Older People as a focus for Inclusive Design

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ABSTRACT

This paper takes an extreme, and to some extent stereotypical, view of the various "inclusive design" paradigms. It has been written to be provocative, and to encourage designers to adopt a radical approach to including older and disabled people within their design brief. It recommends focussing on the needs and wants of older users followed by addressing the challenge of including able bodied people in the potential user group, rather than vica-versa. The paper concludes by suggesting the use of professional theatre to assist this process. The paper focuses on Information Technology systems, but a similar argument can be applied to product design.

Inclusive Design

There is little need, particularly in an article for Gerontechnology", to underline how important it is to consider older people when designing information technology systems. This paper, therefore, will not rehearse the reasons, nor provide supporting demographic statistics, for including older people within the potential user group of IT systems. It will address the question of how to approach the important task of designing "inclusively"?

As with all design, the fundamental question is "for whom are we actually designing our equipment?", and "why have we chosen that particular group of users as our target?". The first group of people who focussed on design for older (and disabled) people were rehabilitation engineers, who were often, but not exclusively attached to hospital physics departments[7]. More recent research in rehabilitation engineering can be found at http://www.resna.org/ the web site of the Rehabilitation Engineering & Assistive Technology Society of North America. Rehabilitation Engineers consider their users as a special group and have an essentially medical model of the design process. They investigate the needs of people with reduced or non-existent functionality and attempt to alleviate or replace this functionality using technology. In general they design exclusively for disabled people and are not concerned with people who did not have significant impairments.

With the advent of information technology, and the much greater flexibility of computer based systems, rehabilitation engineers and others examined how standard equipment can be modified so that people with disabilities could use it[32]. A further spur to this approach was the introduction of disability discrimination legislation in many countries. This has led to "accessibility

options" being provided as an add-on to much standard software, and also hardware has been marketed which allowed people with significant disabilities to use standard software[8]. The World Wide Web Consortium, and others, provide comprehensive guidelines for "accessible" web pages and software *http://www.w3.org/WAI*. Unfortunately, it is wholly possible, for a web site to slavishly follow these guidelines, and thus be "fully accessible", whilst, at the same time, being almost unusable for a person with particular disabilities [18,21]. For example: simply serially reading out tabular data via a speech synthesizer, will make the data fully "accessible", but virtually impossible to comprehend the interrelationships between the sections of the table which are obvious in its visible form. Similarly, it is much more difficult to ignore unimportant data if it is presented visually than audibly. Thus the approach of taking software designed for able-bodied people and providing modifications to cope with disabilities although very important, but does not always produce usable systems.

A different design paradigm promotes a consideration of the needs of disabled people within all product development teams. This is called variously: "Universal Design/Usability" [33] "Design for All" [31] and "Inclusive Design" [5,19,20]. Examples of such initiatives are the INCLUDE project within the European Union (http://www.stakes.fi/include), in the USA, the Centre for Universal Design at North Carolina State University (http://www.design.ncsu.edu/cud/ud/ud.html), and the Trace Centre in Wisconsin-Madison (http://www.trace.wisc.edu), and in the UK, the i-design project, a consortium of the Universities of Cambridge, Dundee and York and the Royal College of Art (http://www-edc.eng.cam.ac.uk/idesign).

The "Design for All" / "Universal Design" movement has been very valuable in raising the profile of disabled users of products, and has laid down some important principles. In its full sense, however, except for a very limited range of products, "design for all" is a very difficult, if not often impossible task, and the use of the term has some inherent dangers [12]. Providing access to people with certain types of disability can make the product significantly more difficult to use by people without disabilities, and often impossible to use by people with a different type of disability. Thus, for example, a "text only" web site can be an ideal solution for blind people, but could provide greater challenges for people with poor literacy than a more visual site. In addition the need for accessibility for certain groups of disabled people might not required by the very nature of a product {A British police force once advertised for a chauffeur indicating that application forms were available in Braille!}. We need to be careful not to set seemingly impossible goals, as this has the danger of inhibiting people from attacking the problem at all. Sir Robert Watson-Watt, the inventor of Radar, once said "the excellent is an enemy of the good". In our context, "accessibility by all" may provide a barrier to "greatly improved accessibility by most". Proponents of "design for all" and "universal design" are fully aware of these restrictions, but the author prefers the term "inclusive design" to underline this semantic distinction.

