Digital Barriers: Making Technology Work for People

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ABSTRACT

Technology is often associated with rapid development and 'cutting edge' innovation and this has resulted in desirable, affordable devices and services. However, these are not always designed to account for variance in age and ability. Whilst universal design has a history of addressing the needs of older or disabled people, this has generally focused on physical environments and products. As information technology becomes more pervasive, the new barriers to inclusivity are increasingly digital. Technology-specific, people-centred strategies need to be developed and the emerging discipline of Design Anthropology can play an important role in understanding the social complexity that surrounds the everyday use of technology. This paper describes the challenges of implementing universal design in a technological context, illustrating this with examples from the Royal College of Art Helen Hamlyn Centre (HHC). Its multi-disciplinary team of designers, engineers and anthropologists undertake practical research projects to advance an approach to design that is people-centred and socially inclusive. Examples drawn from work with companies such as Research in Motion (makers of the BlackBerry®) and Samsung show how centring design around people can increase competitiveness and value, especially in fast-moving technology markets. Theory, methods and findings will be outlined in the case studies.

Keywords

People-centred; technology; design anthropology

INTRODUCTION

Universal design has had a historical focus on the built environment and the design of physical objects and artefacts and had a traditional emphasis on accessibility and capability. The Seven Principles of Universal Design developed by Ron Mace and the team at the Center for Universal Design at North Carolina State University (Center for Universal Design, 1997) have influenced much theory and practice but are typically aimed at products and environments. A key challenge when looking at digital technologies becomes to adapt existing research methods and to evolve new thinking that is directly suited to bringing a people-centred approach into fast-moving, information technology (IT) markets.

IT, as used in this paper, refers to digital technologies that provide communications, information and entertainment. These areas of IT are becoming less bespoke, more convergent and more pervasive in both personal and professional lives (Woods, 2003) They represent an important growth area as digital technologies are now increasingly a part of the consumer experience, influencing every area of design from product design to service design. This is becoming a challenging area for the universal design community to focus on and has great potential to benefit commercial partners and businesses. Whilst universal design methods and practice have focused on physical design and environments, the digital realm could now benefit from the approach. Methods and practice need to be evolved to have specific relevance and benefit for designers and companies working in the IT sector.

Universal design – addressing excluded consumer groups

A key focus of universal design has been on including older and disabled people within design and development processes, but its people-centred techniques can be used to address other marginalised groups in society. Whilst it has great relevance to current political expectations where addressing exclusion is high on the agenda (Coleman et al, 1997), importantly, these methods are now being seen as a business strategy with the potential to open up a direct route to consumer-driven innovation (Eikhaug et al, 2010). Universal design is defined in the UK (under the nomenclature of 'inclusive design') as comprehensive, integrated design that encompasses consumers of diverse age and capability in a wide range of contexts (BSI, 2005). This paper therefore focuses on older and disabled people who represent relatively untapped markets for IT.

Addressing customers of different ages

By 2020, close to half the adult population of Europe will be over 50 (Coleman, 1993), and one third of the inhabitants of the United States will be over 55 (Mueller, 2003). This growing number of older consumers will demand more from IT and be less tolerant of its shortcomings. They will want to continue to use IT into later life to maintain their social circle and support their communication needs (Newell, 2003). However, they will also be affected by the physical results that are a natural part of the ageing process and this will need to be addressed by designers working within IT. The multiple, minor impairments resulting from age typically affect eyesight, hearing, dexterity, mobility and cognition (Haigh, 1993) and this can pose specific challenges for older people trying to use IT. This becomes especially difficult as older people struggle to set up or use new hardware, technology products or software. IT that is hard use, or difficult to access will not satisfy their needs. Design for older people should go beyond physical operation to meet personal aspiration and build emotional connection, values that people continue to see as important as they get older (Audit Commission, 2000). Older people are consumers with contemporary expectations who are valuable participants in the economy.

