRSL systems. The major criticisms of these systems are lack of understanding of sign language and their inability to communicate affectively in a visual style (Naqvi, 2006). Researchers have theorised about what parts of these systems are unsuccessful and continue to redesign and generate new systems. However little to no research (to the authors' knowledge) has been carried out to compare newer DRSLs to older ones. This research could help identify the strengths and weaknesses of both and move forward in development and design.

The research presented in this paper provides a novel approach to the comparative study of these systems, in order to identify which linguistic components of British Sign Language (BSL - the sign language used by the British Deaf community) are missing from these systems.

The main sections of the paper are as follows:
1. Introduction of the different types of DRSLs and what they aim to achieve.
2. Highlighting the problems noted about these systems and major concerns.
3. Details and methodology of the experiment, including the hypothesis, materials used, sample population, data collected and procedure.
4. Presentation and discussion of the results.
5. Conclusions, including the requirement for future research and the involvement of the Deaf community.

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JOINING HANDS: DEVELOPING A SIGN LANGUAGE MACHINE TRANSLATION SYSTEM WITH AND FOR THE DEAF COMMUNITY

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Abstract: This paper discusses the development of an automatic machine translation (MT) system for translating spoken language text into signed languages (SLs). The motivation for our work is the improvement of accessibility to airport information announcements for D/deaf and hard of hearing people. This paper demonstrates the involvement of Deaf colleagues and members of the D/deaf community in Ireland in three areas of our research: the choice of a domain for automatic translation that has a practical use for the D/deaf community; the human translation of English text into Irish Sign Language (ISL) as well as advice on ISL grammar and linguistics; and the importance of native ISL signers as manual evaluators of our translated output.

Keywords: sign language, machine translation, D/deaf accessibility

DESIGN IMPLICATIONS FOR A UBIQUITOUS AMBIENT SOUND DISPLAY FOR THE DEAF

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Abstract: Previous work has already investigated the value of ambient sound visualizations for deaf and hearing impaired people. Our work builds upon the results of these investigations and specifically explores the applicability of the ceiling for such visualizations. Thus, we gathered design requirements based on a participatory design process including expert interviews and an online questionnaire, as well as a design workshop at a local organization for deaf people. Results from the workshop showed that deaf people highly approve of the idea of using the ceiling for ambient visualizations. However, they also expressed a strong need for a supplementary traditional display to obtain more detailed information about environmental sounds. The conclusions of this study form the basis of the design of a prototype that we are currently developing at our research group.

Keywords: Peripheral displays, ambient sounds, deaf, hearing impaired

SESSION 7

SIGN LANGUAGE MMS TO MAKE CELL PHONES ACCESSIBLE TO DEAF AND HARD-OF-HEARING COMMUNITY

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Extended Abstract

1. Introduction

Cell phones are becoming extremely popular and are in use world wide. However, making cell phones accessible to the deaf and hard of hearing community is still a challenge. The main commercially available products for this community offer no more than the facility to increase the volume. Many cellular providers offer individual cell phone models which are compatible with hearing aids and possess speakerphone capabilities. However, if the user is completely deaf, these phones are often difficult or impossible to use.

The use of video phones is increasing in the deaf and hard of hearing community, as they support both lipreading and sign language, the preferred communication method of many deaf and hearing impaired people. However video phones require significant computer processing power to compress and decompress video signals in real time. In addition, this alternative still has to overcome the various technological challenges associated with utilizing video phone technology via a low bandwidth network.

Unfortunately, many deaf people, particularly in developing countries, have poor literacy skills and therefore cannot use cell phone SMS (Short Messaging Service).

This paper describes a new application allowing the use of MMS (Multimedia Messaging Service) to generate sign language animations to enable deaf people to communicate via cell phones. These animations are avatar based and obtained from the automatic conversion of text into sign language. This application is a new component developed using a WebSign kernel.

2. Description of WebSign

WebSign is a Web application developed in the Research Laboratory at UTIC (Anon, undated). It is based on avatar (animation in virtual world) technology. The input to the system is text in a natural language. The output is a real-time and on-line interpretation in sign language implemented by a 3D model. WebSign permits the automatic interpretation of text as visual gesture based spatial language using avatar technology. Its architecture is constructed around a virtual person animated by a system of automatic interpretation of text into sign language. This system uses a dynamic data base to provide a sign dictionary that contains gesture codification of

words. This tool is presented as a multilingual Web application that offers a full set of interfaces for real-time interpretation, collaborative expansion of the dictionary and the creation of deaf communities in addition to administration interfaces (Chabeb et al., 2006).

