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A framework for collecting inclusive design data for the UK population

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ABSTRACT

Successful inclusive product design requires knowledge about the capabilities, needs and aspirations of potential users and should cater for the different scenarios in which people will use products, systems and services. This should include: the individual at home; in the workplace; for businesses, and for products in these contexts. It needs to reflect the development of theory, tools and techniques as research moves on.

And it must also to draw in wider psychological, social, and economic considerations in order to gain a more accurate understanding of users' interactions with products and technology. However, recent research suggests that although a number of national disability surveys have been carried out, no such knowledge currently exists as information to support the design of products, systems and services for heterogeneous users. This paper outlines the strategy behind specific inclusive design research that is aimed at creating the foundations for measuring inclusion in product designs. A key outcome of this future research will be specifying and operationalising capability, and psychological, social and economic context measures for inclusive design. This paper proposes a framework for capturing such information, describes an early pilot study, and makes recommendations for better practice.

1. The inclusive design background

Inclusion is an important topic within Government, as witnessed by a number of recent reports from the House of Lords (Broers et al., 2005) and offices of the Lower House (Johnson et al., 2010; Fitzpatrick et al., 2005; Piatt, 2005). All see the need for change in government and industry to reduce exclusion in society, but few solutions are put forward that will encourage such change. It is also clear that descriptions of 'end-users', i.e. those that we wish to include, are vague and lacking in the detail required to encourage positive action.

Despite this, there is an increasing awareness of the need to design for the widest possible range of users. This is typically focused on the needs of older and disabled people, but also has implications for all adults. By UK estimates, 22% of the UK populations are legally defined as disabled and 18.5% have moderate to severe ability loss, of which 53–83% involve multiple impairments. More severe impairments will demand more extreme design solutions. For example, dementia affects 820,000 people in the UK and 25 million of the UK population have a close friend or family member with dementia. The financial cost of dementia to the UK will be over £23 billion in 2012. Along with this growing demographic problem, mainstream ICT is far from inclusive.

Microsoft surveyed over 15,000 adults and computer users, asking about levels of difficulty with ordinary daily tasks, and concluded that the majority (60%) of working-age adults are likely to benefit from the use of accessible technology (Microsoft, 2003). Similarly, Philips surveyed over 1500 internet users and concluded that only 13% of the American public believes that in general "technology products are easy to use" (Philips, 2004). In direct response to the survey, Philips then re-branded their entire business as "Philips – sense and simplicity" and started to develop simpler, more accessible product interfaces. It is clear that adopting the principles of producing more accessible and usable products has been shown to be of benefit for everyone (Norman, 2002, 2011). In particular, where some users are excluded from using a product or service, many more are likely to find it difficult or frustrating to use (Clarkson et al., 2003). Hence, inclusive design has become synonymous with good design, where accessibility, as an extension of usability, can lead to increased commercial success. This is evidenced by a number of products and companies, that have brought products to market. For example, The Toyota Prius and WellCab car series, The Ford Focus (1st Gen); OXO Goodgrips range of kitchen implements, BT Big Button phone and The B&Q Sandbug and Gofer

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DIY products, (Warburton, 2003; Coleman, 2006). An even larger number of design awards have been made for demonstrator designs incorporating the research, as inclusive design has been mainstreamed following earlier initiatives, (Cassim and Durkan, 2005, 2006).

There is a global market for products and services designed with older and less able people in mind, and industry is responding to this opportunity, both in the UK and internationally. A recent survey commissioned by the UK Department of Trade and Industry looked at awareness and skills gap with regard to inclusive design in UK companies and concluded that the majority are aware of inclusive design and its benefits (Department of Trade and Industry survey on Inclusive Design, 2005). However, barriers remain to industry uptake of the ethos of inclusive design (Dong et al., 2004) in the form of:

- the lack of a perceived justifiable business case to support inclusive design;
- the lack of knowledge and tools to practice inclusive design;
- a lack of understanding of the difficulties experienced by users of new technology products;
- poor access to appropriate user sets.

Importantly, the most salient existing data set is that of the end-user data derived from earlier Office of National Statistics (ONS) surveys on disability (Grundy et al., 1999; Semmence et al., 1998). However, this needs to be updated with data describing users from a product and user perspective to enable designers to estimate better reasons for, and levels of, user exclusion. This will allow greater insights during the search for better design solutions. Providing such data and its corollary functional capability and context information in formats suitable for designers would have a direct effect on the design of products, services and work environments, leading to improved quality of life for the wider population (Langdon and Thimbleby, 2010).