Addressing customers with different capabilities

Design that is mismatched to functional ability has significant negative implications in the marketplace. Disability is not limited to people in a wheelchair and is not age-specific. It also encompasses a large number of individuals equating to considerable spending power and a large market opportunity. In the ten newest member countries of the European Union, 1 in 4 people have some form of disability (Eikhaug et al, 2010). Apart from legislation that many countries have enforced over the last decade to outlaw discrimination on the grounds of disability, recognising the wide and varied ability that exists across the global population should be seen as a fundamental human right (United Nations, 2006). IT is increasingly important in promoting independence and maintaining communication for people with disabilities. For example, people with visual impairments rely on mobile phones and special software, with Nokia phones being traditionally popular with this community in the UK due to compatibility with a particular type of software called Nuance Talks™ (Muhammad, 2009). This equates to around 161 million people worldwide, and devices with enhanced 'text-to-voice' and 'voice-to-text' functions such will begin to have a competitive edge with these consumers. However, designing to include people with a range of abilities can also produce better design for everyone. Everyone can require 'eyes-free' or 'hands free' operation of IT devices at different times.

Technology Push, User Pull

Technology is often associated with rapid technical development and cutting edge innovation in a digital or silicon context. Whilst this has resulted in a number of affordable devices and services, these are not always designed to account for variance in age and ability. Involving users throughout the development of IT-based consumer products and services is typically limited in the commercial environment to the traditional focus group set-up and used to validate or test a new idea once it gets

close to market. Engaging with users is rarely used as a starting point for innovation in IT. Many technology companies are driven by a focus on hardware or software innovation with consumer need and aspiration generally seen as less important. Manufacturers make devices, products and services but dictate how consumers have to use them. This separation and tension between technology and its users is widely described as ‘technology-push, user-pull’.

The terms ‘push’ and ‘pull’ have their origins in logistics and supply chain management (Hinkelman, 2005), but take on special meaning in an IT context as they articulate the difference between an approach where the technology drives the ideation process rather than the market or the users demanding it. The latter has historically been referred to as ‘user pull’, ‘needs pull’ or ‘demand pull’. In the 1960’s, strategists realised that ‘demand pull’ would effectively support programmes biased towards a ‘technology push’ (Roberts, 1968). In the mid-70’s, ‘demand pull’ grew in visibility to be seen as an equal route towards innovation (Lewis, 1975) whilst a decade later, researchers into the stimuli of the innovation process reported that the number of innovations stimulated by ‘need pull’ substantially exceeded those stimulated by ‘technology push’ (Voss, 1984). In critical areas of design such as medical equipment, empirical studies concluded that 'understanding user need' was a discriminating factor between commercially successful industrial innovations and those that failed (Shaw, 1985).

During the 1990’s, technology rapidly developed alongside the industrial innovation processes that were driving this change. A more integrated model of industrial innovation developed from the simpler linear 'technology push' and 'need pull' models of the 1960s and early 1970s and the 'coupling model' of the late 1970s and early 1980s (Rothwell, 1992). Fourth and Fifth Generation models of innovation responded to an increasing pace in IT development and the multi-layered nature of technology processes. Innovation in this sector was no longer sequential but was recognised as having a more complex framework (Rothwell, 1994). Including ‘user need’ as another driver for innovation added further complexity, especially when defining what ‘user pull’ currently means in the context of the increasing impact that technology has on society (MacKenzie, 1998). ‘User pull’ now carries the implication of needing to understand the intricate and multi-faceted nature of human beings and their lifestyles. This presents immediate challenges for designers working in IT.

However, there is a history of collaborating with people in IT as software designers have sometimes included users throughout the design and development process. Cooperative Design has seen designers and users working together as equals to design new IT products since the 1970’s (Greenbaum, 1991). Co-design has also featured when designing information systems and mobile phone development (Balarin et al, 1997). Working with communities of users can give designers new understanding of technology’s use (Hofmeester, 1995), allowing them to act as mediators between ‘technology push’ and ‘user pull’ to enable better communication and increase the value of IT for a wide variety of consumers.

