It is Normal to be Different: Applying Inclusive Design in Industry

Abstract
This paper describes the case for inclusive design developed by the Engineering Design Centre, University of Cambridge. This is based on 10 years experience researching inclusive design and promoting it in industry. The approach is a pragmatic one, bridging from where many companies currently are to a more inclusive approach. This paper uses the starting point that 'it is normal to be different' with regards to a person's capabilities, in order to reframe the argument from a disability focus to one that examines population diversity as a whole. A practical commercial response to this diversity is described by representing capability variation using traditional market segments and personas. Finally different design responses are discussed that address the range of capabilities in the population.

Key Words
Inclusive design; business case; diversity; disability

1. Introduction

This paper is based on the experiences of an engineering design research centre in a UK University (Engineering Design Centre, 2010) working with a number of major international Information and Communication Technology (ICT) organizations on inclusive design, including Vodafone, Sagem Télécommunications and BT (Formerly British Telecom plc). The approach described here was successfully used in attracting members to the Inclusive Design for Competitive Advantage Consortium (Centre for Business Innovation, 2010), which launched in May 2010. Members of this consortium include the BBC, Bayer Healthcare, Roche, Nestlé, Royal Bank of Scotland, Bosch and Siemens Home Appliances and Marks & Spencer.

With an increasing emphasis on knowledge transfer as an outcome of research success this paper describes an approach that has made a difference with commercial organizations. For example this approach formed a key part in helping BT to adopt an inclusive design strategy (Chamberlain et al., accepted for publication).

The approach addresses the key questions of "What is inclusive design?" and "How can it be applied?" in a commercially relevant and engaging manner. At the heart of inclusive design is a better understanding of diversity in the population and its relevance for design. Gregor et al. (2002) define "dynamic" diversity, which covers both the range of diversity and its variation with time. This is neatly encapsulated in the expression "it is normal to be different", drawn from the teaching approach of Lange & Becerra (2007). This paper first expands on typical disability- and age-focused approaches, and broadens the argument to one with a diversity focus. It then describes how the phrase "it is normal

to be different" can be used as the anchor point for a commercially compelling argument. Further aspects of diversity are then explored, based on how it is also normal to want different things and do things in different ways. The paper concludes by examining how diversity can be represented and considering appropriate design responses.

2. Broadening to a Diversity Focus

Many of the organisations that Engineering Design Centre (2010) have worked with have a dedicated function to support customers with disabilities, partly driven by legislative requirements. The United Nations (2006) Convention of the Rights of Persons with Disabilities defines disability as people who are unable to participate in society on an equal basis with others. When determining a specific definition of disability, comparison with the majority is often used to define a threshold that determines when a person's impairment is severe enough for them to be classified as disabled. Defining such a threshold creates a split between the able-bodied and those with disabilities, which can be beneficial in order for people to gain recognition of their rights and to provide appropriate support.

An example disability centric approach is outlined by the World Wide Web Consortium through the Web Accessibility Initiative (Henry and Arch, 2009). The information explicitly states that the main focus of web accessibility is people with disabilities but that there is benefit for those without a disability.

A disability centric argument often starts by quoting the size of the market formed by those with disabilities. One example an online article (Hannah, 2008) quotes an annual discretionary income of USD 220 billion for people with disabilities, according to data from U.S. Census bureau. However, the article does not precisely define "discretionary income" or "people with disabilities", and does not provide a traceable data source. Further confusion arises as alternative sources (National Organisation on Disability, 2010) quote a disposable income of USD 1 trillion, yet further investigation suggests this actually means income after tax.

In the UK, the 'spending power' of the disabled market is quoted as being GBP 80 billion (Department of Work and Pensions, 2004). In this case 'spending power' is clearly defined based each individual's income minus tax and housing costs, and the disabled market is defined based on the Disability Discrimination Act. However the source information is only available by personal request from an electronic archive. Such figures can provide a powerful argument but would benefit from sources that are both robust and readily available online.

