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Metric for Designing Inclusive User Interfaces: Action Research on the Implementation of the Care Act 2014

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Abstract

This action research is aimed at creating a series of metrics for inclusive user interfaces that are intuitive and bridge the gap between skilled users and novice users. This metrics will help user interface designers to measure the 'inclusivity' of their design, thus producing services that are as easy to follow as an IKEA manual. This action research is conducted in Nottinghamshire County Council who invested resources to create online channel that enables customers to apply online for social care services, while recognising that their customer base is very diverse. The council adopted an inclusive design strategy to cater to all users with different needs and computer literacy levels.

Keywords: Human-Computer Interaction, Older Adults, Action Research, User Interface, Inclusive Design

1.0 Introduction

Around the world and especially in industrialised countries people are living longer than their ancestors (Phang et al., 2006). However, with a greying population come new challenges, one of which is the increasing costs of social care due to the high demand. The UK tried to mitigate those high incurring costs of care with the introduction of the Care Act 2014 that insures that no citizens should handle the costs of care on their own, and that they have control over choosing the appropriate care services using the advice services with the help of their corresponding local authority (National Archives, 2014). The Care Act 2014 was introduced to replace and modernise old legislations that date back to 1948.

While recognising that such legislation will spark even higher demand for care services, county/city councils around the UK found it necessary to embrace new channels of communication. This necessitates the introduction of the online self-

assessment and online information advice to reduce the work load on social care staff and to insure that councils are able to reach a wide customer base. So the online services provided by the councils need to be as inclusive of all users as possible including older adults who make up a large number of the beneficiaries of care services. The customer journey through out the application process needs to be consistent and offer the same result regardless of the communication channel used. Nottinghamshire County Council (NCC) took it upon themselves to create an application portal that mimics the interaction that of a natural conversation between social worker and prospective customer.

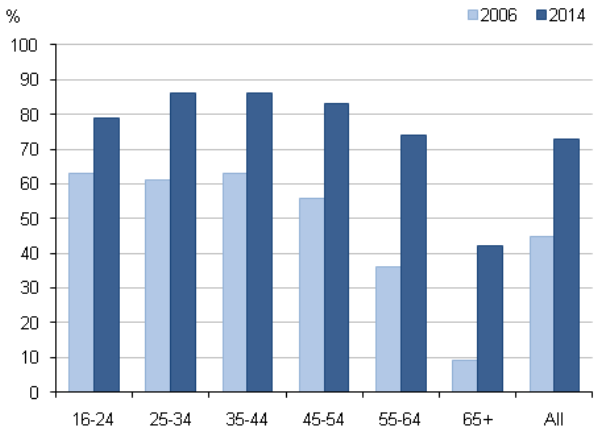

Figure 1. **Daily computer use by age group, 2006 and 2014 (Office for National Statistics, 2014)**

While this approach seems to match the NCC needs, the portal needs to be inclusive to users with different computer literacy levels, especially since that most of its perspective users are going to 65+. However, according to the Office of National Statistics (2014) the percentage of internet users who are 65 and above has jumped from 9% to 42% in the last 8 years as seen in Figure 1. Acknowledging the fact that some prospective customers might delegate the task to their children and other trusted individuals, it is not feasible to develop a website exclusively for older adults, as the disparity of needs within that age group is big. Inclusive design has proven itself to be an appropriate strategy to design such services that will have big customer base with different capabilities. Nonetheless, there is no metric available to measure the inclusivity of a website. The metric will help designers to insure that the user interface is easy to use and intuitive to all users, and does not require a long learning curve to perform tasks.

2.0 Literature Review

In order to fully cover the concept of inclusive designs, one must develop an understanding of the age-based digital divide and the causes that hinder technology use by older adults. Then introduce the concepts of inclusive design that have been talked about in the literature.

