Collaborative HCI and UX: Longitudinal Diary Studies as a means of Uncovering Barriers to Digital Adoption

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In this paper, our proposition is that longitudinal research, such as diary studies, can be used to uncover the core needs of those users who are over 65 and experience difficulty with digital interfaces. Through a two year research project, we have explored the barriers to adopting technology, patterns in monitoring health and finally, how people living with Dementia and their carers might use technology to improve the quality of their life.

Through understanding what these core issues are, we propose that any virtual reality technology can be sufficiently aligned to the mental models of over 65s, so as to be completely inclusive of their needs. By using HCI and UX research approaches, both public and commercial digital agencies, at the forefront of digital innovation, can produce digital artefacts to alleviate barriers to digital adoption in an aging population.

We submit this summary of our research in contribution to Human Centred Design (HCD) for Intelligent Environments workshop at the British HCI Conference, as we are keen to receive feedback and participate in discussions around this area, particularly because some of our research has suggested VR is the next logical step in supporting an aging population.

Digital inclusion; digital adoption; user research; aging population; longitudinal; diary study

1. INTRODUCTION

This research was carried out in order to find an appropriate research method for users who are not typically included in traditional digital design research, specifically the elderly, or over 65's as defined by the UK Government. The core needs of this group are important as it's not only a growing market, but a user group we will all one day be a part of. Finding a research method which captures the core needs of this group will ultimately benefit both this current group and ourselves in the long run. This paper describes our process from interviews and workshops to finally settling on diary studies. The research is ongoing and so our findings at this stage are a summery so far.

In this paper we present some early results which will show diary studies as a promising route to capture this groups core needs. This is because diary studies were found to allow people to capture their thoughts over time and in the context of use, rather than a structured usability setting which affected how people responded to the technology they were using. The use of diary studies has been previously shown to be of benefit in understanding the needs of a range of users. Newman (2004) found diary studies to have great potential in uncovering information not readily captured by other means. He identified their potential in "reaching out to people who have rarely, if ever, been studied by HCI researchers… …capturing the daily activities of people who interact almost entirely with other people and/or with physical artefacts."

In our research diary studies were found to be best in paper form, as this made the research more inclusive by allowing participants just entering the digital realm to articulate their experiences equally without putting pressure on them to learn more quickly in order to complete the diaries.

2. MOTIVATATION FOR THIS RESEARCH

This research was undertaken as a Knowledge Transfer Partnership (KTP) between Salford University and Sigma Consulting Solutions Ltd in

Macclesfield UK. Knowledge Transfer Partnerships are a part government-funded programme that encourages collaboration between businesses and universities in the United Kingdom. Therefore, this structure is already receptive to innovation in challenging areas. In this case, the exchange of knowledge between an academic information systems department and a user experience agency can focus on aligning research methods, and thereby exploring congruent characteristics between HCI and UX.

There are many different definitions of UX but for the purpose of this research we have used ISO 9241-110:2010 (clause 2.15) where it is defined as: *a person's perceptions and responses that result from the use and/or anticipated use of a product, system or service*. It is these perceptions and responses which are the focus of product design and evaluation, and is this approach to user experience research in which Sigma Consulting Solutions is most invested.

As 'experience' is a somewhat fluid term, changing when the product is used and the circumstances of its use, we began with digital inclusion workshops that were open to the public, to ascertain what requirements might be. In the earliest stages of the research, we found that users who were unfamiliar with technology were particularly susceptible to being overlooked; this was evident even in traditional user experience research methods, where they were unable to articulate in a single pre-structured task where they might face difficulties overall. Most, if not all, processes or activities don't happen only once. Nor do they unfold in convenient locations such as a usability lab (Goodman et al, 2012). Therefore a more comprehensive method was required, initially to remove the bias of our ignorance in this aspect of people's experience, but also to provide an opportunity for participants to explain their concerns surrounding the technology they had used so far.

2.1. BACKGROUND TO DIGITAL INCLUSION IN THE UK

In this research, we would like to specifically explore the concept of a user base, which has a growing impact on every project on some level. Whether the designers desire widespread or long term use of their physical interface, website or software, they must address that there will be users who not only possess different skill sets but entirely different 'mental models' around technology itself, and these issues relate directly to an aging population. To not address users specifically over the age of 65 is to create an artefact that has an immediately reduced lifespan.

Over the last two years, the focus on creating digital products that allow access by as many people as possible (or at least, limits their exclusion) in the UK has been increasing. Digital Inclusion has been addressed directly by approaches such has the Government's 'Digital by Default' strategy, making digital inclusion a more prescient discussion point in the UK. In part for financial reasons: if we consider that 20% (10.5 million) of the UK are lacking basic digital skills (ONS 2014) and that 57% of that 10.5 million are over the age of 65, there is a clear imperative to address this digital divide.