A disability-focused approach can easily overlook those with minor ability losses such as age-related long sightedness, which is not severe enough to meet a threshold definition for "disability", yet significantly affects product interactions. Research commissioned by Microsoft (2003) to investigate the benefit of assessable technology makes the following quote:

"Addressing the growing need for accessible technology requires accepting the fact that the concept of 'disability' may have limited the understanding of the need for accessible technology. Instead of assuming that accessible technology is only useful to a distinct group of people with disabilities, the IT industry must consider the wide range of people who could benefit from using accessible technology."

When expanding the horizons beyond a disability focus, people often look towards the needs and spending power of the senior market. Indeed, The over 50s spent GBP 276 billion in 2008, making up around 44 per cent of the total family spending in the UK (Age UK, 2010). In the US, the over 50s annual income after tax is estimated at USD 2.4 trillion, which accounts for 42% of all after-tax income (Immersion, 2010).

However, rather than focusing on a particular subgroup of people, the case for inclusive design developed by Engineering Design Centre (2010) focuses on diversity across the entire population. Although age and disability underpin many aspects of population diversity, other critical factors also include gender differences, aspirational differences, and alternative contexts of use. Population diversity is advocated as a continuum, which all people are throughout their lives. Promoting diversity as a continuum encourages companies to think how their mainstream products might be improved to provide a better user experience for more people, in more situations. This argument contributed to the adoption of inclusive thinking within BT's development process:

"Over the past 5 years BT has undergone a major transformation from a company with a special section devoted to 'older and disabled consumers' to a company with an inclusive design strategy." (Chamberlain et al., accepted for publication)

The different methods used to describe population diversity are now presented, which summarises to the memorable phrases "it's normal to be different", "it's normal to want different things" and "it's normal to do things differently". Practical methods of representing diversity are then discussed, followed by an exploration of different design responses

3. Understanding Population Diversity

In engaging with industry it is not unusual to see a simple approach of specialist products for those with a recognized disability and mainstream products for those without. However, this segregated approach is contradictory to the continuous variation of capability across the population, primarily driven by age (Keates and Clarkson, 2003), but also depending on the real-world context. This repositions the issue into the mainstream, consistent with the British Standard definition of inclusive design (British Standards Institute, 2005).

Even with an understanding of an ability continuum, there is often still a focus on single disabilities. However a statistical understanding of the population is that multiple, often minor impairments are the most common for older people (Gregor et al.. 2002 Keates and Clarkson, 2003). The prevalence of co-occurring ability loss can be investigated using

data from the 1996/97 Disability Follow-up Survey (UK Data Archive, 2000 ; Grundy et al., 1999). This dataset is multi-variate, covering a range of vision, hearing, cognitive, reach & dexterity, and mobility disabilities. The prevalence of co-occurring ability losses from the Disability Follow-up Survey can be shown by representing the population with a segmented pyramid. This is an evolution of the work by Benktzon (1993) who described a pyramid with 3 segments that represent increasing levels of capability loss, and the Inclusive Design Cube (Keates and Clarkson, 2003), which examined a layered approach to understanding population diversity and co-occurrence. The segmented pyramid is shown in Figure 1 below.