The point of these design methodologies is to attempt to ensure that all potential users are included within the design spectrum. There is, however, a tendency for the methodology to focus primarily on the particular product and to examine ways in which the design can extended so that it can be used, or used more easily, by excluded groups such as older and disabled people [31]. In this sense, "design for all|" could be seen as an extension of the "accessibility approach", but with the intervention at an earlier stage in the design process.

Design for ordinary and extra-ordinary people and situations

In contrast, Newell et al.[25] propose a design methodology which is focused specifically on the needs and fuctionalities of older and disabled people. They developed the concept of "Ordinary and Extra-ordinary human-machine interaction" as a wider justification for this approach[28]. They suggest that a focus on the needs of older people and people with disabilities, encourages the designer to contemplate a much wider range of user capabilities than would be the case were the designer to assume that all their users would be "able-bodied". They draw a parallel between "ordinary" people operating in an "extraordinary" environment (e.g. high work load, adverse noise or lighting conditions), and an "extra-ordinary" (older or disabled) person operating in an ordinary environment, and suggest that this approach can provide much improved systems for everyone including those who would never be considered to have any disabilities at all[26]. They suggest, for example, that the challenges of a pilot flying a high performance aircraft are similar to those of a disabled operator of a standard computer system. Even with perfect eyesight, the pilot has not got a sufficiently wide visual channel to take in all the information needed to do his job optimally, and would benefit from faster motor movement, in the same way as would the visually and motor impaired user of a word processor. In addition, they pointed out that people could be "disabled by their environment" - an extreme example being engineers in space who, although being apparently healthy and at the peak of their physical and mental fitness, are effectively extremely disabled due to the environment in which they have to operate and the protective clothing they have to wear. At a more mundane level, the use of standard equipment, in non-standard locations can effectively disable the user. If a lap or palm top computer has to be operated by a free-standing person, then effectively the user is one handed, and if they are outside in cold weather, the keyboard will be difficult to use whilst wearing gloves. If extreme portability as well as high functionality is required, such as alphanumeric data exchange with a mobile telephone, then all human beings are effectively handicapped. These are examples of the bandwidth of the information channels between the machine and the user (i.e. the connection between the user and the equipment) being the dominating factor in constraining the performance of the human machine system. In addition, of course, able bodied people often need to use equipment when they are not at the peak of their abilities with dysfunction caused by stress, fatigue, or drugs (legal and illegal).

There are some interesting historical examples of designs which were targeted specifically for older and disabled people providing substantial benefit for non-disabled people[11]. The cassette tape recorder was first designed by a company who were producing "Talking Books" for blind people,

and it is arguable that, without a focus on disabled people the product would never have been invented (at the time engineers said that, because of its poor sound quality, cassette tape recorders would never be popular). More recent examples include:

- The Ford Focus, currently best selling car in the UK, which was designed with the older driver in mind – the designers were given special suits which reproduced the effects of ageing on limb movements.
- A large button telephone designed by British Telcom for people with sight and dexterity impairments became a best selling model.
- The latest mobile telephones use disambiguation techniques (see http://www.tegic.com) which were developed ten years earlier by rehabilitation engineers for people with poor dexterity[2] .

A further reason for considering a focus on the needs of older and disabled people in all design activities is the profile of the functional characteristics of people as they grow older [13]. An approximation to the change in functional characteristics is shown diagrammatically in figure 1. From early teenage to middle age the range of most physical, sensory and cognitive abilities of the majority of human beings is generally not large (this figure does not include young and middle aged people with severe disabilities). As the body ages, ability starts to decrease, but it decreases at different rates for different people. Some specific abilities do start to decline very early in life, whereas others show little decline, but the majority follow a trajectory similar to that shown in Figure 1. Some older people's functional abilities will not change very much, whereas others will be subject to major decline (and they all decline to zero at death, either suddenly or following an increasingly steep downward trajectory). The figure illustrates how the range of functional abilities increase dramatically as the user group grows older, but that "high functioning" older people have similar characteristics to "medium functioning" middle aged people. Thus, in terms of their abilities, design which is appropriate for older people will be appropriate for most of the population, whereas design for younger and middle aged people will exclude significant numbers of older people. Wood[35] gives the simple example that "if a lamp is designed which meets the requirements of an older eye for more light, another user can use it dimmed if preferred thus rendering the design suitable for a wide range of user needs. If a lamp is designed only for the average consumer, the design will probably be unsatisfactory for nearly half the potential user population".