As the public sector begins to use UX and digital agencies to extend online services and advisory content, there is yet to be a clear approach on how these agencies should address the needs of the full UK population, including those currently overlooked. Digital inclusion is a challenging area for agencies who are nearly always restricted by not only the two notorious constraints of client work – time and budget – but also access to participants, or even the wherewithal to produce meaningful insights from the data that can be used in developing digital services. In the wider digital economy, over 65s are often excluded, and as a result of the exclusion, they lack the digital vernacular to express the real issues they might be having in traditional usability studies (Telefonica 2014).

As a demographic, over 65s are statistically more likely to require support from public sectors, as well as having more free time and potentially more disposable income than other demographic markets. Perhaps more selfishly, we should address this because it's a circumstance that sooner or later, we will all face. As a population we are living longer and due to improvements in health care and education, we are living in an aging population where 11.4% lack basic digital skills (Green and Rossall 2013).
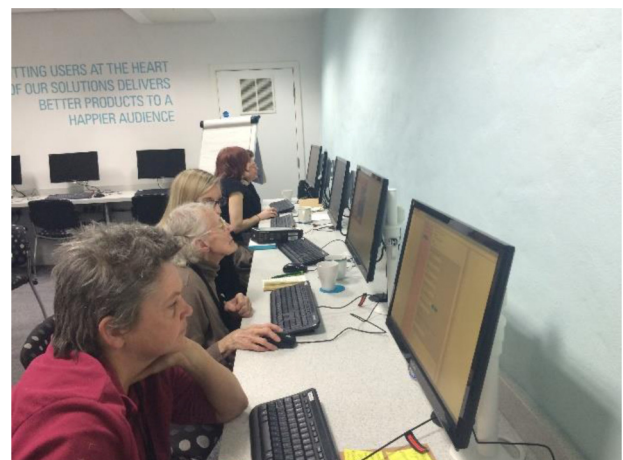

Figure 1: *A photo of the digital inclusion workshops which were run in Sigma, Macclesfield.*

2.3 DIGITAL INCLUSION WORKSHOPS

Our research tried to focus on the inherent question of "*what do users want*" when they become (rightly) preoccupied with typically un-digital things such as their physical health?

We wanted to work backwards to get an idea of what would be a strong enough imperative to carry through the 'drop out' phase. For example, what motivates people to get online to begin with?

We started running regular digital inclusion workshops for over 65s who were just starting to acquire digital skills. The workshops took place in Sigma's usability lab and training room. The sessions were run in fortnightly blocks, with an open session in the first week, to which people often brought their own devices. The second week was used to provide more structured support, with an element of task-based learning, e.g. signing up to Google mail or filling in a form. During the workshops, we prioritised open-ended questions, as well as advice, to get the best observable behaviour and responses.

While it was acknowledged that we were more experienced with computers and mobile devices in how they should be used, we also emphasised that we were novices in why they should be used. For example, where the device belonged in the home, when you should go online and how you should use the content you access. From this, we gained an idea of the journeys people were taking in digital adoption. The maintenance of the computers and devices had the largest negative impact, but the ways in which this occurred were mixed and it became difficult to see which problem should be focused on to uncover deeper insight. We observed issues such as apps 'disappearing' because of filter settings on the device's menu, to software requiring updates, which significantly changed the interface they had become accustomed to. There was also the apprehension that these interactions were made because they were being told to "get online" by the media, their family or even ourselves as part of the digital skills training. Our biggest realisation was around the role of language in both navigating the web and articulating their experiences, and therefore usability tests would not be sufficient for this type of audience. We would need to create an environment for people to express their experiences in their own words.

Even in a relaxed setting within the workshops it was still a controlled environment where there was a possibility that people didn't always remember or perhaps feel entirely able to articulate what would truly motivate them. We realised that this point we would need to look at longer term studies, where people could record their experiences in their own homes, and in such a way that it would not contain a bias toward test verification.

For this reason we decided a contextual study such as a diary study would be best placed to capture this. Bolger et al (2002) discusses how diaries can be used to track the progression of people's attitudes, even over a small period of time using 'pencil and paper' as the easiest method. Although this process has issues around people remembering to complete the diary or carry it with them, any self-reporting is a powerful way of collecting the gaps in understanding.

3. DIARY STUDY METHOD

To build on the digital inclusion sessions, we conducted usability tests with over 65s who were unfamiliar with technology. Finally, we ran three longitudinal diary studies simultaneously with 25 participants. The diary studies were based in different parts of the UK; one locally recruiting participants from Cheshire, one in Dorset and another in Tavistock, Devon. They each explored specific areas of technology use, with the first study looking at motivations in conjunction with a housing association called Peaks and Plains, who provided their own digital skills support through a weekly drop-in session. The second looked at technology in health, by working with Public Health Dorset, who had recently launched their own website and wanted to get a better idea of how people used it and other online resources or apps for health research. The final study looked at services for people living with Dementia and their carers in Tavistock with Amano Connect, a technology provider for people living with long-term difficulties and illness.