1.1. Research requirements for inclusive design

Current research responds to the above challenges by extending the focus of earlier i~design work (Waller et al., 2010) to reflect these new priorities. The key research requirements of this work are:

- Better descriptions of the demands made by products and services on the user, linked to more accurate data about users, represented in designer-friendly formats
- Closer integration of anthropometric, capability, psychological and social data
- More effective application of user data to contexts, such as those of the home, workplace, and daily living
- Better understanding of the extent and nature of exclusion across the whole population
- Definition and verification of the means to capture a national user data set.
- Designing and piloting the research requirements for a major survey capable of international replication.

1.1.1. The current research paradigm

During the past 20 years, considerable advances in a variety of fields have contributed to research aimed at of extending the quality of life. Attempts have been made to categorise the needs of this rapidly expanding group of researchers by mapping a research agenda (Smith, 1990) and developing an ergonomic description of older people (Fisk and Rogers, 1997). Scientific studies on ageing in the US, e.g. the Baltimore Longitudinal Study (Fozard et al., 1993, 1997), have gathered much data, focussing on human performance in controlled laboratory situations. Another approach developed in North America, is that of Transgenerational Design, which seeks to bridge the needs of old and young. The US protagonists have developed extensive design guidelines and case-studies which form a useful basis for future work (Pirkl, 1993), while Japan has taken a strong interest in Universal Design (Kose, 1999). The European Union has embraced the idea of 'design for all' and integrated this as a core strand into its IT initiatives. For example, Ariadne is an online virtual resource Centre infrastructure providing access to material related to Design for All, and EDeAN (EDeAN) is a web portal for the EU's e-inclusion goals that references it.

Most of the emphasis on the types of measures required for inclusive design has been given to objective measurements such as body dimensions and perceptual functioning. Previous researchers have put considerable effort into deriving statistics on capability range in the wider population including the aged and disabled (Smith et al., 2000). This is illustrated by the Human Factors area application to product design, and skill acquisition (Stanton, 1998; Charness and Bosman, 1992); human–computer interaction (HCI) research into product desirability, the AVANTI product evaluation system (Stephanidis et al., 1998), and user sensitive design (Norman, 2002, 2011; Rizzo et al., 1997; Newell and Gregor, 2000); usability engineering and interaction design (Nielsen, 1993; Hartson, 2003); and psychological approaches, such as that of intuitive prior experience, cyclic interaction theory and characterising cognitive loss in ageing (Langdon et al., 2007, 2010; Ryu and Monk, 2004; Rabbitt, 1993).

While past research (Clarkson et al., 2003) has focused on design exclusion and capability data and scales based on the WHO ICD (WHO01) classification of disability, current work is addressing areas neglected by the previous scales, including visual, hearing, cognitive and motor functions that are involved in human capability assessment (Waller et al., 2010; Tennati et al., 2012; Johnson et al., 2010).

In order to calculate realistic levels of product exclusion and difficulty, accurate and up-to-date data on impairment in the population needs to be combined with a robust and complete model of human–product interaction with reference to environmental and social context of use. To achieve this, it is necessary to build on the interaction model and basic capability data of earlier inclusive design projects by increasing the scope and accuracy of population data and the integration of scales and their underlying models. It is also necessary to collect a statistically accurate data set of population capability information and build the foundations for the collection of survey data, ultimately at a national and international level. Instead of focussing on merging separate tools and techniques into an integrated inclusive approach, the aim is to increase the accuracy and effectiveness of these tools in a wider range of contexts, to collect new, current data and to bring the ensemble to national awareness and utility.

The methods of development of more accurate scales must be based on iterative cycle of validation of new scales of perceptual, physical and cognitive capabilities. These scales should be theoretically derived from first principles of psychometrics, ergonomics and cognitive psychology (e.g. Stanton, 1998; Poulson et al., 1996; Wickens and Hollands, 2000) in conjunction with knowledge of prevalence of impairment (Clarkson et al., 2003; Persad et al., 2007). Algorithms for combining scales such as that of Kondraske will be necessary to integrate the model as previous paradigms have dealt with functional capabilities using linear additive models. Kondresake proposed a resource economic system performance model based on limited resource utilisation and non-linear