There is, of course, the danger that guidance for either beginners or those with cognitive impairments may become too intrusive as these people learn how to use a particular system[9]. Thus 'training' pathways may reach obsolescence fairly rapidly for some users, but may retain their usefulness for others, especially for those with mild cognitive impairments. Designers thus need to consider features designed for naive users that can be turned off as people get more used to the system, with system functionality increasing as people learn to use the system – rather than, as in some systems, functionality decreasing as one learns to use the system.

In addition, and relevant to the previous point, individual's functionality changes from day to day and sometimes minute by minute. Thus a mobile phone which a young man finds very easy to use in normal circumstances, can provide too high a cognitive load after he has imbibed too much alcohol, is not loud enough for use in a noisy pub and the text is too small to read easily. In addition he cannot use it on a cold night without taking his gloves off and risking frost bite, and it is impossible to use for a few weeks after he caught his hand in a car door. If he had purchased a mobile phone which had been well designed for older people, none of these problems would have occurred.

Design Philosophies

The approach of the four design philosophies to their potential user groups are shown diagrammatically in figure 2:

- Rehabilitation Engineering – focuses exclusively on specialised client group,
- Inclusive Design - aiming to increase the range of users for a particular product, but in practice unlikely to reach all potential users,
- Accessibility options - providing access to standard equipment for a greater range of users, but sometimes provides this in an unusable form, and
- The Ordinary and Extraordinary Design concept, where the design goal is a user group of older (and disabled) people in the knowledge that (i) this design is likely to be appropriate to a much wider group, and/or (ii) in some cases the design may be ideal for very high functioning people in extreme environments.

All these approaches have their advantages, and suit particular situations, but it can be argued that the Ordinary and Extraordinary Design approach can produce:

- New ideas for mainstream design (such as the cassette tape recorder), and
- Products which are easier for everyone to use for a greater proportion of their time (the simplified mobile phone)

In addition, because the designers are aware that a wider range of people than "just older people" will be using their products, they are less likely to fall into the trap of assuming that their user group will have no aesthetic sense. This will reduce the ghettoisation of products for older people.

Educating Designers

A major part of implementing more inclusive design philosophies is that of educating designers in how to take into account the needs and wants of older

people. Many designers, particularly software designers, tend to design for young and middle aged people, and rarely consider the challenges which their systems will present to older people. This could be because of stereotypical view that older people are not interested in new technology, but this is a self fulfilling prophecy. Disability discrimination legislation has increased designers awareness of the needs of disabled people, but many are not aware of differences in designing for older people, who may or may not have a particular disability, but will all be subject to multiple minor motor, sensory, and cognitive impairments.

Traditionally data about the functionality of older and disabled people, and their approach to interaction with IT systems is available in the form of tables of data, guidelines, and checklists, examples of which can be found in web sites referred to in the Inclusive Design section above. Such data is very extensive, and is usually communicated as scientific/engineering data. The sheer bulk of the data available, however, can be overwhelming, and the style is usually data tables and descriptive text and thus not always appropriate for busy designers. There is significant evidence that these data are not used effectively by designers both of general IT systems[14,30], and for web pages[21,23]. Newell et al.[27] have also observed this effect within a specific collaborative IT project between government industrial consultants and academics. They found that actually meeting and developing a relationship between the designers and older people within the development cycle made a substantial difference to the designers: their empathy with older users increased substantially - this changed their mind sets, and had a dramatic effect on their designs.

