Commentary on “Computers and People with Disabilities”: Accessible Computing - Past Trends and Future Suggestions

ALAN F. NEWELL

ACM Transactions on Accessible Computing Vol 1, No 2 2008 pp 9.1-9.7

This paper gives a personal perspective on Glinert & York’s 1992 paper, focusing on whether and how the situation has changed over the past 15 years, and makes recommendations for the future of the field of accessible computing with a particular focus on the needs of older people and people with cognitive dysfunction.

Categories and Subject Descriptors: K2 [History of computing]: K.4.2.[Computers and Society]: Social Issues – assistive technologies for persons with disabilities.
General Terms: Assistive Technology, Older and Disabled People, Inclusive Design.
Additional Key Words and Phrases: Cognitive Dysfunction, Theatre in Design

---

Authors' address: School of Computing, University of Dundee, DD1 4HN, Scotland.

1. PROGRESS IN THE YEARS 1992 TO 2007

Glinert & York's 1992 paper comments that "Access to information … by disabled people has been hampered by short sightedness on the part of computer and communication systems designers". Unfortunately, to a large extent, this is still true. I, and other authors, have made similar comments in the intervening years. The Digital Divide – "the divide between those groups of people who benefit from Information Technology and those who do not or cannot access it" was discussed by Pieper, Morasch and Piela (2002). In that same year, Gregor and Newell (2002) commented that: "the time is ripe to promote major changes in the way in which products are designed and the range of users who can benefit from technology", "improve our abilities in special purpose design" and provide "mainstream engineers with an effective and efficient way of including people with disabilities within the potential user groups for their projects." Gregor et al (2005) commented that "The digital divide still exists - while many major players and niche companies are clearly working hard to avoid excluding people, there are still many systems appearing – software, hardware and web services, - which have clearly not been designed with any thought for the whole range of users". "Much software appears to have been designed by and for young men who are besotted by technology, and are more interested in playing with it, and exploring what the software can do, rather than achieving a particular goal in the simplest way".

Despite these comments, a great deal has been achieved over the past 15 years – a number of specialised journals are now published, including this one, and a somewhat greater proportion of papers in mainstream conferences address the needs of disabled people. Accessibility options have been offered within a range of software products, increasing numbers of web pages are following accessibility guidelines, and researchers have examined the way in which web pages can be adapted so that the original data is presented in a more accessible form (Hanson et al., 2005). A significantly greater range of computer systems specifically to support people with disabilities are appearing on the market, and information technology is being more widely exploited within "smart home" environments.

In respect of specific comments in Glinert & York's paper, Gregor et al (2003) have produced "SeeWord", a word processor which provides "mechanisms for fundamentally modifying the visual aspects of the display". The results of research in the field of Augmentative and Alternative Communication (A.A.C.) systems have appeared in commercial products for non-speaking people, including the work described by Alm, Arnott, & Newell, (1992), and Pausch & Williams (1992) and Demasco & McCoy, (1992). Many commercial systems now contain predictive systems and provide pre-

stored phrases, and sentences which can be used to improve conversational momentum, and there has been an increasing interest in A.A.C. devices which facilitate story telling (Waller and Newell 1997). Systems originally developed for disabled people have also found a large mainstream market, one of the most popular examples being the "predictive systems" offered in mobile (cell) phones. These, originally called "disambiguation" systems, were developed in the 1980s for people who, because of physical disabilities, could only use a small number of large keys (Arnott & Javed, 1992).

There is, however, still a long way to go before we can truly claim that disabled people have full access to information technology. Blindness remains a priority for accessibility researchers – in some senses, just as a wheelchair user is the archetypical disabled person in the "real world", a blind person has become the archetypical disabled user in cyber space, to the detriment of systems to support people with other disabilities, whose numbers are greatly in excess of the numbers of blind users of technology. Gregor et al (2005) provides tabular data indicating that, in Europe, only 2.2% of the population are blind or have low vision, compared with 5.6 % with intellectual impairments and 4.7 % with dyslexia. More research effort needs to be devoted to computer systems to support people with cognitive dysfunctions than has been in the past (Newell et al 2008) , and a very pressing challenge to accessible computing is an increasing ageing population (Newell 2006).