Design Anthropology

The emerging practice of design anthropology plays a key role in enabling this. The nomenclature brings together the practice of people-centred design with anthropology, mainly realised through its primary modus operandi of ethnography. People-centred design research borrows heavily from the discipline of ethnography as the aim is to ultimately engage with people and understand their perspective on the systems, products or services that they use. Ethnographic fieldwork, which can consist of interviews, participant observation and detailed diary entries from the researcher, often takes place over longer time periods lasting from a number of months to over a year. Methods and techniques therefore have to be adapted to suit the time-pressures that generally exist in commercial design and that particularly drive the IT sector. Many of the ethnographic methods employed by designers have come to be known as ‘rapid ethnography’ (Norman, 1999). This method allows

designers to gain insights into users activities and preferences whilst keeping pace with the needs of commercial business. The longer studies and observational methods of research that ethnography favours can lead to fundamental truths about the way individuals or groups behave but designers who have to adapt to shorter timescales need to provoke response rather than wait for interesting behaviour to be revealed. The search is for creative insights rather than an expansive understanding of every aspect of a user's life.

Designers tend to challenge and change things around them and this also true for the tools and the techniques that are co-opted from ethnography. Whilst commercial pressures may mean less time is spent with participants than traditional ethnography demands, designers can still get meaningful insights and the engagement is no less valuable. Such an approach in design thinking can enable the 'capture of unexpected insights and produce innovation that more precisely reflects what consumers want' (Brown, 2008). The use of ethnographic techniques in design can inspire commercial designers and the business organisations that they work with. In many cases, design ethnography is not just about solving problems, but finding problems to solve. For businesses working in the IT sector, this can reflect the strength of a 'user pull' approach, allowing the market to generate ideas and be an active source of inspiration. This can be a low-cost, high return way of innovating by moving closer to consumer aspiration. In many organisations, design already takes user data from ethnographic research and is tasked with translating it into market-ready concepts. Bringing together design and anthropology and sending the designer out to do the research can therefore be seen as a natural progression of this relationship.

Case studies from the Helen Hamlyn Centre

The Helen Hamlyn Centre (HHC) based at the Royal College of Art (RCA) in London focuses on people-centred design and innovation. Its multi-disciplinary team of designers, engineers, architects, anthropologists and communication experts undertake practical research and projects to advance an approach to design within the RCA that is people-centred and socially inclusive. The research looks at developing the practice and theory of universal design and working with older and disabled people has remained a central activity over the last eleven years. The HHC works with a range of external business, academic, government and voluntary sector partners. It maintains a core interest in working with IT companies to improve their consumer offer and the case studies described in this paper will draw on work done with older and differently-abled consumer groups.

The Research Associates programme

The HHC's Research Associates (RA) Programme, initiated in 2000, demonstrates a process in which academia can work with business to transfer design knowledge, capability and understanding. It takes new RCA graduates from a range of design disciplines and partners them with an industry organisation to work on a year-long, people-centred design project that addresses an area of specific interest for the partner organisation. The result is the implementation of universal design thinking within a 'real world' business context. During the last decade the RA programme has completed over 100 design projects with around 75 organisations and not-for-profit partners such as Omron, GlaxoSmithKline, Osaka Gas, Ford, Nokia and the UK National Health Service have participated. Over 100 RCA design graduates from the various RCA design departments have taken part. Every designer is called a research associate (RA).

An important part of HHC practice is to involve users within the design process. RA's are encouraged to work with people in their own space to empathise with their lifestyles as nothing can replace this type of direct contact (Warburton, 2003). This is especially important when a young designer has to engage with a person who might be more than 50 years older than them or with someone who has very

different abilities. The RA year can be divided into two halves, one focusing on research activities and the other lead by design development:

1) Research for design: In the first six months, particular emphasis is given to working with people and each RA is directed to spend time designing their research carefully. Although RA's are schooled in a range of research techniques including questionnaires, workshops, expert consultation, diaries, interviews, observation, design provocation and research 'kits', every RA has to tailor their methods and sometimes create bespoke research techniques. All research is conducted with the end purpose of producing actual design ideas and concepts, rather than just being an exercise in engaging people. The research activities are therefore designed with the ultimate aim of producing design results and design anthropology plays a key role in this. The RA acts as a facilitator of research during this process.
2) Design from research: During the following six months, the RA's typically focus on design activities such as developing briefs from their research insights and begin to create designs. It is important that they do not lose the rich information gathered from the research phase, so personas, characters or scenarios are sometimes generated from research with the real people that have been consulted. Images, video, drawings, artefacts created by users and other research data are organised and examined to inspire ideas. The concepts that result in this phase are based on the research and have a people-centred evidence base. Further interaction with user groups can also take place for evaluation, input and final advice. The RA primarily acts as a designer to develop new ideas during this phase.

The people that the RA's conduct research with are selected carefully to challenge the scope of the project and are involved from the outset with setting initial direction and project focus rather than just acting as 'test subjects' to validate the designers own thoughts at the end of the process. RAs are encouraged to embrace the concept of peer-to-peer exchange, seeing every person that they work with as a valued contributor in the research process and as a human being with a context and lifestyle. Whilst authorship of design development and final design remains with the RA, it requires them to relinquish their position of control when working with users and to create research activities that allow people to express themselves and actively participate rather than just be involved as passive respondents. People are generally seen individually or in small groups to encourage a richer exchange of information and opinion, which in turn, can become a powerful instigation for creating new design insights and inspiration. This allows the designer and user to act as equals, an important factor in maintaining 'user push' over 'technology pull' and in understanding the complexity of the social context that IT designs will have to function in.

Case Study 1: Out of the Box – Access to Mobile Communications for Older People

This design study aimed to investigate and design solutions to bridge the increasing divide between European elders and digital technology. As the number of people over the age of 60 now exceeds the number of teenagers in the UK, this age group was seen as a powerful market segment. A central idea at the start of the project was to take a user-focused view rather than a technology-centric one. The project was a partnership with Samsung, makers and distributors of electronics, with a focus on mobile phones. These devices have saturated younger markets but there is still the potential to capture older customers. Clara Gaggero and Adrian Westaway, graduates from the RCA Industrial Design Engineering department worked on this project as RA's. They co-founded founded Vitamins, a London-based design consultancy, at this time.

For many users, the joy of a new mobile phone can be quickly lost as they take the device out of the box, try to learn to use it and struggle with the manual. In a recent UK survey of 4000 people, 85% reported difficulties in setting up their phone (BBC, 2009) and older people can have a particularly frustrating experience as they apply analogue modes of learning to the digital experience, looking in the box for help that simply is not there. There were a number of drivers for the research. This included finding out about older people's attitude to technology, how they learn to operate devices, their lifestyle and how they engage with their social networks.

An initial workshop with a bingo club in London defined the primary focus group as 60-80 year olds who are mobile, travel outside the local area and technology-curious. The people at the bingo club were aged over 80 and saw little reason to engage with mobile phones. Single older people and couples in the UK were then visited in their homes to be interviewed and complete a research kit. They were asked to draw their social network, explain their preferences for learning and show the RA's the technology in their home, explaining how it worked and why they had it. An exercise which challenged two users, one in their 20's and the other in their 60's, to unbox, set up and use a popular mobile phone. The older person spent more time looking at the manual and inside the box for help but got confused by the amount of material it contained. The younger person ignored the manual and figured out the phone using 'trial and error'. This lead to the hypothesis that the unboxing process could be a rich area for design focus.