A direct interaction between designers and older users can be a very successful methodology, particularly if designers and older people to work together in a creative mode. This has been proposed both for IT systems [10] and within the more general field of ergonomics[36]. These processes, however, present challenges which Newell and Gregor[12] list as:

- Much greater variety of user characteristics and functionality, leading to the challenge of it being difficult or impossible to provide a truly representative user group,
- Finding and recruiting appropriate users,
- Difficulties of communication with users due to hearing and sight impairments, and keeping focus groups of older people focussed,
- Ethical issues of dealing with vulnerable user groups [1] or those whose confidence in using equipment is very fragile, and
- Possible conflict of interest between accessibility for people with different types of disability, (including “temporarily able-bodied”).

It is also not always possible, or appropriate, for direct interaction with users for pragmatic and business reasons.

One approach to introducing designers to the needs and wants of older people is the development of “Personas”[16] and “Scenarios” [4] which articulate the important characteristics of older people have been used to address these

issues. Personas and Scenarios provide an alternative way of presenting the design challenge and "introducing" designers to older people[17]. They are normally text based descriptions of potential users of technology and the situations in which they might be using either specific or generic technology, presenting the characteristics of the user, their environment and their needs in a documentary form, focusing on the important physical sensory and cognitive characteristics of the users, and those environmental issues which directly relate to the use of technology. Moggridge[24] also suggests the use of storytelling techniques within the design process and the Participative Design methodology also can involve story telling techniques[6,15].

The use of theatre

Although personas, scenarios and story telling offer a novel approach to the challenge of introducing designers to older people, we wanted to examine techniques which could have a higher impact in terms of developing an empathetic relationship between designers and users and would encourage a change in the mind sets of designers in terms of the needs and wants of older people.

Theatre is a traditional communication medium, and good theatre is a very powerful way of communicating messages to people, and can be used to change their mind sets of audiences. Theatre can play a part in the two crucial aspects of designing for older people, raising the awareness of designer about the challenges presented to older people by current information technology and requirements gathering, particularly in the early stage of the design of novel products.

We thus experimented with the use of theatre as an extension of the ideas of personas and scenarios We collaborated with a professional theatre company to produce a series of videos which described the challenges older people, found in using new technologies[3]. The process was as follows:

- Research by a professional script writer, which included iterative discussions with researchers and older users,
- A script writer developed dramatic scenarios, which included story lines, humour and conflict,
- These scenarios were captured on video using professional actors, and
- These videos were edited to produce final cut.

To date we have used videos in the requirements gathering phase of a project developing a monitoring system for detecting falls, and as a general awareness raising technique with designers. In the former the script writer produced a series of short plays telling stories which illustrated how a monitoring system could impact on the lives of older people and their relatives. An important characteristic of these videos were that they were designed to encourage creative thinking, and thus had a narrative rather than a documentary style, avoiding the danger of producing a dry all encompassing description of what such a system was and how it worked. These videos were shown to focus groups containing a range of potential users of such a

system - older people living both in their own homes and in residential homes, and professional carers The videos contained stopping points in the narrative where the audience were encouraged to discuss issues raised by a facilitator who was a researcher on the project. The videos were also used by the facilitator to keep the groups focussed on the monitoring system and those aspects of its design on which the researchers required guidance. These videos were found to be very successful in encouraging the audience to tell their own stories, and in this way provide the requirements for the system[22].

In a joint project, with an industrial company, to design an internet portal for older people[9] we had discovered how difficult it was to persuade designers about the major challenges older people had in using current information technology product. This impasse was only solved by the designers meeting with and talking to a range of older people about the paper prototypes they had initially produced. We wished to produce a series of videos which we could show to designers to start them on this learning path. We thus repeated the process outlined above with script writer having the brief described in this paragraph. There was significant interaction between the script writer, the researchers, and some older people who worked with us on this project. This initially was not an easy process, as the aim of the video was not to be didactic, but to raise designers' awareness of their need to learn more about the challenges of designing for older people. The script writer thus had to take the data, stories, and comments from the researchers and older people and turn them into interesting narratives, which would make this point forcefully and memorably. This involved an iterative series of interaction between the researches and the script writer, but the script writer retained responsible for the artistic decisions, concerning the narrative.