2.1 Age-based Digital Divide

The digital divide is broadly defined as the gap between users and non-users of Information and Communication Technology (ICT) (Lam and Lee, 2006). The study of the digital divide in the Information Systems (IS) literature mainly concentrates on the gap and access inequality to ICT by investigating the difference in technology access between different demographic groups in terms of gender, ethnicity, income, education level, etc. (Dugdale et al., 2005). However, the term has evolved over time to provide a deeper understanding of the issue rather than just access to technologies. While a great deal of research was focused on physical access and possession of ICT products, van Dijk and Hacker (2003) expanded the phenomenon of the digital divide to address types of access to the internet and other ICT products, their classifications of access types include: (1) Motivational access, which deals individuals' desire to use ICT products and be connected; (2) Material access, which deals with individuals' physical and economical ability to access an ICT product; (3) Skills access, which deals with individuals' ability to operate and understand ICT products; and (4) Usage access, which deals with the actual usage and appropriation if ICT products in individuals' lives. The digital divide between age groups has been receiving much interest from IS researchers due the shifts in demographics and the everlasting ICT craze around the world (Lam and Lee, 2006; McMurtrey et al., 2011).

The main causes of the digital divide can be categorised as technical issues that deals with technology design and features, physical and cognitive issues, and psychological and sociological issues; all of which affects users and reinforce their resistance to technology.

2.1.1 Technical issues

While most organisations pour their resources towards creating an online presence to interact with their customers, the needs of older adults are not nearly met with those online services (Marcellini et al., 2000). Considering that older adults are not constituting a significant customer base online, this encouraged organisations to design online services that appeal to their younger customers who are more likely to use them due to their familiarity with online services, however this is changing due to the increase of silver surfers online.

Design strategies like the use of metaphors have been utilised extensively in the HCI field especially when designing user interfaces, these metaphors simplify the interaction with different technologies by mapping the interface with the user's prior knowledge in the real-world, these strategies could potentially widen the digital divide if not used wisely, because older adults did not grow up with those technologies that young people nowadays use and their experience and previous knowledge differ substantially (McMurtrey et al., 2011). Especially with the use of novel designs that are unnatural to the average user, just to showcase the organisation's ability to design a 'beautiful' interface with complete disregard to the value of the elements in the interface and how it can help make the interaction intuitive and natural (Norman, 2010). Current Graphical User Interfaces (GUI) places great emphasis on aesthetics and little on utility. Even though the effect aesthetics influence can sometimes exceed the effect of utility and usefulness in software and hardware design, Norman (Norman, 2005) argues that designing appealing items whether technology or non-technology products, would influence individuals preferences to use certain products. However, Tuch et al. (2012) found that this is not always true as aesthetics is a very subjective matter and can differ from one person to another. Especially since many

designers fall in the mistake of designing for themselves without considering the unique needs of users (Lim, 2010). Czaja and Lee (2007) argue that many designers do not consider older users when they design user interfaces, and thus do not consider age related changes in the users' capabilities.

2.1.2 Physical and cognitive issues

In order to comprehend the issue of technology adoption among the older adults, one must develop a deeper understanding of the effects of ageing on people and the needs of this age-group. Fisk et al. (2012) emphasised the effects of ageing on three areas, (1) sensory modalities which deals like taste and smell, hepatics, audition, and vision; (2) cognition which deals memory, attention, spatial cognition, and understanding spoken written language; and (3) control of movement. The matter is further complicated since older adults are more likely to suffer from age related illnesses that affect their physical and cognitive capabilities (van Dyk et al., 2012). Thus reinforcing the older adult's position to avoid technology because failing to do simple tasks using technology will have a negative effect on their self-esteem that will ultimately result in technology resistance. However, the effects of ageing can be substantially different due to many circumstances like health care issues, educational level, and economic conditions.

2.1.3 Psychological and sociological issues

Psychological and sociological issues can also affect older adults' attitudes toward using technology and online services; issues like self-efficacy and culture have similar affect to physical and cognitive issues.