Workshops to capture the diverse aspirations of European elders were held in Oslo in Norway and in rural Italy where different methods of learning were explored. By working in Oslo with a population of 575,000 the RA's could talk to inhabitants of a medium-sized modern city in the North of Europe. In Italy, research took place in Chiusa Pesio, a very small village with a population of only 3000. The workshops were designed to last 4 hours, and involve 6 people each time. They were not designed to be a static interchange but participants were asked to go through a series of activities to design their 'perfect' experience. Instead of manuals, people wrote novels, interactive engagements and wanted conversations to help them learn. One challenge that faced the researchers was how to get older people to talk about something like technology when they might not be familiar with the jargon. In one activity, users were given a new banana and a kit of scissors, glue, buttons, pins, ribbons and craft material and invited to create a magical banana phone. This activity was aimed at releasing people from the constraints of talking about a real product and real technology. By using a banana, all references to mobile phones were removed and people were able to concentrate on their aspirations instead of worrying about what was technologically possible.

Figures 1 and 2. Workshops in Oslo (left) and Italy (right).

This research indicated that product design alone does not make a mobile phone easier to use. Phones with big buttons, large screens and easy-to-read fonts all currently exist. The area with real potential for design intervention was redesigning the 'out of box' experience, rather than modifying the phone itself. This was an area currently underexplored by IT companies but was seen to have the biggest impact for consumers of all ages.

Two main concepts resulted, ranging from the paper-based to the technology-driven. The first turned the throwaway manual into a hardcover book that is designed to be kept on a shelf and referred to throughout the life of the phone. Many older people often asked friends or family to talk them through the phone set-up, so the pages of the book reflect this process using a conversational tone that is devoid of technological jargon and acronyms. Turning the pages reveals step-by-step instructions with graphical and text-based instructions pointing to the actual device and accessories, minimising chances for error. The book then takes the user through other phone functions using the same process.

Figures 3 and 4. The set-up book (left) that contains the phone and the instruction book (right).

The second idea is based around a pack of cards that digitally interact with the phone to add and use basic functions. The user chooses a function they want, purchases the card and places the phone on it to automatically connect. The phone screen then runs a tutorial that takes the user through the function. The cards also act as a shortcut, for example, the Photo card will turn the phone into a camera by just touching it without the need to scroll through complex menus. Together these ideas present a novel way of enhancing mobile phone set up and use, and could have implications in the way devices are packaged and presented to the customer in the future.

Case Study 2 – Alternative View

The second case study was partnered by Canadian company Research in Motion, makers of the Blackberry® range of smartphones. The RA, Yusuf Muhammad graduated from the RCA Department of Industrial Design Engineering. Smartphones are mobile phones that offer advanced capabilities. They are becoming more widespread and offer PC-like functionality including email capability, music players, web browsing and fast data transfer. However, they rely heavily on the user having good vision to access even their most basic features. There is also a growing trend towards touchscreens, which often have few physical buttons and offer little or no feedback to indicate when an onscreen icon is pressed. This has implications for the 161 million people worldwide who are visually impaired. This design project aimed to study mobile phone usage, communication needs and lifestyles of low vision communities to create new designs, technology concepts and services inspired by real people. The idea was to look at how smartphones could adapt to new forms of interaction that rely less on sight and support visual impairment. Although visually impaired people formed the lead user group, the solutions also supported fully sighted individuals and were applicable to the mainstream.

The research strategy involved comparing and contrasting mobile habits, social networks, aspirations and difficulties of blind and visually impaired people at opposite ends of the age spectrum. The under 25's are typically at the front end of new technology take-up and the over 65's represent a relatively untapped market. The rationale was to understand what both groups wanted from their phones, and to see whether this was specific to a particular age group or common throughout the low vision community. A day was spent with three individuals from each age group, capturing insights and observing attitudes. This was followed by group workshops to get a collective opinion on specific questions. Workshops took a gameshow format to give participants more control and have a high level of interactivity with other participants and the RA.

What emerged was a framework of needs for each age group. Both wanted connectivity, though the over 65's wanted to be able to switch off. The younger group desired a device that could change to suit their mood or mode of use, could be easily found and was desirable, but not to thieves. The older people wanted to lose unused functions and get the most from those they did use. Everyone wanted a mainstream device that was not specific to blind people.

Figures 5 and 6. Images from workshops and interactive sessions held with visually impaired people.