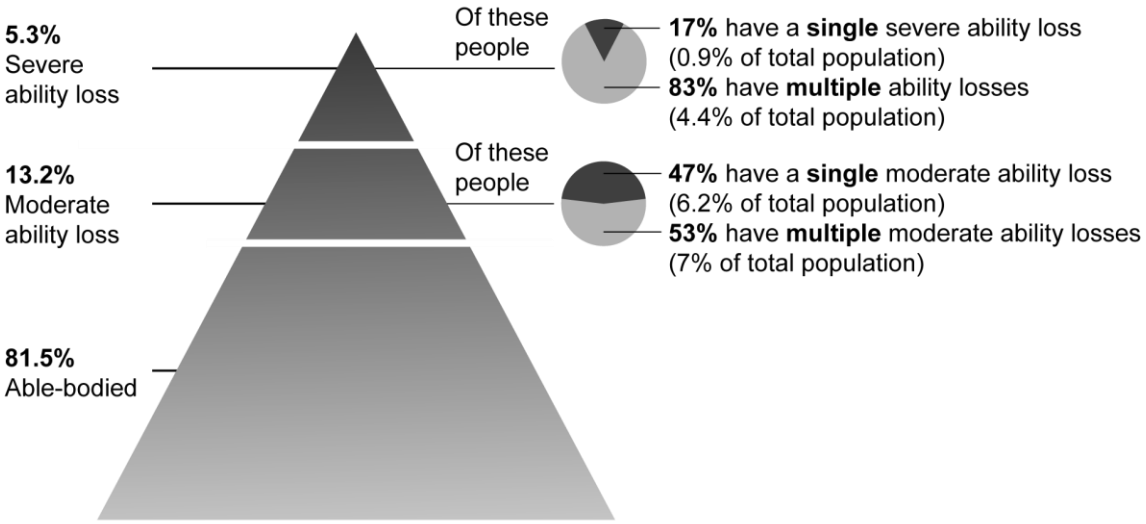

Figure 1: A pyramid showing a segmented model of vision, hearing, thinking, reach & dexterity, and mobility losses from the1996/ 97 Disability Follow-up Survey (Grundy et al., 1999), which sampled Great British adults (16+) living in private households (definitions of the different levels of ability loss and further details of the survey are contained within Appendix 1). Figure reproduced from Waller et al. (2010a), with permission.

The upper segments of the pyramid show the breakdown of single and multiple ability losses for people in that segment, which demonstrates that only 0.9% of the total population have a single severe ability loss. This challenges the approach of focusing on a single disability and demonstrates the need to consider real people with multiple losses.

The Disability Follow-up Survey data set (UK Data Archive, 2000 ; Grundy et al., 1999) is especially valuable because it is multi-variate, however its focus on disability means that it does not cover the wider variation in the general population. However, an alternative segmented model can be developed from the prevalence of difficulties and impairments from the Microsoft (2003) survey. This survey specifically intended to quantify the people who would benefit from the use of accessible technology, and was therefore designed to capture mild levels of difficulties and impairments, which were not

severe enough for the individual to be classed as "disabled". The prevalence of difficulties found from this survey is therefore much higher than typically found by disability-based surveys. This survey data is therefore particularly beneficial for challenging the minority perception of difficulties and ability losses, and reinforcing the concept of continuous ability variation across the whole population.

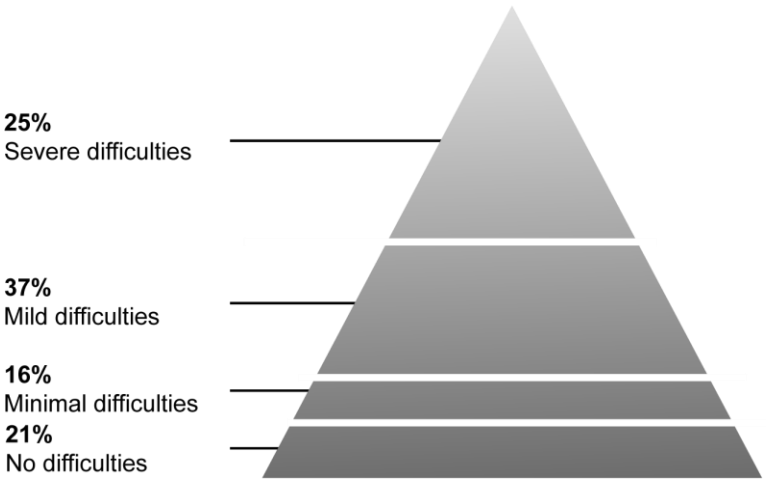

Figure 2 – An alternative segmented pyramid showing a breakdown of vision, hearing, cognitive, speech & dexterity difficulties and impairments for American adults of working age (16-64) from the Microsoft (2003) survey (Definitions of the different difficulty levels and further details of the survey are contained within Appendix 2)

Figure 2 provides a perspective that moves diversity from being a minority issue to a majority one. This further demonstrates that inclusive design is about the mainstream and not the margins. Experience working with large ICT organizations has shown that using a pyramid to explain population diversity helps them understand the nature and size of the issue across the population. Taken together Figs 1 and 2 challenge single disability thinking and a perception that inclusive design is a minority issue.