Self-efficacy deals with one's perception that s/he can execute a certain task and achieve the desired goal from the task (Bandura, 1997). Especially since individuals tend to perform tasks that they believe they are good at and avoid those that they believe they cannot do (Lam and Lee, 2006). The Social Cognitive Theory (SCT) outlines that self-efficacy stems from (1) enactive mastery which is created from ones successful previous experience; (2) vicarious experience which is created from observing others performance; (3) verbal persuasion which is created from encouragement and support from others; and (4) physiological and emotional state which deals with the state before attempting new behaviour (Bandura, 1997). The notion of self-efficacy is domain specific as individuals have different perceptions of their capabilities in different tasks. Thus, computer self-efficacy is more appropriate to describe individuals' perception of their competency to achieve a certain goal using a computer system. On the other hand, computer anxiety deals with the fear that people experience when using computers, due to their fear to damage the computer or look silly once they committed a mistake. Computer anxiety has a strong effect on computer self-efficacy which ultimately affects users' performance (Barbeite and Weiss, 2004).

In today's global economy, cultural differences between markets have to be carefully examined especially when it comes to technology related issues, especially since culture can affect the way individuals perceived the technology. Hofstede (1980) defines culture as "the collective programming of the mind that distinguishes the members of one group or category of people from another". The issue here is measuring the effects of culture can be deemed as a very difficult task. As the effects

of culture are not obvious as one would think, and it needs a proper understanding to know which element can considered a valid measurement of culture (Ford et al., 2003).

Issues like individuals' perceptions of independence can play an important role on technology adoption (Sayago and Blat, 2008). The current research in technology adoption among the older adults in particular have attributed independence as the main driver of technology adoption (Marcellini et al., 2000; van Dyk et al., 2012). However, the notion of independence vary within cultures and even within time, as Long (2012) found in her longitudinal study about the meaning of relaying on assistive technology for seniors in Japan, that the Japanese seniors' perceptions of independence have changed through the years. Especially since historically the role of taking care of the elder parents in Japan was the job of the daughter-in-law. However, in the midst of economic changes and calls for modernisation and in the Japanese society, the value of independence has been reinforced among older adults. Individuals from eastern cultures tend to be more holistic and interdependent, as they value hierarchy and society's role prescriptions. On the other hand, individuals from western cultures tend to be individualistic and independent, as they value their goals and objectives without being constrained by others demands (Nisbett and Miyamoto, 2005).

2.2 Inclusive Design VS. User-Centred Design

There are two schools of thought in terms of user interface design, which are (1) User-centred design, which concentrate on a specific users with certain needs, and (2) Inclusive design, which caters to as many users as possible without distinctions (Newell and Gregor, 2000). van Dyk et al. (2012) argue that the 'one-size-fits-all' strategy should be avoided when it comes to designing a hardware or software for the older adults as designers need appreciate the heterogeneity of their needs. Lim (2010) suggests The inclusive design strategy promises a better design that caters to as many users as possible by including variety of possible users during early design stages, thus resulting in less stigmatising products that do not make the user feel inferior. Current Inclusive design guidelines produced by some governing bodies like European Telecommunications Standards Institute (ETSI) focuses more on inclusivity of ICT products rather than user interfaces (Cremers et al., 2013). Keates and Clarkson (2004) created a model for inclusive design illustrated in Figure 2. Designers can divide the steps when creating inclusive user interfaces to these five levels:

- **Level 1:** Investigating the requirements of the system or service in hand.
- **Level 2:** Looking at how the users will get the information from it.
- **Level 3:** Looking at how users understand the process.
- **Level 4:** Looking at how users enter data and manipulate the system.
- **Level 5:** Evaluate the system.