We wanted the research to complement Amano's existing activities, especially where technology was routinely used in conjunction with care. So we began working with the main users of their services; early-and mid-onset Dementia patients, as well as family members involved in their care. The decision to involve carers directly in the study, as well as the process, came from speaking to care nurses about the role family play in organising and sharing the activities of the patient. Another reason for including carers was an additional support point to inform us if at any point the diary became a burden from their perspective. Essentially, receiving informed consent from both the carer and the family allowed us to address the sensitive nature of the research. This meant we would have to be completely open about the purpose of the research, ensure complete confidentiality and anonymity and also make it absolutely clear they had the right to withdraw at any timeTo adhere to HCI standards, it was also imperative to keep the questions within the diary study as generative as possible, and not be constricted solely to the use of their individual device. So, we opted for paper

diaries to collect the data as they are offline and device independent.

Accepting that we were not always going to be able to capture participant's responses "on the go", we also opted to use incident diaries, and questions which explored existing use. We limited the number of entries to 3 per week, in order to manage the intensity of the activity. We kept the questions as simple as possible by drawing from our previous research during the inclusion workshops, which had shown that language around devices and internet use was a barrier we needed to work around. We conducted participant screening through further groups such as Memory Cafes, and followed with a semi-structured interview to see whether this would be an acceptable undertaking to the potential participants. Memory Cafes are volunteer run bi-weekly or monthly classes for people living with Dementia and their family carers to attend for activities, advice and support.

It was decided to run the study for a month, but break the diary into two parts, so the first two weeks could be posted back and analysed before the next diaries were sent. Once the first draft was completed, it was reviewed by several medical practitioners, carers and patients with early stage dementia. This included an interview with a Consultant in Older Adult Psychiatry. This was important in ascertaining what the boundaries of the study were likely to be; the point at which it could be considered work or whether the participants would feel like they were being tested. With their advice, we included more options for devices, and also a final question asking about both the participant and carer emotions that day in order to distinguish what responses were negative due to what they had used, and what were more likely related to bad days in difficult circumstances.

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4. INITIAL FINDINGS

When we talk about inclusion we tend to think of accessibility. That is, the physical, mental and emotional engagement with or usability of a system. Yet inclusion reflects a wider set of circumstances, the connectivity or indeed access to the device, and the skills the user has to access it, as well as consume any content it browses or delivers.

(i)   Skeuomorphism: This method of design was used over the past decade to "onboard" users by simulating offline experiences on the user interface, but recently this design method has not only been considered less favourable it has been superseded by 'flat' or minimal design approaches, which makes it impossible for other users to situate the interface within their mental model. This mentality has in essence, kicked the ladder away and removed the skeuomorphic support which had previously helped us acclimatise to digital. In simple terms, the concept of "affordance" in user interface design use to make buttons look like buttons, links were clearly clickable, tabs were well-defined as separate content areas but flat design patterns have reduced these familiar features.

This affects people living with Dementia. Due to the nature of the disease, short-term memory often becomes disambiguated with external things that reoccur – and take priority because they're emotionally charged. As a result people are more likely to remember the mechanics of the their first

job – writing a letter, 'punching in' sharpening a pencil , than typing or even turning on a computer. Appealing to older and more stable memories will help people in this situation, especially in rural areas where digital technology and the internet can bring so much benefit to peoples' lives.

> The future of technology use in this area may be in virtual reality, as no instructions are required to operate 'the interface' and the technology works with real life muscle memory, which is the last aspect process a person living with Dementia can utilise.

> Some participants across all the diary studies who had difficulty using their existing devices expressed interest or actively participated in gaming and virtual reality: "When they gave me my iPad I was terrified [but] I'm all for that VR" – participant aged 84. Another participant living in Tavistock regularly used her Xbox to play *Call of Duty* with her Autistic grandson who lived 300 miles away, but almost never went online on any other device. During the debrief interview, she expressed that it was the set-up of the console and the TV source selection which was difficult and not the game or controls itself:

> "I don't know whether I can continue to use it much longer, as I have said in the diary what makes it difficult is just setting it up. Once the screen [game screen] is on I'm okay but before that, such a pain."

Burmeister (2010, cited in Kreps et al. 2016) mentions that an attitude where we believe these barriers will not be an issue in the future because of younger generations' capability with technology doesn't acknowledge the cognitive limitations that the ageing process brings to usability of technology. As Kreps et al states:

> "To avoid this problem, we believe, technology developers need to embed into their design processes a principle of skeuomorphic reassurance. This principle moreover, needs to be a 'rolling' one, that keeps skeuomorphs (like the film reel and floppy disk icons) for roughly 30-40 years, and drops them gradually as time goes by, and piecemeal rather than wholesale."

