Coordination Action in R&D in Accessible and Assistive ICT

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CARDIAC

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Executive Summary

This report covers the organisation and outcomes of the final conference of the Cardiac project. The conference was held on 22nd January 2013 in London. This deliverable describes the outcomes of this conference.

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Introduction

The Cardiac consortium developed a roadmap for priorities for future research on accessible and assistive technology. The purpose of the conference was to bring together key stakeholders with an understanding of this type of planning.

The aim of this conference was to obtain a consensus on priorities for future research on accessible information and communication technology systems and services. Funding bodies need to ascertain the best strategy for investing their finite resources in research and development to benefit disabled and elderly people. The scope included network-based services (social networks, collective intelligent systems, augmented reality, cloud computing, advanced location aware services and ambient intelligent systems) as well as novel user interfaces and technology transfer.

The conference was widely publicised with the help of the Institution of Engineering and Technology and the ICT Knowledge Transfer Network. To help potential participants understand the purpose of the conference, a background document was produced (see Appendix 1) in both PDF and HTML formats. A list of the participants is included in Appendix 2.

Agenda

The presentations were:

- Research Actions to Facilitate eInclusion (Patrick Roe with Pier-Luigi Emiliani, Iosif Klironomos and Helmut Heck)
- Internet for All (Mike Short)
- Mapping Interoperability Requirements in Assisted Living (Graham Worsley)
- What Makes Systems Accessible? (Gunela Astbrink)
- Research Priorities for Accessible Smart Living (Peter Ball)
- How Fond Hopes Become Reality (Alan Newell)
- Panel Discussion (Gregg Vanderheiden, Brian Collins, Guido Gybels)

Summary of Presentations

Prof Patrick Roe explained that the aim of the Cardiac project is to produce a roadmap for priorities for future research on accessible ICT. The primary audience for this roadmap is the European Commission to help them determine priorities in this area. He explained that the project had organised three workshops to identify the priorities in three areas – technology transfer, user interfaces and network applications. He walked the audience through the resulting roadmap, which can be found at http://www.cardiac-eu.org/roadmap/index.htm along with a questionnaire to collect views from all relevant stakeholders on the priorities of the identified research lines.

Dr Pier-Luigi Emiliani explained the work on trends on inclusive network-based applications. This was based on the model of ambient intelligent systems and on services which were useful to people with activity limitations. There is a change from the internet being a repository of information to an interactive system including the internet of things. This requires the development of new modalities of operation. It is important to ascertain whether people with disabilities can use these new systems and services.

Iosif Klironomos presented examples of research priorities for human-computer interaction. This included studies of user needs as well as trends in interaction techniques. The advances in ubiquitous computing are of significance to people with disabilities and elderly people. However attention will have to be given to the design of the user interfaces to ensure that new systems are fully accessible in practice.

Dr Helmut Heck discussed the problems of technology transfer for accessible and assistive ICT products and services. At present there appears to be fragmentary market without sufficient involvement of end users. An extra problem is the different service delivery systems in the various EU countries. There is a need for a systematic analysis of present and future user needs, as well as studies on appropriate business models including support services. An important aspect is the training of end users to understand what the technology can do as well as how to use it.

Dr Mike Short gave a virtual presentation on internet for all including the role of mobile communications. Digitizing is affecting many areas, but it is important new services are inclusive. The rapid rise of smart phones and the increasing role of tablets will significantly affect how people access the internet. There are about 6 billion mobile phone users and 1 billion smartphone users – it will not be long before there are more mobile phones than people in the world. Social networking is becoming of increasing importance which is no longer just for teenagers. By mid 2013 it is anticipated there will be more than 20 billion downloads of ‘apps’. Android is coming the dominant operating system for smartphones, at the same time as Symbian is becoming of less significance.

In terms of accessibility, the technological developments have provided the possibility of adaptable user interfaces (eg larger characters on a screen). This has implications that other services (eg billing) have to be appropriate for people with special needs. This raises a number of research challenges. New systems need to be inclusive both by geography as well as by customer. There appears to be insufficient input from the accessibility community on quantifiable user needs. There needs to be better guidance on data protection for location-based services. Inclusive design and global standards will be crucial if new systems and services are to be fully accessible. The demand drivers are the best way to influence inclusive design.