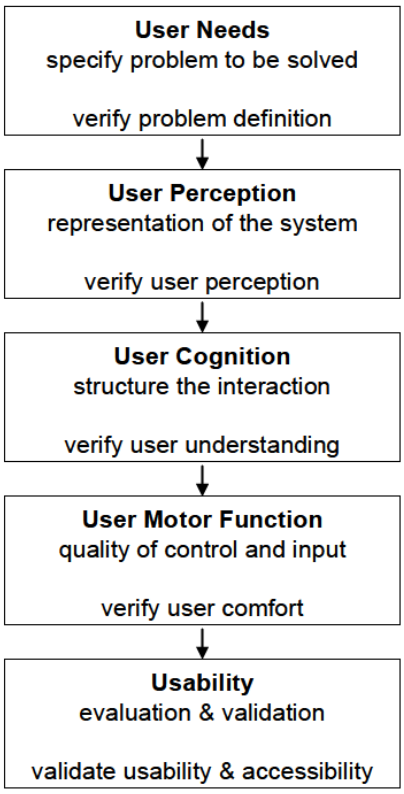

Figure 2. The 5-level design approach (Keates and Clarkson, 2004)

3.0 Research Design

With current push to bridge the gap between theory and practice, Action Research became more attractive to researchers as it provides the ground to impact the society while allowing them to further theory and knowledge (Byrne, 2005). Action Research is the most favourable research design for throughout this study, by working alongside the NCC's Care Act team to develop inclusive interfaces for the online services that will be provided upon the implementation of the Care Act 2014. This environment enables the researcher and the Care Act Team to test the interfaces using the metric suggested, allowing the metric to be tested and verified beyond the realm of scholarship.

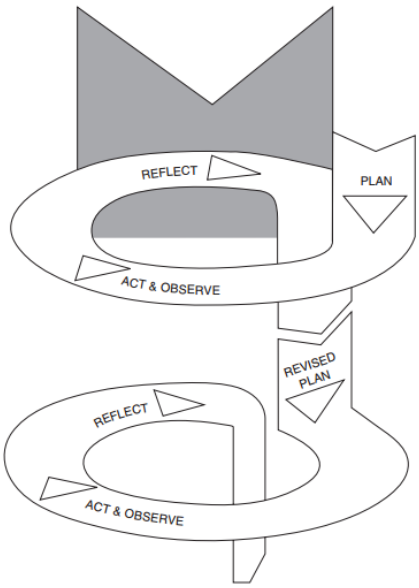

Figure 3. Action research process (Kemmis et al., 2013)

As shown in Figure 3, action research in its basic form is an iterative process that moves from planning to implementing the plan and then evaluating the results (Kemmis et al., 2013). The research first identifies the needs and capabilities of older adults by capturing them during computer training courses conducted in the Nottinghamshire along the current literature in the digital divide. this will help to insure that users' needs are needs are not forgotten especially since designers tend to design interfaces for themselves (Fisk et al., 2012). Thus making the interface experience difficult for users who do not share the capabilities of the designers which will ultimately make the users feel excluded and resort to other means of communication of delegate the task to a relative. After that, Design teams conduct a series to design sessions to insure that the business process are met along with the user requirements gathered in the previous round. This process is not linear as it seems to be several iterations will take place before a consensus will be reached over the final design, as the NCC follows an Agile System Design Life Cycle which allows people from different expertise collaborate to create such system. This insures that proper wording and good interaction flow is maintained. Before finishing the online service, the metric produces and number figure that shows how inclusive the design was, and to further improve the reliably of the interface, the system will subject to user testing social workers first and then to users to insure that requirements are met.

4.0 Inclusive Design Metric

Borrowing the notion from the field of architecture, inclusive design can be applied in the field of Human-Computer Interaction (HCI). While in the architecture field inclusive design translates into incorporating ramps alongside of stairs and wide doors. Inclusive design also applies to HCI in insuring that the interaction with the interface provides the same level of information –and enjoyment- to users with different skill sets (Story et al., 1998). To further tailor the inclusive design principals to HCI, and bridging it to the notion of affordance that Norman (2005) talks about in which objects inform users to how to interact with them without providing any instruction. This creates a user interface that insures that all users can interact with it

and accomplish their goals similar to IKEA's assembly manuals. IKEA's manuals have high level of inclusivity as any person can understand the manual with no prior knowledge in furniture assembly. The Inclusive Design Metric is as follows:

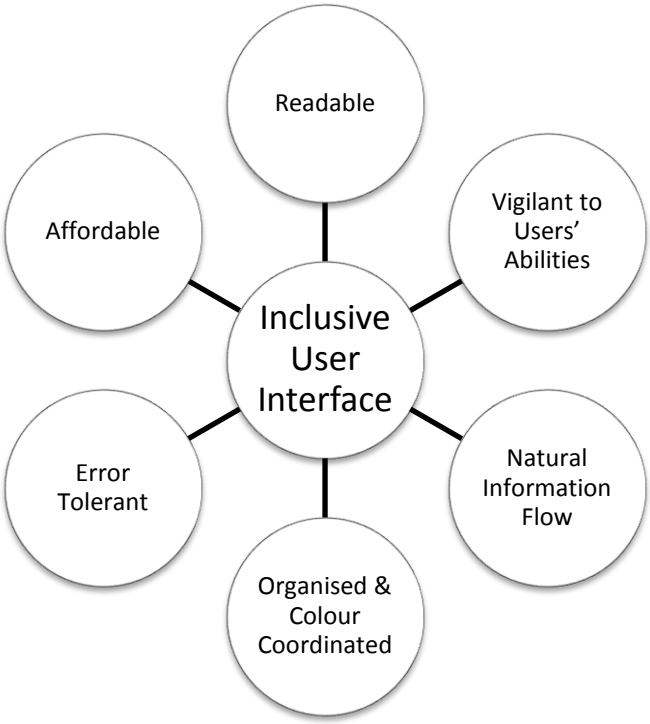

Figure 4. Constructs of the Inclusive Design Metric

In order to fully understand the Inclusive Design Metric demonstrated in Figure 4, the definitions of the constructs need to be clarified.

1. **Readable:** The terms used in the interface are easy to understand and does not require field knowledge.
2. **Vigilant to users' abilities:** The interface has all the assessable features that enable any person with disability to use it without asking for help.
3. **Natural flow of information:** The interface mimics normal conversation.
4. **Organised and colour coordinated:** The interface has enough colour contrast and the information is clearly organised in small chunks.
5. **Error Tolerant:** The interface prevents users from making errors and if so the errors are clearly worded.
6. **Affordable:** The interface provides visual and audio clues that inform the users how to interact with the objects.

The items that can be listed in each construct are open for interpretation for the design team depending on the project (See Appendix 1).

5.0 Conclusion & Future Work

The metric introduced in this research can provide a structured way to allow designers to evaluate their user interface designs in terms how inclusive they are to users with different capacities. The inclusive design metric provides the development team with the flexibility to configure the constructs of the metric based on the needs of the system in hand, especially since some systems require different forms of interaction. This metric was created for an online service that can be accessed on web browser; it would be interesting to see it used for mobile applications and household products.

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Appendix 1 – Inclusive Design Metric Example

Construct	Description	Score
Readable	The website uses simple language with no jargon	
	The fonts used are clear	
	The readability test	
Score		
Affordable	The website provide visual clues for navigation	
	The website provide breadcrumbs to show the position in the process	
	The website provide audio clues	
	The website avoids drop down lists	
	The website provide logical mean to know how to use the elements in it	
Score		
Error Tolerant	The website does not allow entering invalid data	
	The website tell you the correct format for each field	
	The website avoids text fields	
Score		
Organised & Colour Coordinated	The data are clearly divided	
	The data are logically divided	
	The website uses a good contrast between text and background	
	The website don't only rely on colours	
Score		
Natural Information Flow	The website provide a logical information flow	
	The website informs the user of what is needed to finish a transaction	
Score		
Vigilant to Users' Abilities	The website is compatible with screen readers	
	The website provides a black & white option	
	The website provides options for bigger or smaller text	
Score		
Overall Score		