Although the population numbers can improve the understanding of diversity, they give limited insight with regards to the impact on everyday life. Impairment simulation can bring this to life, and therefore provide a strong complement to population numbers. The Engineering Design Centre (2010) has developed wearable devices and software that reduce sensory and physical capability (Clarkson et al., 2007). These include gloves that restrict hand movement, glasses that impair vision, and software that simulates different types of visual and hearing loss. In keeping with the message that ability is a continuum, all of these simulators can produce varying levels of ability loss. Used correctly these can open people's eyes to the reality of capability loss. They do not however simulate the pain someone may feel or how over time they can adapt to work around capability loss. They are not a substitute for working with real users and are intended to reinforce the need to bring real users into the design process.

So far the focus has been on capability variation across the population. Other important

aspects to consider when designing a product include gender, culture, lifestyle and aspiration; especially with respect to purchasing decisions. Eden et al. (2007) indicate that US women influence 80% of buying decisions, yet the results of a survey at the Consumer Electronics Show in 2006 indicate only 1% of the surveyed believe that consumer electronics companies took women's needs into consideration.

Gender is used here as one example to highlight the importance of considering a wider range of factors with regards to diversity, which can be summarised with the phrase "it's normal to want different things". Broader aspects of population diversity can further be encapsulated with the phrase "it's normal to do things differently". This covers a diverse range of usage cases, such as when at home, at work, or on holiday, and a diverse range of environmental factors, such as ambient lighting, background noise, social pressure and fatigue. Other contextual factors such as looking after children may distract attention, and may limit the use of one or both hands.

4. Representing Diversity

Working with mainstream companies often shows a stronger awareness of diversity with regards to areas such as lifestyle, represented through market segmentation and personas. However, companies the Engineering Design Centre (2010) has worked with lacked a clear segmentation model that effectively covered diversity within the senior market. For these companies a basic sub-segmentation suggested by Deutsche Seniorenliga e.V (2010) provided a useful starting point:

- Go-go (active)
- Slow-go (slowing down)
- No-go (stay at home)
- Know-go (problems with dementia, hence the 'know')

This may seem obvious, but has helped to identify gaps in existing segmentation models, which require more detailed exploration. Other companies have more sophisticated segmentation models, which are typically proprietary.

Using the segmented pyramid to represent population diversity has helped companies better understand and resolve gaps in their existing segmentation and design strategy. Personas are an established method for bringing different types of users to life (Cooper, 1999). Although it can be argued that personas should be suitable for representing different levels of capability across the population, there is ongoing debate about the validity of using personas to depict marketing data, and incompatibilities between user centred design and market segmentation (Siegel, 2010, Cooper et al., 2007). However, others are trying to improve the validity of personas by using data to drive their construction (McGinn and Kotamraju, 2008). The approach outlined here is a pragmatic one that enables the extension of current practice to be more inclusive. Personas are used by many of the companies that the the Engineering Design Centre (2010) has worked with, so understanding diversity through personas provides a useful bridge into current practice.

It is important to determine an appropriate range of personas that cover the continuum of capability loss. Rather than creating stereotypical personas it can be more useful to consider the boundary cases, which are those people on the borderline for exclusion, frustration or difficulty. Focusing on such boundary cases can readily expose design opportunities that can benefit a wide range of other users, improving the reach of the product further up the segmented pyramid.

Determining an appropriate range of personas is a balancing act between having too few, which means that sufficient capability variation cannot be adequately represented, and having too many, which makes them more difficult to apply and makes it harder to maintain focus. Drafting a prototype set of personas and then iteratively updating is a good way of getting the balance right.

the Engineering Design Centre (2010) is advocating the use of market segmentation and personas, linked to capability data, in order to drive products that are usable, desirable, and successful for the business. Work is ongoing to validate this approach with commercial partners.

5. Design Response

The nature of the design response will depend on the breadth of the target market. This can vary from a universal service obligation, for example government services, through to specific market segments and niche markets.

The needs of those with severe capability loss will often need to be met through 'assistive' technology; such as screen readers for the blind. The aim of inclusive design is to extend the reach of mainstream products as far up the pyramid as possible, while maintaining commercial viability, and without compromising the design for those at the bottom of the pyramid, shown in Fig. 3.