Graham Worsley explained that the Technology Strategy Board funds research and development in the UK; this includes the area of assisted living. He discussed the work on improving interoperability – device to device, device to system, as well as system to system. The present system is fragmentary, but a large number of stakeholders need to be influenced to improve interoperability in practice. The key issue is that scalability requires interoperability.

Gunela Astbrink addressed how to make systems accessible; she concentrated on the key people involved centred around the champions. A European report identified that the situation is characterised by deficit, gap and patchwork. However there are some business opportunities to improve the situation which some companies claim to be adopting in relation to accessible ICT. She described a number of initiatives including the European Mandate 376 to incorporate accessibility requirements into government procurement. She emphasised the need for end-user participation in the whole design and development process which includes research as well as standardisation. This end-user focus needs to be realistic.

Peter Ball described some current activities in accessible smart living. The Welsh government have a project on assisted living technology which included a demonstrator and a technology showcase. They are studying what mainstream devices and apps could replace expensive stand-alone technology designed specifically for elderly users. He explained that the Knowledge Transfer Networks can influence the priorities for UK funding.

Prof Alan Newell explained the need to improve communication skills in the community. Designers often over emphasise the importance of extra functionality without considering the effect of so doing. He said that data and guidelines are necessary but not sufficient – an empathy with potential users is required. Mainstream designers are not fully committed to inclusive design. Data informs, but a good story can change minds. Therefore we need to develop appropriate stories about disabled users to influence mainstream designers. There is a need to stress the positive aspects of inclusive design. He explained that actors can present behaviour in engaging ways, and can provide a human rather than a technological focus.

Prof Gregg Vanderheiden said that roadmaps have been developed but they were not implemented. The situation is changing by the rapid change in technology which is affecting most people in modern society. However there are numerous barriers, but access solutions are often excessively complex. Vendors of assistive technologies have concentrated on the main disability groups while ignoring the needs of minority groups. However the needs of the main groups are being partly addressed by mainstream vendors (often with special 'apps'). Increasing product churn is causing extra problems for the assistive technology industry. He explained how the GPII project will address this problem using assistive software based in the cloud.

Prof Brian Collins explained that policy frameworks are often fragmented. Engineering policy is problematic since it is difficult to predict outcomes of a change in policy. He described various projects in UK universities looking at the likely effects of new technological developments – synthesis of design, engineering and policy is still in its infancy.

Guido Gybels stressed the need for finding mainstream solutions for most people whilst still providing specialist solutions for those whose needs are not met by the mainstream version. Too much assistive technology looks like it was designed 30 years ago, and lacks interoperability. People want to buy solutions and not technology.

Output

The PowerPoint presentations (in PDF format), photographs and biographies of the speakers are available on the project website at http://www.cardiac-eu.org/about/conference.htm. In addition a summary of the conference together with the background document is available. Also provided is a link to videos of each of the presentations. Participants were sent an email with a link to this website.

Conclusions

The conference successfully generated serious discussion on the priorities for future research in this area. Among the participants were people with experience of determining priorities in related research areas so brought fresh insights into the area being addressed by the Cardiac project and contributed to the discussion of the Cardiac roadmap.

Appendix 1 Background Document

The Future of Accessible ICT

Introduction

In the past, technology for people with disabilities was largely stand-alone devices which had a single specific function. In the last few years the emphasis has changed to designing mainstream systems and services so that they can also be useful to people with disabilities. This leads to the problem of how to educate mainstream designers about the desirability of adopting such an inclusive design approach, and how to make their systems accessible when this can mean very different things for users with different impairments.

The Numbers

In the UK the number of people living to an older age is increasing, and therefore the number of people with age-related impairments will also increase.