2. OLDER PEOPLE

The issue of older users was not considered in Glinert's 1992 paper. Since then a worldwide demographic change has highlighted the pressing need to address the access requirements of older users. The US Census Bureau International Data Base reports that there are more people over sixty years of age than under sixteen in the UK and 1.1 million are over eighty. It is predicted that by 2030 in the UK there will be 2.3 million people over eighty, rising to 5.5 million in 2050, which reflects a world wide pattern. There is, of course, some overlap between older people and people with disabilities, 42% of 64-74 year olds having one or more disabilities limiting their quality of life. The prevalence of cognitive dysfunction, particularly dementia, also rises rapidly with the age. In addition, the aging of the population is likely to lead to a raising of retirement age, and thus business software, as well as personal software, will need to be sensitive to the needs and characteristics of an older workforce

There are major differences between older people and the more traditional "disabled person" for whom assistive information and communication technology has tended to be designed. Older people have different motivations and are less likely to be excited by,

and want to learn to use, unfamiliar technology. Most older people have multiple minor impairments, which can be inter-dependent as far accessible computing is concerned. The range of functionality of older people is also very great - high functioning older people have similar functionality to middle aged people, whereas low functioning older people have much lower functionality than middle aged people. There are many more minor cognitive impairments (e.g. memory and ability to learn new processes) even in high functioning older people than in young and middle aged people. Older people's minor impairments can make traditional assistive technology solutions for their major impairments ineffective (e.g. hearing impairment and declining cognitive capacity, can reduce the effectiveness of speech synthesis as an aid for severe visual impairment). Older users have reduced capacity for learning new techniques, forget them more easily, and are often much less prepared to devote a long period to learning such techniques. Older people are also much less confident with and accepting of information technology.

There also appears to be a view that it is not necessary to design beautiful objects to support older and disabled people, and manufactures do not seem to correlate poor (private) sales and/or utilization of their equipment with this view. Although beauty seems to play little or no part of the design brief for walking sticks for elderly people, there was a time when a walking stick was a fashion accessory, and a very wide range of very beautiful and expensive walking sticks were available. In contrast, during roughly the same time period, spectacles have moved from looking like prosthetic devices to fashion statements. Many older people have significant wealth and disposable income, but are unlikely to spend it on equipment which either makes their homes look like a hospital or them look like a patient.

In addition, the economic cost of caring for older people figures high in the political discourse of many countries. Well designed accessible computing could play an increasingly important role in the care of frail older people, enabling them to stay in their own homes longer, to have an improved quality of life, and have opportunities for hobbies and recreation provided by accessible computing systems.

3. INCLUSIVE DESIGN

Since Glinert & York's article there has been the movement towards "Inclusive Design". (Hypponen, 1999, Clarkson 2003). This, and the very similar "Design for All", and "Universal Design" paradigms, propose an alternative approach to that of designing for specific disabilities. These movements have played a valuable part in raising the profile of disabled users of products, and have laid down some important principles and

guidelines. There are, however, a number of disadvantages of these approaches from a research standpoint:

- It is very difficult if not impossible to provide a design which everyone can use.
- The concept of “everyone” as the user population is not very helpful for designers. The design process can become an impossible task if the characteristics for which one is designing, in terms of physical, sensory, motor and cognitive abilities, to say nothing of culture, knowledge and motivation, seem to include the whole population.
- The above can also lead to Inclusive Design being considered a “box ticking” exercise of following guidelines without too much consideration of the people for which one is designing. This has led, for example, to the appearance of web pages which follow accessibility guidelines, but are either very difficult or sometimes impossible to use (Thatcher et al 2002).
- Inclusive Design can often appear to be focused on modifying mainstream products, recommending that, somewhere - usually towards the end of the design cycle - designers should take account of the unusual demands of marginalized people such as older users. Applying the “universal design” concept towards the end of the design cycle, however, can lead to the requirements of marginalized groups being considered as an “add-on” to an otherwise well designed product. Not only does this patronize older and disabled people, but is also likely to lead to significantly increased costs, and possible to inappropriate compromises which are bad both for the traditional and the marginalized groups of users – that is a poor overall product (Newell & Gregor 1997).

