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Gradually including potential users: A tool to counter design exclusions

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ABSTRACT

The paper describes an iterative development process used to understand the suitability of different inclusive design evaluation tools applied into design practices. At the end of this process, a tool named Inclusive Design Advisor was developed, combining data related to design features of small appliances with ergonomic task demands, anthropometric data and exclusion data. When auditing a new design the tool examines the exclusion that each design feature can cause, followed by objective recommendations directly related to its features. Interactively, it allows designers or clients to balance design changes with the exclusion caused. It presents the type of information that enables designers and clients to discuss user needs and make more inclusive design decisions.

1. Introduction

Independent living is a topical issue as many societies are coping with ageing populations (UN, 2011). For example, in the United Kingdom it is expected that by 2035 around 23% of the population will be aged over 65 (ONS, 2012). This demographic change means a sharp increase in the older adult product and service market sector. However, compared to the other age groups, the older adult market segment is likely to have a greater number of people with physical, sensorial and cognitive disabilities (WHO, 2011). In fact, in Europe, on average, the disability prevalence among people aged 65 and over is four times higher than people aged 15 to 44 and two times higher than people aged 45–64 years (Eurostat, 2015). Similarly, in the USA more than 38% of people aged over 65 reported having at least one type of disability, which is the age group with the highest incidence of disability (He and Larsen, 2014). A recent survey conducted in England demonstrated that, on average, the quality of life of people aged over 64 years decreases due to disabilities affecting individuals' locomotion, dexterity, vision, hearing, memory, and other capabilities (ONS, 2014).

In analysing previous studies Karlsson (2013 - p.213) stated that products generally target younger able users, and as a result, "*older users have to cope with technology that does not meet their more fundamental needs*", causing them extra difficulties. These difficulties reinforce the case that "*if something is both less useful and less pleasurable in practice, then people are understandably less inclined to engage with it*" (Selwyn, 2004). Thus, unless the needs of older adults and people with disabilities are integrated into design processes, new designs will not meet these needs or, in turn, promote independent living.

The research presented here recognised that inclusivity can be a challenge for designers. Addressing inclusivity issues during product development means that designers should be aware of the diverse range of capabilities in the population. However, the connection between design features and the end-users' physical, sensorial or cognitive capability is not easily identified (Persad et al., 2007). Furthermore, the relationship between the skills required by design features and their impact on different levels and types of capability loss readily identified is not simple to understand (Tenneti et al., 2012; Johnson et al., 2010). Thus, it is necessary to facilitate the linkage between design features and the potential exclusion they may cause.

For instance, the interaction with controls with small switches (or sliding buttons or pressing buttons) placed close together requires precise grips that are difficult to be performed by people with dexterity problems, such as arthritis or Parkinson's disease. In other cases, there are innumerable products and packages that use

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text fonts or foreground and background colours that are illegible for people with vision loss, whether it is a result of macular degeneration, glaucoma, cataracts, colour blindness, short sightedness or other disability. In these cases, the design feature itself causes the exclusion of a portion of the population.

Nevertheless, the research recognised that product development is complex and design elements are interconnected, which compromises design decisions. For example, the text size in a product may be related to the size of the product, which may be related to the reduction of materials which classifies it as a sustainable product. However, even in such a case, balancing design requirements with design changes informs design decisions. Thus, despite those major limitations, product developers could gradually include small changes in their designs. As an example, having the option to change the text font, text colour or background colour to make a final product more accessible and usable would not necessarily affect other project specifications. The mobile phones and the remote controls in Fig. 1 are some examples where small changes could result in a more legible and usable product for a wide range of users without necessarily affecting other design attributes. The text size, colour and foreground-background colour in the mobile phones make the mobile on the right more legible and ease of use. The option of having reduced functions (or hidden functions in the slide cover) and higher colour contrast make the remote control on the right simpler and more legible.

In the same way, in Fig. 2, the toaster, the coffee maker, the telephone and the camera could all increase the colour contrast of their labels for more legible ones. In these cases, product developers could have been informed about the design exclusion, enabling them to make changes while it was still possible during early stages of the design process, thus making such changes less expensive.

1.1. Inclusive design tools

The need to enable product design teams to understand the end-users' requirements has driven experts to develop an extensive range of techniques for many years. However, according to Goodman et al. (2006a and 2006b), one of the barriers to inclusive design adoption is the incompatibility between the techniques and design practice in industry. In this paper, the tools are measured according to three major aspects presented in the literature that influence their use or lack of use:

1. **Integration** to process: the earlier a product meets user requirements, the less the changes impact the process (Clarkson et al., 2007). Assessing new designs while they are created - during the conceptual phase - have minimum effect on the project's budget, the project's plan and the design activity (Ulrich and Eppinger, 2008).
2. **Interface** of design evaluation tools: visual interactive interfaces with graphical information, like simulations, images, or animations are described as the best way to communicate with designers (Macdonald and Loudon, 2007; Porter and Porter, 1999; Henderson, 1999).
3. Effective **results**: quantifiable data directly related to design issues rather than human characteristics can be more effective and efficient (Happee and Wismans, 2009; Burns et al., 1997). In a study conducted by Dong et al. (2003 - p.116) the designers underlined that exclusion numbers could help to persuade clients to invest in inclusivity. Thus, another requirement is that results have to persuade not only designers, but also clients. As indicated in past studies, both clients and designers make design decisions and they need information that satisfies their interests (Cornish et al., 2015; Goodman-Deane et al., 2010; McDonnell and Lloyd, 2009; Le Dantec and Yi-Luen Do, 2009; Goldschmidt and Eshel, 2009; Oak, 2009).

The available inclusive design techniques vary in format and scope, including, among others, guidelines, user tests and physical or virtual simulation tools (Zitkus et al., 2011; Zitkus, 2017). They are briefly described below, while their integration to process, interface and results provided are outlined in Table 1.

1.1.1. Guidelines

Standards and guidelines have been suggested by many experts as a way to guide designers to address the needs of end-users (Nicolle and Abascal, 2001). A broadly acknowledged example is the World Wide Web Consortium (W3C), which has developed standards and guidelines for designing accessible websites (Brajnik et al., 2012). The main difference between guidelines is their scope; some of them cover general requirements, whilst others cover specific information. The type of information presented influences the stage in the process where it could be applied (as shown in Table 1), which is directly related to its integration to design processes (Burns et al., 1997).

1.1.2. User tests

Direct user participation in the design process is a well-known way to enable designers to understand user needs and develop empathy with them (Sanford et al., 1998). Involving older adults and people with disabilities is beneficial as the outcomes show product problems related to a diverse range of users, which supports inclusive design (Cassim and Dong, 2015; Wilkinson and De Angeli, 2014). Methods where end-users are involved include usability tests (Norman, 2013), user observation (Eisma et al., 2004), user co-designing (Rode et al., 2004) and, user theatre (Newell et al., 2006). However, the value of user-centred techniques is often undermined by the time needed to recruit and select a representative sample of users, added to the time for data collection and analysis (Marshall et al., 2015). In addition, concerns about ethical issues, such as the vulnerability of elderly or disabled people, are often cited by industry as reasons to not engage in this technique (Newell et al., 2006; Dong et al., 2003). As a result, user

Fig. 1. Comparison of similar products: on the right, examples of design attributes favouring the legibility of mobile phones and remote controls.