The videos which resulted from this process were engaging and fun to watch, and, in a series of detailed evaluation studies, were found to change the views of both students and professional designers of older users of technology. Respondents commented that they conveyed the importance of considering older users in the design of technology, and provided them with useful ideas[3]. The videos can be seen http://www.computing.dundee.ac.uk/projects/UTOPIA/UtopiaTrilogyVideo .

These experiments have indicated that theatrical techniques using professionals have significant promise as part of the design process for IT systems particularly where the user group includes older people. Newell et al. [29] have discussed the advantages of these techniques within the design of IT systems. They suggest the following activities within the product design cycle in which theatre could have a place:

- A theatrical performance being used to set the scene for a focus group of potential users (as in the Advanced Sensors project described above)
- A theatrical performance encapsulating the results of usability experiments or ethnographies and to present these results to designers (as with the UTOPIA trilogy),

- A well briefed actor replacing a user within (particularly early) usability testing, and
- A theatrical performance being used to facilitate dialogue between real users and designers.

To further this research, the purpose designed building for Applied Computing at Dundee University, includes the Queen Mother Research Centre for Information Technology to Support Older People, which has a fully equipped studio theatre and a script writer / director has been employed as Artist in Residence in this Centre. This will support a further series of experiments using both video and live theatre within the context of research programs designing IT systems for older people.

Conclusions

A number of design philosophies have been involved in developing products and systems for older and disabled people. The focus of Rehabilitation Engineering is on the design of specific products to support this group. Inclusive Design (also called Universal Design and Design for All) is aimed at increasing the range of users for which services and products are designed. The Accessibility Option is an approach to design mainly of IT products and systems, but has a place in product design, consists of adding extra modules to a main-stream product to provide access for older and disabled people. In contrast, Ordinary & Extra Design proposes focussing design effort on the needs and wants of older and disabled people, and following this by making adjustments for the younger market where necessary. A number of very successful mainstream products have been developed following this route, and it is argued that using the insights gained from focussing on the needs and wants of older people, not only produce products and services for those users, but also produces systems which are more easily usable by younger non-disabled people.

Focussing on user groups of older and disabled people brings its own challenges, in terms of communicating with users, and interaction between users and designers. The paper thus suggests using professional theatre to develop and present scenarios and actors to play the role of the user at various stages of the design process. Evaluations of early experiments have shown that this approach has promise, and the infrastructure to pursue these ideas has been developed at Dundee University.

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Figures

1. Functionality versus age

2. Range of users targeted by various design philosophies
   - Rehabilitation Engineering focuses on older and disabled users
   - Inclusive design focuses on extending the user base of products to older and disabled people.
   - Accessibility options add features to a mainstream product for older and disabled users
   - Ordinary and Extra-ordinary Design focuses on older and disabled users whilst also providing enhanced usability for able bodied people and for those in extreme environments.