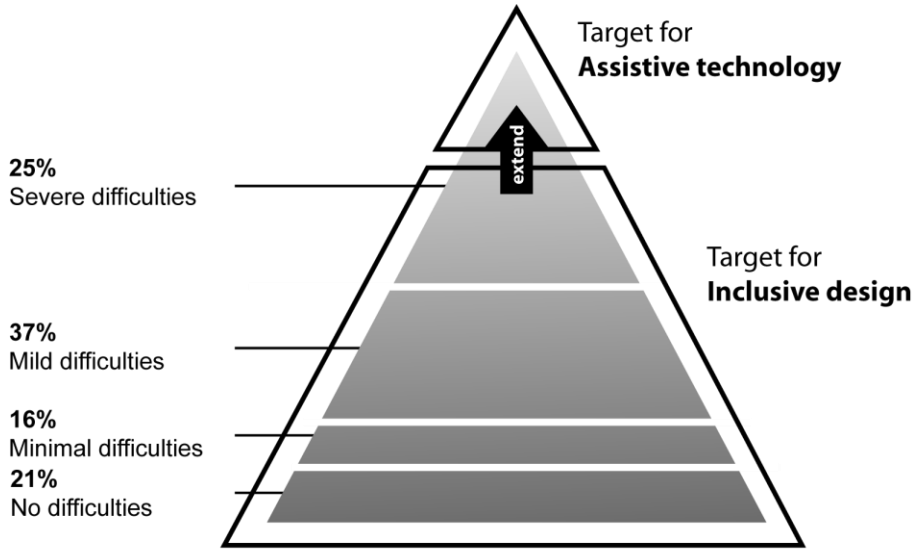

Figure 3: Different design responses for different levels of capability loss, based on the same segmentation model as Figure 2

In the middle of the segmented pyramid, it is possible to consider adding features to mainstream products to include more people, such as font size adjustment. However, experience with ICT industries indicates that companies sometimes keep on adding more features to try and differentiate against the competition, yet an increased number of features usually leads to greater complexity. Results from the Philips Index (2010) indicate "one third of Americans think that technology companies have no idea what their lives are really like or what products they would be likely to use". In a Microsoft survey asking what features users would like in the next version of Office, 9 out of 10 people asked for features that were already in the current version. This is not surprising considering that Microsoft Word has grown from around 100 commands in version 1.0 to 1500 in Word 2003 (Caposella, 2005; Harris 2008).

Other companies have delivered business success through a focus on simplicity. The third of Google's ten design principles is "Simplicity is powerful" (Google, 2010).

"Google doesn't set out to create feature-rich products; our best designs include only the features that people need to accomplish their goals …Google teams think twice before sacrificing simplicity in pursuit of a less important feature."

The segmented pyramids presented in this paper help to bring a perspective on how the needs of the whole population can be met, which may require a combination of mainstream products and specialist solutions. This helps counter a "one product must fit all" mentality and allows a pragmatic approach to addressing diversity within the population. Indeed, the Engineering Design Centre (2010) prefer to promote the name "inclusive design" rather than "universal design" or "design for all" because businesses

often literally, although incorrectly, interpret the latter names to advocate the design of one product to meet the needs of the entire population (Keates and Clarkson, 2003).

6. Conclusion

This paper has outlined an approach to answering “What is inclusive design?” and "How can it be applied?”. The first question is addressed by framing the issues around the fact it is “normal to be different”. This diversity it explained by the use of a segmented pyramid to indicate the prevalence of disability, and highlight that co-occurrence of disability is much more common than having a single disability. Diversity is then extended beyond capability to include broader issues of lifestyle and preference.

A practical approach to applying inclusive design is addressed by investigating the extent to which existing market segmentation models have adequately covered the whole range of diversity evident across the segmented pyramid. In particular this challenges how the senior part of the market can be effectively represented. Personas can then bring the segments to life, and make them more meaningful for design. Finally different design responses are considered to discuss how mainstream products might be made more inclusive.

The approach outlined here is a logical extension to existing market segmentation models. This means that companies can build on their existing expertise and knowledge, while better understanding the potential market for more inclusive products and services.