Approximate proportion of the population who experience difficulties in using standard ICT (NB Do not aggregate the figures since multiple impairments are common)

0.4%	Wheelchair users	1%	Dyslexic
5%	Cannot walk without an aid	3%	Intellectually impaired
2.8%	Reduced strength	0.1%	Deaf
1.4%	Reduced co-ordination	6%	Hard of hearing
0.25%	Speech impaired	0.4%	Blind
0.6%	Language impaired	1.5%	Low vision

Just to group people by the impairment can be misleading since each impairment can take many different forms. To give an example, about 1.5% of the population in the UK have vision such that they could be registered as ‘blind’ or ‘partially sighted’. However the impact depends on a number of factors including medical condition (eg macular degeneration), environment (eg illumination), and contrast.

In the past having a modest hand tremor was not a problem for operating controls, but the introduction of small touch screens on smart phones has meant that more people potentially have problems using everyday devices.

Assistive Technology

Twenty years ago, devices to specifically help people with disabilities were largely mechanical or electro-mechanical, but more recently computer hardware and software systems have become of increasing significance. Frequently such systems were so expensive as to be beyond the reach of many disabled consumers. This resulted in a complex system of subsidies being introduced for various products in specific situations. In the present economic climate, these subsidies may not be maintained at the present level or could even be withdrawn.

However mainstream technological developments may help alleviate the situation. For instance special software, such as screen readers, could be stored in the cloud and only accessed when required. With smart phones, special apps can be downloaded – the cost of these apps should be significantly less than normal assistive devices.

Mainstream Technologies

The trends in technological development mean that it is increasingly important for all users to be able to use mainstream systems and services. All too often these systems have been designed for what has been perceived as a 'typical' user, and little allowance has been made for people with disabilities.

Prioritising research for social inclusion in the emerging information society is not just about determining what new technological developments to fund, but how to influence mainstream design teams to take into account the needs of people with disabilities when designing new products or services. It is essential that their needs are considered from the outset in the design process.

In the longer term the full integration of various technologies offers exciting possibilities to provide a wide range of services that are inclusive and able to support people when necessary. Whether this will be fully achieved is subject to debate, but ethical and privacy considerations will be significant factors in the uptake of new services.

The key to delivering full integration to users is being able to provide what is wanted, when, where and how it is wanted. All these aspects are important so that the user receives the right information and is given the possibility of interpersonal communication, at the right time and in the right way. However user control is paramount so they can decide what information they want and whom they want to contact and whether or not they want to interact with information and people at any given point.

Users should not need to understand the technology to use it, and most will have no desire to think about it. Information should be delivered to the users on their own existing devices, and the interfaces must be straightforward and meaningful without, for example, the user being overwhelmed by options and menus.

The involvement of users throughout the design and development of services and products cannot be over emphasised. It is vital that ideas and concepts are tested as well as prototypes and the final product. User testing and evaluation centred on real life implementation rather than conceptual technology are the key to achieving products and services that meet real user needs.

Historically the World Wide Web has been mainly a repository for indexed information. However it is now evolving in a number of directions to provide a range of new types of service including virtual interactive spaces for social interaction, semantic services and interconnected intelligent objects such as sensors. In the longer term ambient intelligent systems may fully integrate environmental control systems, navigation systems, and alarm systems using broadband communication networks. Such intelligence in the environment leads to many exciting possibilities for making life easier for people with disabilities.

User Interfaces

During a normal day most people interact with a wide range of switches, keypads, instruments and machines. At the end of the twentieth century a major shift took place in the way computers are used to drive these machines - which saves time, provides information, entertains, and permits communication.

With the introduction of more sophisticated machines, such as digital interactive television, mobile telephony and the Internet, even more complex controls, buttons and interfaces are being employed.

When considering the needs of elderly people and persons with disabilities, it is necessary to be aware that having little or no vision, poor manual dexterity or weak grip can make using the machines and tools in everyday activities very difficult. Lack of foresight and thought into the way people interact with machines can mean that access is denied to a significant section of the population.

It is not just with new devices where there can be problems for people who have a disability. The increasingly sophisticated controls for cookers, microwave ovens, washing machines and central heating systems have created extra problems for disabled users.

In some instances it has been feasible to provide an adapted user interface such as a special keyboard for a user with a physical disability. However this type of approach has not proved viable for most public terminals, so adaptable user interfaces have been developed. For example the user's card might contain information which is used by the terminal to automatically change the font size, or foreground and background colours on the display; this type of approach is limited to changes which can be achieved using software alone. A more sophisticated approach is to have an adaptive user inter interface which automatically adjusts the terminal based on the user's behaviour; this type of approach has been demonstrated under laboratory conditions but has proved difficult to implement in practice on public terminals.