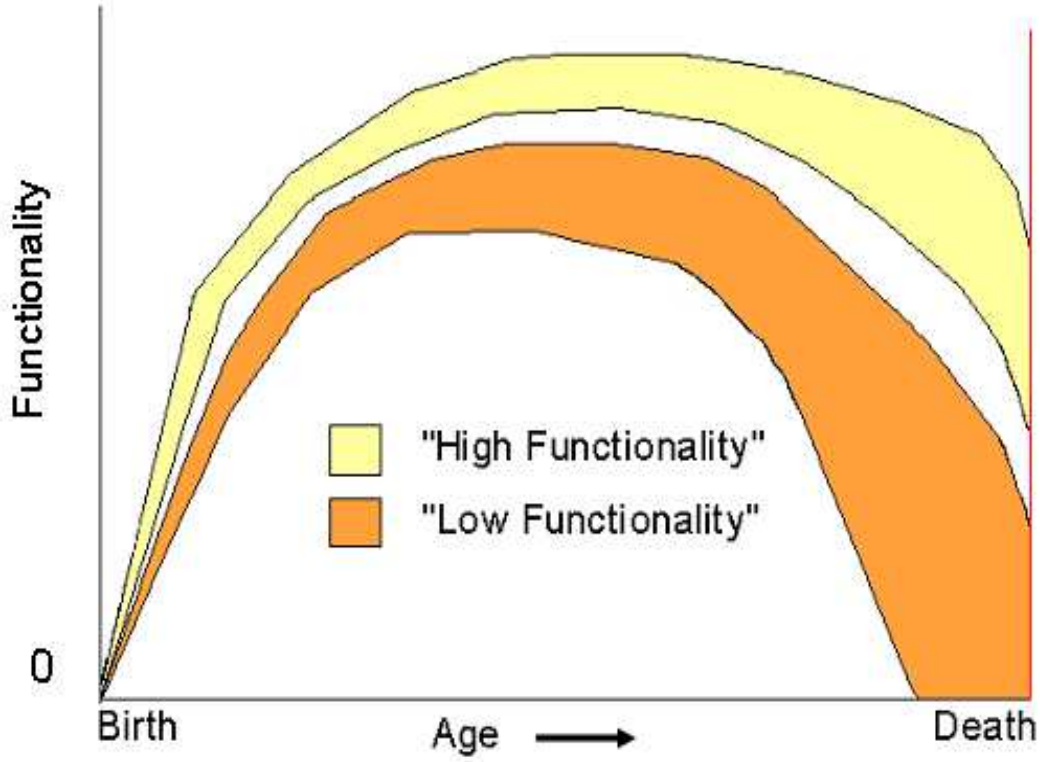
Functionality
0
"High Functionality"
"Low Functionality"
Birth
Age
Death

Figure 1

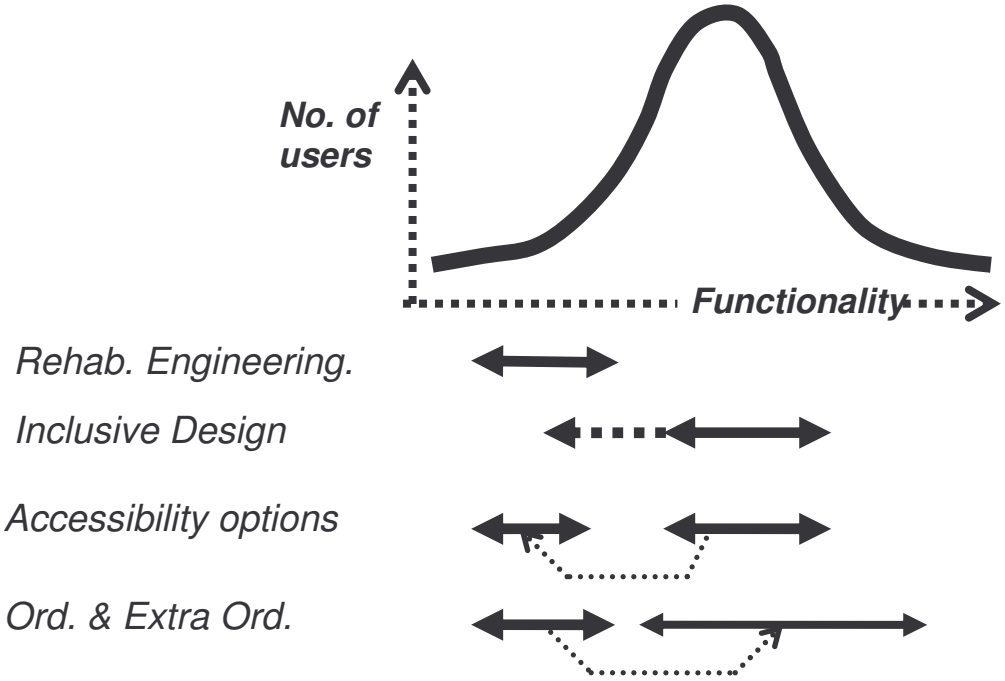
No. of users
Functionality
Rehab. Engineering.
Inclusive Design
Accessibility options
Ord. & Extra Ord.

Figure 2

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