4. DESIGN METHODS

Rather than follow traditional inclusive design methodologies mentioned above, I believe that research should focus on individual older and disabled users, as people rather than a simply a set of user characteristics. Pullin and Newell (2006) suggest that the design brief be stated as focusing on a small set of specific users. Designers should first consider what characteristics of older users are particularly relevant for the product/system or service for which they are designing, and, rather than strive towards developing the description of "representative users", they deliberately chose to describe a set of appropriate "extreme users". This design brief will thus consists of a small number of users, who may seem to have very little in common, but together map out the "user space".

A number of individual solutions, each tailored to a specific "extreme user", could appear at the early stages of such a design process, but the design team's task is to bring these various designs together to produce a final design, or limited number of designs. At this point, but not till this point, should the designs be assessed as a product for younger, non-disabled people. Pullin and Newell (2006) believe that this approach is likely to inspire more radical solutions and lead to designs which are truly innovative without compromising accessibility.

5. KNOWING THE USERS

Gregor et al (2005) commented that "the challenge is how to provide designers with the right sort of information (about users), and in a way which doesn't get in the way of the design process itself."

This follows the traditional "User Centred Design Principles", but, for older and disabled users, Newell & Gregor (2000) suggested the term "User Sensitive Inclusive Design". "Sensitive" replaces "Centred" to underline the extra levels of difficulty involved when the range of functionality and characteristics of the user groups can be so great that it is impossible in any meaningful way to produce a small representative sample of the user group, nor to design a product which truly is accessible by all potential users.

In addition to having detailed data of their characteristics, it is essential that designers develop empathy with their user group. A personal relationship with members of the user groups is ideal, but this may not be possible for a range of reasons such as availability and/or cost. Newell et al (2006) have thus experimented with the use of well briefed professional actors working to a well crafted script to introduce designers to the needs, wants and characteristics of older people. Theatre professionals, actors and scriptwriters, have many of the characteristics of ethnographers, with the addition that they are very practiced in what I like to call "what if" ethnography. They are also trained to present the output from their research in very powerful ways. This approach also removes ethical issues which can arise when the design brief includes fragile people, either physically, mentally, or in terms of self-confidence. An actor's ego is not involved in the character they are playing and thus the design team can be much more probing or even brutal in their questioning. An acted performance can thus be a very powerful and valuable way of requirements gathering and of presenting design briefs, with the safety which comes with the use of actors as surrogate users.

8. CONCLUSIONS

A great deal has been achieved since Glinert & York's 1992 paper, but, if accessible computing is to achieve its true potential, much remains to be done. Researchers need to address the challenges of people with a wider range of impairments, and interactions between different impairments, than has traditionally been the case. This should include more emphasis on supporting cognitive dysfunction, providing computer systems which are accessible to those with mild cognitive dysfunction, as well as developing systems to support people with major cognitive dysfunction. Researchers should not only consider what older users are perceived to need, but also what they want and provide accessible computing in a way which is aesthetically pleasing as well as effective.

User Sensitive Inclusive Design is recommended, whereby designers gain a holistic knowledge of the user population, knowing them as people as well as sets of "user characteristics". In those cases where it is impossible to form close links with older and disabled users, the use of theatre professionals and conventions have been found to form a useful intermediary between designers and users.

REFERENCES

Alm, N., Arnott, J. L., & Newell, A. F. 1992. Prediction and conversational momentum in an augmentative communication system. *Communications of the ACM 35, 5 (May. 1992),* 46-35.