Most user interfaces are designed for someone conceived as a 'standard person'. The most common human characteristic is variety, so most designs do not completely fit the needs of an individual. Therefore the user has to adapt him or herself to the interface. Those not able to do this adaption may find that they are excluded from using a product or service.

Although techniques exist for avoiding unnecessary limitations, they are frequently not employed by designers of mainstream applications. The reasons for this include the complexity of applying existing methodologies and the time involved. However inclusive design means that mainstream products can be used by people with disabilities as far as is reasonably possible.

When the inclusive design approach does not meet all the needs, assistive technology can provide enhancements or alternative methods of interacting with systems. However such assistive devices have to be designed such that they fully integrate with the mainstream systems.

Technology Transfer

The problems associated with transferring assistive devices from the laboratory to being widely available are significantly different from those associated with introducing mainstream products and services which are usable by people with disabilities.

In the area of assistive technology for people with disabilities, many devices have been developed but most of them have failed to make the transition from the laboratory to being generally available at affordable prices. In some cases the devices have not met an unmet need, but there are many others where the technological aspects of the device were excellent and it was potentially useful. The difference between devices for disabled people

and general technical developments is that the market is not simple – the inability of the potential user to afford the full price of the product coupled with the peculiar subsidies which vary from one sector to the next mean that this area requires extensive experience to negotiate the various pitfalls.

Technology transfer may involve converting the design to one suitable for manufacture in an economic manner as well as marketing and providing support for the product. In the case of users with disabilities the provision of training in the use of the device may be time consuming and therefore expensive. The person who undertook the original development of the device may not have the necessary skills to manage these activities, but at the same time may be reluctant to hand over to another party who is perceived as not having an understanding of the needs of the disabled consumer and may not have the enthusiasm to devote to this activity. This enthusiasm is often mentioned as a key factor in bringing a device for disabled people to the market.

Since software is easy to replicate it is often considered relatively simple to bring to the market. However many disabled users may require extensive support to configure and efficiently use the software. Together with the high costs of marketing to this sector, it can mean that the price of the software is greatly in excess of the equivalent in the mainstream area, and this results in a reduction in sales.

Assistive technology devices are often required in relatively small quantities, but modern production techniques require large quantities to keep the unit price low. However some companies are set up to produce small quantities for military use, but have times when they have no work so are interested in manufacturing assistive devices to keep their workforce occupied. These companies frequently have no relevant expertise in marketing, so that has to be done by another organisation.

Funding bodies have long been concerned that they fund research but the products fail to reach the market. One technique which has been used to good effect has been not to fund the research directly but to agree to pay a considerable price for the first few units which reach the market with the appropriate support facilities in place.

The regulations regarding subsidy to assistive devices varies from one country to the next, and it can also vary by application (eg in education or employment). This situation does not appear likely to be resolved in the foreseeable future, so those marketing assistive devices need clear guidance as to the various systems of subsidy which are currently in use in various areas and countries.

Not all devices are for individual use. For instance audio beacons to help blind people navigate public spaces have been piloted in many countries. Often the manufacturers insist on using proprietary protocols whereas the purchasers want systems based on open standards so that they are not trapped in a single supplier situation.

Designing accessible mainstream information and communication technology (ICT) systems requires developers to have a good understanding of the aspects which affect the ability of individuals to use specific systems and services. All too often designers consider accessibility issues too late in the design process; like quality, accessibility needs to be considered from the outset and not added at the end of the process like a coat of paint.

Traditionally designers would test prototypes with a range of potential users to identify any problems. However nowadays the speed of converting a concept into a production model often means that there is no prototype to test, so all evaluation has to be done with computer simulations.

The Way Forward

There needs to be a coherent plan for developing future accessible ICT systems and services.