Most people in the low vision community can actually see something. The minority see total darkness. The design concepts developed aimed to utilise the sight that people do have and supplement this with other sensory input. Sight, Sound and Touch formed the broad headings under which solutions were grouped. The first entitled Sense Profile comprised of an Audio slider, Visual slider and Tactile slider on the phone screen. Moving the Visual slider up, for example, progressively makes the font size bigger, icons larger and contrast greater, removing the need to change multiple settings from within a complicated menu structure. This allows the smartphone to easily adapt to an individual's needs.

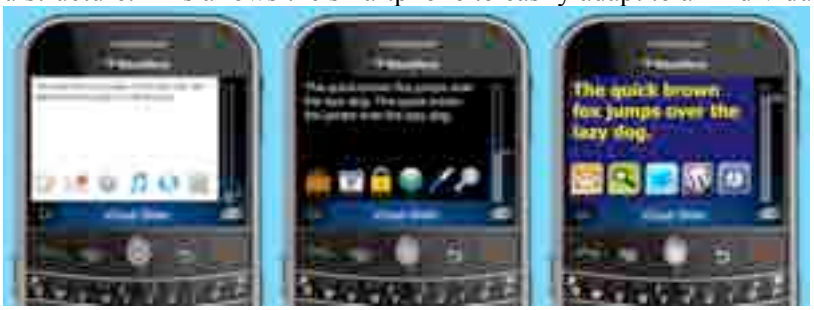

Figure 7. Visual slider increases contrast and font size (from left to right). N.B. This is a conceptual idea not a real product.

Voice Design sketches out ways in which voice interaction can be more interactive, human and customisable. Service Design looks at how the phone might connect to the laptop, a device that many visually impaired people already have, to control settings, software and get online help on a larger screen that has been modified with talking software. Form Design suggests how the shape of the phone might change for 'eyes-free' navigation and use. All these ideas aim to make the digital experience more inclusive of visual impairment, but importantly, they represent new ways for fully sighted people to interact with smartphones.

Findings and Learnings

The techniques afforded by a design ethnography approach allowed the RA's to see designs for the IT sector in the broader scope of their social context, and interaction with user groups as a way of successfully achieving that. This process was used as a vehicle for rethinking and reinvigorating the creative process, to understand the complexity of 'user need' and 'user pull' and put it before the binary approach of 'technology pull'. This allowed the RAs to design solutions that were innovative, unexpected and meet consumer aspiration. IT is becoming more convergent and more pervasive in both personal and professional lives but with it can come new barriers and new difficulties. IT is not always easy to learn or intuitive to use and sometimes can be perceived as an engineering gadget rather than a lifestyle product or service. There is a large gap in the effort designers and companies put into designing devices and the focus on designing the unboxing, setting up and learning experience. Getting this right for customers will ensure a more positive view of a company or brand.

For many older or differently-abled people, the various forms of communication that technology enables can support them to live, travel and work more independently. Digital data can be communicated and received using sound, image, graphics, text, video and touch and this variety gives more scope to design appropriate IT for people of all ages and abilities. Using binary language or technical jargon also alienates rather than empowers people. This is important when conducting research as it can be difficult to speak about technology benefits to people who are not versed in the language of IT. Designing a series of engagements that give people familiar objects and the space to dream can be a powerful way of provoking imaginative response. The exercise with the bananas allowed the users to show the RA's their way of thinking and take ownership of the research process. This, in turn, gave deeper insights and a better level of response.

CONCLUSION

Designers have to look for the convergent points where 'technology push' meets 'user pull' and where consumer need can be met by technological progress. Technology should not fight the user and the people should not have to significantly adapt their learnings and lifestyle in order to access technology. Designers need to develop clever and interesting ways to engage older and differently-abled users as equals within IT research and build on existing universal design methodologies to create new ways to talk about digital technology. The emerging discipline of design ethnography which draws on the history of design and ethnography can give a solid way of approaching subtler aspects of design such as people's aspirations and attitudes and bringing them as valuable insights into design and business contexts.

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