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Appendix 1

Figure 1 was produced using a reanalysis (Waller et al., 2010b) of the Disability Follow-up Survey dataset (DSS, Social Research Branch, 2000). This survey was conducted with approximately 7000 Great British adults (16+) during 1996/97, sampled by postcodes. The survey questions used to define the pyramid's boundaries were only chosen if the authors judged they best reflected their corresponding type of ability loss, and none of the other four types of ability loss.

These threshold levels chosen to define **severe ability loss** are:

- **Vision**: Cannot see well enough to recognise a friend who is at arms length away
- **Hearing**: Cannot follow a TV programme with the volume turned up
- **Thinking**: Cannot count well enough to handle money and/or Often gets confused about what time of day it is and/or Often forgets the names of friends and family that are seen regularly
- **Reach & dexterity**: Cannot pick up and hold a mug of tea or coffee with either hand
- **Mobility**: Cannot walk up and down one step

The threshold levels chosen to define **moderate ability loss** are:

- **Vision**: Has difficulty reading ordinary newsprint and/or Has difficulty recognising a friend across the road
- **Hearing**: Has difficulty following a conversation against background noise
- **Thinking**: Thoughts tend to be muddled or slow and/or Often forgets what was supposed to be doing in the middle of something and/or Often loses track of what is being said in the middle of a conversation and/or Cannot remember a message and pass it on correctly and/or Has difficulty expressing themselves to other people and/or Has difficulty understanding other people and/or Often forgets to turn things off such as fires, cookers or taps
- **Reach & dexterity**: Has difficulty tying a bow in laces and/or Cannot pick up and carry a bag of potatoes with each hand and/or Has difficulty raising both arms above the head
- **Mobility**: Cannot walk 350 m without stopping and/or Cannot manage a flight of 12 steps, even if a handrail is available and/or Occasionally needs to hold on to something to keep balance

Prevalence statistics are calculated based on 43.3 million GB adults living in private households (Grundy et al., 1999). This represents a refined assumption compared to previous publications by the same authors, which calculated prevalence statistics based on 45.6 million adults living in the whole of Great Britain.

Appendix 2

Figures 2 and 3 were drawn using prevalence data of difficulties and impairments from the Microsoft (2003) survey, and the following definitions are paraphrased directly from this report. This survey was conducted during 2003 with 15,000 American adults aged 16-64, 10,000 of which were sampled by household address, and 5000 sampled by random digital telephone dialling. Again, areas on the pyramid are drawn proportional to the number of people in each segment. The survey covered the five types of difficulties and impairments that would most likely impact computer use: visual, dexterity, hearing, speech, and cognitive, where cognitive difficulties and impairments refer to an inability to appropriately respond to information presented by sight or sound. For each type of difficulty and impairment, the survey contained the following types of questions:

- Difficulties with daily tasks to identify individuals who have difficulty performing daily tasks in each of the five types of difficulties and impairments.
- Direct questions about impairments to assess the proportion of the population who self-identify as having an impairment.
- Direct questions about impact on employment to allow individuals to communicate their assessment of the restrictions imposed by an impairment.

Severe difficulties was defined to include:

- Individuals who reported having an impairment that limits employment.
- Individuals who reported difficulty with all of the tasks within a difficulty/impairment type some of the time and report having an impairment.
- Individuals who reported difficulty with most of the tasks within a difficulty/impairment type most of the time.

Mild difficulties was defined to include:

- Individuals who self-identified as having a difficulty/impairment that did not limit their employment and daily life.
- Individuals who reported difficulty with more than one daily task within a particular difficulty/impairment type some or most of the time.

Minimal difficulties was defined to include:

- Individuals who had trouble performing one or two daily tasks in a difficulty/impairment type, only some of the time

Examples of severe difficulties and impairments include being blind or deaf, experiencing pain in the hands, arms, or wrists that limits activities most of the time, and having non-correctable vision problems that cause difficulty performing many vision-related tasks. Examples of mild difficulties and impairments include being slightly hard of hearing or having difficulty hearing conversation some, but not most, of the time and experiencing pain in hands, arms, or wrists that limits activities some, but not most of the time.

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