Short term priorities

- The design teams in mainstream industry need to develop an understanding of the needs of users with disabilities, and how to reflect these needs in the specification of new products or services. Similar education is needed for the other stakeholders such as standards committees.
- The business case for industry to take into account the needs of people with disabilities needs to be made based on reliable data.
- Independent guidance should be provided to companies developing new products. This could take the form of a series of guidebooks and/or the provision of broker agencies specialising in technology transfer issues.

Medium term priorities

- The attitudes of users with disabilities to pervasive technology will be crucial. For systems on which users with disabilities rely, it is important to incorporate facilities to cope with the effects of system failure or any misuse of the technology.
- Develop services to share knowledge about accessibility of ICT.

- Implementation of accessibility requirements for government procurement.

Long term priorities

- Currently little is known about how users with disabilities interact and cooperate with intelligent systems. There is a need for a scientific study using a statistically valid cross-section of potential users in realistic settings.
- Research is needed on an automated system for analysing an individual's needs, and then modifying appropriately the features of services. This becomes significantly more complex when there is more than one person using a system at the same time.
- Establish a body to monitor the protection of the rights of the users against invasive technology.
- Provision of procedures, easy to use tools and environments for accessibility testing.
- Provide incentives to bring academia, industry and users together.
- Support user involvement in all phases of product life cycle.
- Offer incentives to suppliers who offer effective accessible products and services.

Appendix 2 List of Participants

Julio Abascal

Peter Abrahams

Gunela Astbrink

Weiqin Chen

Samantha Cocksedge

Brian Collins

Martyn Cooper

Archibald Cunningham

Jenny Darzentas

Gus Desbarats

Olaf Druemmer

Margaret Ellis

Pier-Luigi Emiliani

Olan Ernstzen

Cristina Espadinha

Margaret Ford

John Gill

Tanya Goldhaber

Michael Grosse-Drenkpohl

Guido Gybels

Jonathan Hassell

Helmut Heck

Kieran Holmes

Andrew Jacobs

Steve Jones

Sabina Kason

Siri Kessel

Iosif Klironomos

Yiannis Laouris

James Munro

Alan Newell

Mary Nolan

Jocelyn Pearson

Leonor Pereira

Steven Postlethwaite

Deborah Pullen

Lucy Pullicino

Patrick Roe

Mike Short

Jim Slater

Tunde Turbucz

Robert Twitchin

Steve Tyler

Ad van Berlo

Gregg Vanderheiden

Gillian Whitney

Gwyn Williams

Roger Wilson-Hinds

Patrick Wollner

Graham Worsley

Emilene Zitkus-Andrade

Appendix 3 Photographs of Conference

Prof Patrick Roe worked as a senior researcher on several European projects including the three COST219 Actions, where he acted as Chairman for five years of the COST 219ter Action “Accessibility for All to Services and Terminals for Next Generation Networks”. Within the framework of these COST Actions, he has been the main editor of several publications and books.

Dr-Ing Helmut Heck coordinates R&D projects. His current interests relate to computer/robotic applications, human-machine-interaction for people with disabilities, accessibility of IT systems, as well as AAL.

Guido Gybels is an information and communication technology expert and senior manager concerned with innovation, research and development activities, software and hardware projects, standardisation and policy and regulatory strategy.

Over the last two decades of his career, Guido Gybels has been involved in digital technologies for desktop and mobile, with a special interest in Internet applications, usability and user-focused design. He acts as an expert advisor to both the UK government and the European Commission. He has studied and published in such diverse fields as history, linguistics, geography, didactics, docimology and psychology.

Professor Brian Collins CB FREng is Professor of Engineering Policy at University College London. Previously he was Chief Scientific Adviser at BIS as well as being the Chief Scientific Adviser for the Department for Transport and Professor of Information Systems at Cranfield University. His previous roles include International Director of Information Technology at Clifford Chance; Head of Information Systems at the Wellcome Trust; and Director of Science and Technology and Chief Scientist at GCHQ. Collins' university research was in the field of astrophysics, specifically solar and laboratory spectroscopy. He has a special interest in information exploitation in modernising national infrastructure, particularly in transport and energy, and in the design and engineering of structured, secure and dependable knowledge and information management processes and systems.