WebSign represents a kernel that contains many applications such as a web-based tool to create online courses for deaf students (Jemni et al., 2007) and a messenger tool that automatically translates text into sign language in order to enable deaf and hearing people to communicate via the web.

3. The new component

The new component (called MMS Sign) added to WebSign permits the creation of an animation sequence in MMS format (3gp) corresponding to the translation of written text input into a sign language. The input text can be introduced via a Web interface or via an SMS. This sequence will be integrated in an MMS service to be sent, received and visualized in mobile phones that support 3gp format.

The procedure of text conversion to 3gp format is based in the following five steps:

1. When a text arrives to MMS Sign via the web application or from the server which receives the SMS, it will be submitted to the WebSign application to automatically generate an SML file. This is an XML based code which encodes the movements of the avatar.
2. The SML file comes from WebSign through the Web service and will be parsed by DOM (a specific parser of XML) using Python.
3. Using the above information, the file goes into Blender to animate the avatar. Blender is an open source program, which uses the OpenGL package to create and animate 3D object.
4. Creation of a video sequence in avi format by using the Render option available in Blender API.
5. Conversion of the avi format sequence into 3gp format, which will be visualized in the mobile phone.

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TELEPHONE AND HEARING IMPAIRED – NEW APPROACHES FOR INCREASING THE TELEPHONE SPEECH QUALITY FOR HEARING IMPAIRED USERS

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Abstract: The future age structure of industrialized countries will shift towards elderly people. The average elderly telephone subscriber is likely to have a mild high frequency hearing impairment. Hearing impaired telephone users will be one of the major groups of subscribers for telephone connections and telephone service vendors. To offer them an improvement on existing solutions does not require much effort or special new technologies, but does require precise knowledge of the needs of this group. Some of these needs are presented in this article. The information presented here has been drawn from interviews and lessons learned from previous research, which was presented at CVHI 2006 (Krebber et al. 2006). In addition, new approaches and recommendations, as well as the requirements for standards are discussed in this paper.

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ACCESS TO PUBLIC SERVICES FOR PEOPLE WITH VISUAL AND HEARING IMPAIRMENTS - LEGISLATION & IMPLEMENTATION IN HUNGARY 1998-2007

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Abstract: This paper provides an overview of access to public services for people with visual and hearing impairments in Hungary. Since 1998 the “Act on Equal Chances” has provided a strict, but general legislative basis to support accessibility. However, its implementation has been rather slow and often results in relatively low quality solutions. The paper analyses how the general demands have been transformed into weak standards and even weaker technical solutions. In addition, illustrations of good practice are provided and trends are identified. The conclusions summarise some of the measures that could be used to promote accessibility.

Keywords: access, legislation, standard, building, blind, deaf, hearing impaired

HOUSEHOLD SOUND IDENTIFICATION SYSTEM FOR PEOPLE WITH HEARING DISABILITIES

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Abstract: This article discusses the classification of household sounds for the development of an application to aid hearing impaired people in recognising every day sounds. These sounds include telephone calls, the sound of the door bell, an alarm clock and the completion of a domestic appliance programme. This can be used to support them in resolving everyday situations which could otherwise present them with serious problems.

The paper presents the study carried out in order to obtain the best acoustical parameters by adopting training and evaluation techniques using GMM models with a varying number of Gaussian components. Parameters such as MFCCS, ZCR, roll-off point and spectral centroid are tested using the classifier.

Keywords: sound classification, signal processing, deaf, hearing impaired, systems

A SYSTEM FOR CONTROL OF HEARING INSTRUMENT SELECTION AND ADJUSTMENT BASED ON EVALUATION OF CORRECT TRANSMISSION OF SPEECH ELEMENTS AND FEATURES

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Abstract: Modern digital hearing aids provide unprecedented means of compensating for hearing impairments. However, this comes at the price of the need to adjust complex processing parameters. To achieve optimum settings for a particular individual, all the processing parameters have to be carefully pre- and re-adjusted. The requires time and effort, which cannot always be made available. To provide an independent means of optimizing speech intelligibility, we developed a dedicated solution using mostly off-the-shelf hardware and a dedicated software. With this, a PC-literate hearing impaired person can independently check his or her aided speech reception. The result could provide a valid basis for improving the adjustment of the hearing aid parameters.

Keywords: hearing impaired, individual adjustment, hearing instruments, speech reception.