Arnott, J.L. & Javed, M.Y. 1992. Probabilistic character disambiguation for reduced keyboards using small text samples, *Augmentative and Alternative Communication Vol.8, No.3*, Sept. 1992. 215-223.

Clarkson, J., Coleman, R., Keates S. & Lebbon C., (eds). 2003. *Inclusive Design – Design for the whole population.* Springer, London.

Demasco, P. W., & McCoy, K. F. 1992. Generating text from compressed input: An intelligent interface for people with severe motor impairments. *Communications of the* ACM 35, 5. 58-66.

Glinert, E. P., & York, B. W. 1992. Computers and people with disabilities. *Communications of the ACM 35, 5*. 32-35.

Gregor P., Dickinson A., Macaffer A. & Andreasen P. 2003. See-Word - a personal word processing environment for dyslexic computer users, *British Journal of Educational Technology, 34(3).*341-355.

Gregor, P. & Newell, A. F. 2002. Design for older and disabled people - where do we go from here? *Universal Access in the Information Society, 2(1)*. 3-7.

Gregor, P., Sloan, D. & Newell, A. F. 2005. Disability and technology: building barriers or creating opportunities, *Advances in Computers, 64*. 283-346.

Hanson, V. L., Brezin, J., Crayne, S., Keates, S., Kjeldsen, R., Richards, J. T., Swart, C., & Trewin, S. 2005. Improving Web accessibility through an enhanced open-source browser. *IBM Systems Journal, 44 (3),* 573 - 588.

Hypponen, H., 1999. *The Handbook on Inclusive Design for Telematics Applications,* Siltasaarenkatu 18A, 00531 Helsinki, Finland.

Newell, A.F., & Gregor, P. 1997. Human computer interfaces for people with disabilities, in Helander, M., Landauer, T.K., Prabhu, P.: Eds. *Handbook of Human-Computer Interaction*. Elsevier Science BV. 813-824

Newell, A.F. 2006. Older people as a focus for inclusive design. *Journal of the International Society for Gerontechnology, 4(4).* (Eds. J. E.M.H van Bronswijk, H. Bouma, D. G. Bouwhuis, J. L. Fozard, F. L. van Nes and L. R. Normie).190-199.

Newell, A.F., Carmichael, A. Morgan, M., Dickinson, A. (2006.The use of theatre in requirements gathering and usability studies. Interacting with Computers, Vol. 18, 2006. pp. 996- 1011

Newell, A. F., Carmichael, A. Gregor, P., Alm N., and A. Waller, A. 2008 Information technology for cognitive support, *The Human-Computer Interaction Handbook, Second Edition.* Lawrence Erlbaum, New Jersey, USA .811-828.

Newell A.F. & Gregor, P., 2000. "User Sensitive Inclusive Design – in search of a new paradigm", Proc A.C.M. Conference on Universal Usability, (ed. J. Scholtz and J.Thomas), Washington, DC Nov. 2000. 39-44.

Newell. A.F. & Pullin G. 2007. Focussing on Extra-ordinary users" HCI 2007 July 23rd -25th 2007 Beijing. *Lecture Notes in Computer Science, (Springer) 4554, Vol. 5*. 253 – 262

Pausch, R., & Williams, R. D. 1992. Giving CANDY to children: User-tailored gesture input driving an articulator based speech synthesizer. *Communications of the ACM 35, 5.* 58-66.

Pieper, M., Morasch, H. and Piela, G. 2002. Bridging the educational divide. In: *Universal Access and Assistive Technology*. Springer-Verlag London. 119-130.

Thatcher, J., Waddell, C., Henry, S., Swierenga, S., Urban, M., Burks, M., Regan, B. and Bohman, P. 2002. *Constructing accessible web sites.* Birmingham, UK: Glasshaus.

Waller, A. and Newell, A.F. 1997. Towards a narrative-based communication system" *European Journal of Disorders of Communication, 32*.289-306.