Professor Alan Newell MBE, FRSE is an Emeritus Professor at the School of Computing at Dundee University. This contains one of the largest academic groups in the world researching into computer and communication systems for older and disabled people. He has published widely in this field, including his recent book: “Design and the Digital Divide: insights from 40 years in Computer Support for Older and Disabled People” (Morgan & Claypool 2011). His current interest is the use of professional theatre to raise awareness and facilitate discussion on these issues. He was appointed a Member of the Order of the British Empire in 2000 for contributions to computer-based systems for people with disabilities. In 2011 was presented with the (US) Association for Computing Machinery SIGCHI Social Impact Award, and in 2012 elected a member of the ACM SIGCHI Academy. A former Deputy Principal of the University, Alan is a Fellow of the Royal Society of Edinburgh, the Association for Computing Machinery and the British Computer Society, and an Honorary Fellow of the Royal College of Speech and Language Therapists.

Peter Ball is Strategic Research Director at Building Research Establishment. Since graduating with a degree in Construction Technology and Management in 1984, Peter has spent a considerable amount of his time working outside the construction sector developing new and innovative technologies in smart, wireless, mobile and emerging technologies and is the winner of two International Innovation Awards for mobile solutions.

As Strategic Research Director, he now plays an important part of the shaping the research strategy of BRE and works with the Modern Built Environment Knowledge Transfer Network on new and emerging technologies and innovative technologies. Peter works closely with the UK Government's Technology Strategy Board and EPSRC as a mentor, assessor and industry stakeholder and helps to shape the funding roadmap to support Research and Development for the built environment.

Peter also sits on the UK Management Board of Construct IT, is an advisor to the Design in Mental Health Network and leads BRE's Health and Wellbeing strategy.

In 2011, Peter helped develop and launch the NHS Sustainability Portal with a number of key healthcare estates stakeholders which is looking to address the challenges faced by the NHS Estate. He is currently working with the Welsh Government on an innovative demonstration of tele-health and assisted living. The CEFALT project has created a living lab for highlighting addressing the issues and challenges of elderly people living alone and is fuelling research into new replacement technologies for assisted living as well as technologies, processes and opportunities for the built environment to deliver preventative healthcare interventions to address the issues of chronic illness and disease.

Pier Luigi Emiliani undertakes research in ICT theory and applications, with main emphasis on the applications of digital signal processing and information technology in eInclusion. He is (co-)author of over 160 scientific and technical papers.

Iosif Klironomos is member of the Human-Computer Interaction Laboratory and Centre for Universal Access and Assistive Technologies of ICS-FORTH.

Graham Worsley joined the then Department of Trade and Industry in 1978 with a focus on the ICT area. From around 1990 he ran collaborative R&D programmes in the telecommunications area and was asked to work on the development of the Assisted Living Innovation Platform in 2006 He is a member of the Advisory Board of InfoLab21 at University of Newcastle. He was responsible for pulling together various existing networks to build the Digital Communications Knowledge Transfer Network (DCKTN) and represents the UK on the European COST domain committee in ICT.

Gunela Astbrink is based in Australia and is the Principal of GSA InfoComm. She holds the adjunct position of Senior Research Fellow at the Institute for Integrated and Intelligent

Systems at Griffith University. She has 20 years of international experience in research and policy with a focus on regulatory processes to benefit people with disabilities. Gunela has represented disability organisations in advocating to improve the accessibility of technology products and services. Gunela is a Director on the Board of the Internet Society of Australia and a Fellow of the Royal Society of Arts (RSA).

Prof Gregg Vanderheiden is Director of the Trace R&D Center and a Professor in both the Industrial & Systems Engineering and Biomedical Engineering Departments at University of Wisconsin-Madison. Dr. Vanderheiden has been working on technology and disability for just under 40 years. He was a pioneer in the field of Augmentative Communication before moving to computer access in the 1980s. Many of the accessibility features that are now built into every Macintosh, Windows and Linux computer were created by his group in the 1980s. He has worked with over 50 companies, served on numerous governmental advisory and study committees on both sides of the ocean, and has chaired and/or edited many of the early accessibility standards. He is co-founder of "Raising the Floor" and initiated the international efforts to build National and Global Public Inclusive Infrastructures.