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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.

"Good design for people with disabilities is frequently good design for everyone."

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

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Just to group people by the impairment can be misleading since individual 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

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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 is 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.

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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 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

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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 e.g. 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

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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.

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