The effect of Skeuomorphic patterns was also an issue for carers, as the convergence of different technologies and applications the carer used became very complicated, for example "I would need to be a doctor to use this". Therefore unable to tell which website, app or device should be trusted, it's possible that carers' fears were enhanced by the services online (e.g Googling symptoms) and they reported the Memory Cafe as "grounding" by comparison.

Amano had previously identified that the family were instrumental in setting up and supporting tech in the home. Finding something which complements existing behaviour and routines could be the best way to achieve this. In the Memory Cafe interviews some relatives reported being put off by software that did not use familiar concepts such as Google maps. Or that some of the technology they had been provided by the hospital or recommended from healthcare practitioners was too complex and they did not feel confident in relying on it to look after their loved ones, especially if they lived further away.

> "When we got the band to put round her neck in case she left the house - I was concerned that I wouldn't be able to recharge it. So I couldn't trust where it was telling me she was, even if I looked at it"

> "Picked up a call from Deb, couldn't hear her very well and had to leave the store. Occasionally rings me to pick up things we already have […] I set up the Pebble, made sure it was charged and so forth […] It's another damn thing to charge. "

The diaries however suggested that carers put far more onus on themselves, and that any failure in planning or day-to-day maintenance was mostly if not entirely down to them. Carers are quickly expected to become experts on the condition, and construct a life around being a carer. Carers are generally close family and/or spouse and are often over the age of 65 too, and equally unfamiliar with technology. Those more familiar with using a computer, often for work, were less familiar with the disjointed information that can come from an online search.

Another issue is that design patterns are based on the idea that either people will immediately 'get it' and use it, or never use it at all. Tutorials don't allow for forgetting, or only partial memory of the interface. When asked about some of the experiences cited in the diary some participants struggled to recall specific details, but this was in part due to the similarity of all the devices and screens they had used over that time. This is interesting because in website designers and creators are often encourage users to actively re-appropriate successful affordances from other designs, but this could be clouding more long term use.

In an extreme example, one participant reported having difficulties with a household radio they had had for some time "I just could not get it to turn on" but the carer's comments for that day stated that they had not had a radio for many years. This suggests that while similarity with other physical and digital products in interface design makes it easier for some users to access, it is not a complete solution because over time these items will blur.

5. CONCLUSIONS

In the learning process, we seek familiarity in order to process and understand what we're seeing. The sheer unfamiliarity of an interface makes this difficult, and regular updates to websites or apps makes the learning curve steep. In the early studies, we have seen that aspects of interfaces are innate, for example a button or icon changing size when hovered over means it's clickable – and therefore intuitive, and we should strive for this in design.

We are currently in the process of analysing the data we received from the diary studies, but our next steps will be to continue refine the methods and suggest a framework for designers to utilise when considering developing complex applications for the elderly.

On the back of previous research into how over 65s use technology we were able to alignthe diary studies with the way in which people understand and relate to each other, and how that is compromised by dementia. The relationship between the people living with Dementia and their immediate carers is paramount, from a technological perspective as well as deeply personal. The levels in which people relate to each other do not get 'buried' in the same way as we are traditionally used to, by distractions and daily life.

The rapid increase in technology in the last five years alone has made it difficult for participants to identify which devices or programs would be of best use to them. Mobile healthcare devices such as the Pebble and the iWatch were reported to be used for tracking and maintaining health, and also the Fitbit was used by family members to ensure some people living with dementia would remain active. Several carers in the Memory Cafes said they would be interested in getting sensors put into their loved ones' homes, but were unsure of how to access that or what it would cost. Moreover, maintaining the devices was a concern because the carers already felt ill-equipped to update and monitor their own technology let alone something they had never used – "I imagine it's like trying to set up a wireless printer and we all know how bad that can be. I thought about cameras but that seems excessive and not fair on her (mother)".

The carer entries of the diary regularly reported instances of technology being used to keep this bond as long as possible. Although the dementia participants were in early or mid-stages of the disease, there was a sense of needing to prepare for worse things in the future. Establishing a routine was a key priority, using their own personal phones for monitoring and tracking care and medication.

In looking at the fastest way to improve this situation, we found convergence of different technologies the easiest area to remedy currently, as it only involves improving the user experience of existing technologies or developing a bridging solution for carers. For truly life changing benefit targeting an important need of purpose and enjoyment, would be extremely influential because it effects the everyday life of people living with Dementia so easily. This could be linked with other needs if that solution also included the carer to become an activity to give one another back to each other, even briefly.

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